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Measurement Invariance of the second edition of the Fifteen Factor Personality Questionnaire (15FQ+) over different ethnic groups in South Africa

by

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Thesis presented in partial fulfilment of the requirements for the degree of Master of Commerce in the Faculty of Economic and Management Sciences at Stellenbosch University

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December 2013

DECLARATION

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Date: September 2013

ABSTRACT

Commericial organizations operate in a free-market economic system. The goal of commercial organizations in a free-market economic system is to utilise scarce resources at their disposal to optimally maximise their profits. To achieve this goal, the human resources function is tasked with the responsibility to acquire and maintain a competent and motivated workforce in a manner that would add value to the bottom-line. The human resource management interventions are therefore a critical tool in regulating human capital in such a manner that it optimally adds value to the business. Personality tests are used in the world of work to determine individual differences in behaviour and performance. There was recently a dispute over the effectiveness of the use of personality tests in predicting job performance, but personality is nowadays regarded as a an influential causal antecedent in the prediction of job performance.

From the first democratic elections held in 1994, greater demands have been placed on the cultural appropriateness of psychological testing in South Africa. The use of cross-cultural assessments in South Africa are therefore currently very prominent. The use of psychological tests, including personality tests, is now strictly controlled by legislation, including the Employment Equity Act 55 of 1998. In order to make informed decisions, industrial psychologists and registered psychology practitioners need reliable and valid information about the personality construct which will enable them to make accurate predictions on the criterion construct. This argument provides significant justification for the primary purpose of this study, namely an equivalence and invariance study of the second edition of the Fifteen Factor Questionnaire (15FQ+) in a sample of Black, Coloured and White South Africans.

Bias in psychological testing can be described as ‘troublesome’ factors that threaten the validity of cross-cultural comparisons across different groups e.g., ethnic groups (Van de Vijver & Leung, 1997). These factors can be caused by construct bias, method bias and/or item bias. It is therefore essential that the information provided by the test results must have the same meaning across all the various reference groups. This assumption necessitates evidence of equivalent and invariant measurements across different groups. Equivalence and invariance in this study is investigated by making use of Dunbar, Theron and Spangenberg (2011)'s proposed

steps. Complete measurement invariance and full measurement equivalence is the last step and implies that the observed measurements can be compared directly between the different groups.

OPSOMMING

Kommersiële Organisasies word bedryf in 'n vrye-mark ekonomiese stelsel. Die doel van kommersiële organisasies is dus om skaars hulpbronne tot hul beskikking optimaal aan te wend ten einde wins te maksimeer. Daarom is dit belangrik vir die menslikehulpbron funksie om 'n bevoegde en gemotiveerde werksmag te verkry en in stand te hou op 'n wyse wat waarde tot die onderneming byvoeg. Dit is daarom uiters belangrik om die regte menslikehulpbron intervensies in organisasies te implementeer om die menslike kapitaal so te reguleer dat hulle optimaal waarde tot die onderneming byvoeg. Persoonlikheidstoetse word gebruik in die wêreld van werk om individuele verskille in gedrag en werksprestasie te bepaal. Daar was onlangs 'n dispuut oor die effektiwiteit van persoonlikheidstoetse se gebruik in die voorspelling van werksprestasie, maar persoonlikheid word hedendaags beskou as 'n invloedryke oorsaaklike veranderlike in die voorspelling van werksprestasie.

Vanaf die eerste demokratiese verkiesing van 1994 word daar sterker eise geplaas op die kulturele toepaslikheid van sielkundige toetse in Suid Afrika. Kruis-kulturele assesserings in Suid Afrika is daarom tans baie prominent. Die gebruik van sielkundige toetse, ingesluit persoonlikheidstoetse, word nou streng beheer deur wetgewing, onder andere die Wet op Gelyke Indiensneming 55 van 1998. Ten einde ingeligte besluite te kan neem, benodig bedryfsielkundiges en geregistreerde sielkundé praktisyns betroubare en geldige inligting oor die persoonlikheidskonstruk om hul in staat te stel om akkurate voorspellings van die kriteriumkonstruk te maak. Dit bied wesenlik die regverdiging vir die primêre oogmerk van hierdie studie, naamlik om 'n ekwivalensie en invariansie studie van die tweede uitgawe van die Vyftien Faktor Vraelys (the Fifteen Factor Questionnaire, 15FQ+) op 'n steekproef van Swart, Kleurling en Wit Suid Afrikaners te onderneem.

Sydigheid in toetse kan beskryf word as 'lastige' faktore wat die geldigheid van kruis-kulturele vergelykings oor verskillende groepe (bv. Etniese groepe) bedreig (Van de Vijver & Leung, 1997). Hierdie faktore kan veroorsaak word deur konstruksydigheid, metodesydigheid en/of itemsydigheid. Dit is dus noodsaaklik dat die informasie wat verskaf word deur die toetsresultate dieselfde betekenis moet hê oor al die verskillende verwysingsgroepe. Hierdie aanname noodsaak bewyse van ekwivalente en invariante metings oor verskillende groepe. Ekwivalensie en Invariansie in hierdie

studie word ondersoek deur gebruik te maak van Dunbar, Theron en Spangenberg (2011) se voorgestelde stappe. Volle ekwivalensie en invariansie is die laaste stap en impliseer dat waargenome metings oor verskillende groepe direk met mekaar vergelyk kan word.

ACKNOWLEDGEMENTS

I would firstly like to thank John-Henry Holtzkamp for his abiding love. He supported me in every way possible from day one and made me believe in myself and everything I do. I would like to dedicate this thesis to him.

Secondly, I would like to thank my supervisor, Doctor Gorgens, for her guidance, accuracy and dedication to my thesis and my co-Supervisor, Professor Theron, for his patience and valuable statistical knowledge and support. They allowed me to constantly learn more and improve myself far beyond what I thought was possible. It has been an honor to work and learn from them. Special thanks go to the test distributor company for giving me the necessary data for my thesis. I would also like to thank my parents for their unending encouragement, patience, understanding and incredible support and prayers every step of the way.

Dedicated to my loving husband, John-Henry Holtzkamp

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CHAPTER 1

INTRODUCTION AND OBJECTIVE OF THE STUDY

This section provides a systematic reasoned argument with the intention of justifying the objective of this research study. In essence it is argued that personality assessment plays an important role in ensuring that organisations employ, develop and promote competent employees into the right positions according to their interests, skills and abilities. This should ultimately lead to the maximisation of profits. Subsequently the lack of demonstrated measurement equivalence and measurement invariance could complicate the interpretation made, and use of, personality assessments across ethnic groups, thereby impeding the abovementioned objectives. Measurement equivalence and measurement invariance is essentially defined as the mathematical equality of corresponding measurement parameters for a given factorially defined construct, across two or more groups (Little, 1997). Only when measurement equivalence and measurement invariance has been demonstrated may observed scores from measurement instruments be meaningfully compared across different ethnic groups.

1.1 INTRODUCTION

Organisations do not constitute natural phenomena but rather man-made entities which exist for a specific purpose (Theron, 2007). The primary goal of any commercial organisation in a free market economic system is to maximize profits. Organisations' ability to maximize profits is dependent on the optimal use of scarce resources of which human capital is amongst the most important. Therefore, human resource management interventions are used to shape, influence and control human behaviour in order to accomplish organisational objectives (Theron, 2007).

The extent of success with which an organisation creates value is largely dependent on human capital. Human capital can be defined as the knowledge, abilities, other characteristics and skills that allow employees to achieve the output they are tasked to achieve and have market value because of its instrumentality in achieving specific results valued by the market. Employees are the carriers of labour which constitutes an essential production factor due to the fact that organisations are managed, operated and run by people (Theron, 1999). Labour is a life giving production factor through which the other factors of production are mobilized. This represents the factor which determines the effectiveness and efficiency with which the other factors of production are utilized (Gibson, Ivancevich & Donnelly, 1997). The quality of the human resources the organisation has at its disposal affects the efficiency with which organisations produces products and/or services. The human resource function, therefore, strives to contribute towards the organisational objectives through the acquisition and maintenance of a competent and motivated workforce, as well as efficient and effective utilisation of such a workforce (Theron, 1999).

Organisations need to strive to find the best employees, invest in their training and development and create an environment contributing to high employee work performance. Therefore it should be the imperative of the human resource practitioner or Industrial Psychologist to create selection, development, promotion and other human resource interventions that allow for high performing employees to enter the organisation and to maintain a work environment that encourages high work performance. It is clear that the human resource interventions form a vital part of the human resource function in organisations. Human resource interventions should be designed to allow only employees performing optimally on the identified criterion/performance construct (i.e. comprising performance factors that constitute employee competence) to enter the organisation and be identified for training, development and promotion interventions. An accurate estimate of the criterion/performance construct at the time of the intervention will be possible, to the extend that (a) the predictor correlates with a measure of the criterion and (b) the extent to which the predictor-criterion relationship in the relevant applicant pool is accurately understood. The criterion/performance construct must be identified and understood through empirical research.

Personality tests are generally used in the world of work to focus on individual differences in behavior and job performance. A personality test is an instrument used to understand the uniqueness of the individual and consist of highly structured and standardised questions, possible response options, scoring procedures and methods of interpretation (Swartz, De la Ray, Duncan & Townsend, 2008). In the years preceding the 1990's some disputed the use of personality tests as personnel selection instruments because it was believed that such tests do not demonstrate sufficient predictive validity when used to predict job performance (Hurtz & Donovan, 2000). In the South African context, personality testing has been the topic of profuse criticism in terms of validity, reliability and especially cultural bias issues (Claasen, 1998).However, Visser and Du Toit (2004) recently reported that during the past one and a half decades there has been a revival in the use of personality tests by industrial psychologists in South Africa. Personality is now generally appreciated as an influential causal antecedent of job performance and especially contextual workplace performance (Borman & Motowidlo, 1993). There are, however, some researchers who believe this argument to be an over-enthusiastic approval of personality as a predictor of performance (Morgeson et al., 2007a, Morgeson et al., 2007b). Ones and Viswesvaran (2001) argue that the increased popularity of personality measures are due to the various positive outcomes of meta-analytical studies which indicate that personality traits are not just effective predictors of employee performance but also of other behaviours in the workplace. For example, Hough (2003) lists important outcome variables on which personality has been shown to have main effects. These include, for example, counterproductive workplace behaviour, career success, life satisfaction, stress, job satisfaction, goal setting, workplace aggression, leadership, embracing and adapting to change, innovation and creativity, as well as tenure and work-family balance. Personality tests are therefore used in organisations to improve the quality and quantity of information available and necessary for human resource interventions.

The inappropriate cross-cultural use of personality tests can seriously jeopardize the objectives of personality assessment and its related decisions. Given the multicultural nature of the South African society practitioners are faced with the challenge of applying personality tests on clients from varied ethnic backgrounds. According to Patterson and Uys (2005) the changes in legislation placed new demands on psychological tests and practitioners that use these tests. Since 1994, stronger demands have been placed on the cultural appropriateness of psychological tests, as outlined in the Employment Equity Act 55 of 1998 and other relevant guidelines, for example, the *Classification of Psychometric Measuring Devices, Instruments, Methods and Techniques (2006)*. These regulations are a direct response to the irresponsible usage of psychometrically questionable measures that had negative consequences for the majority of South Africa's population.

The aforementioned changes in the regulatory framework place pressure on practitioners, test developers and test distributors to generate sophisticated scientific evidence that the instruments used in South Africa are psychometrically appropriate for, and relevant to, the South African context. Consequently, this challenges the Psychology fraternity to demonstrate that the measurement models underlying each test is transferable across ethnic groups. Therefore it is necessary to establish measurement equivalence and measurement invariance of tests.

Equivalent numbers of personality factors as well as equivalent patterns of factor loadings is a necessary, but not sufficient, requirement to ensure that observed scores mean the same thing in terms of the underlying latent variable across ethnic groups. Even though the number of latent personality dimensions and the pattern of factor loadings might be the same across ethnic groups, the magnitude of measurement model parameters could still differ across such groups and thereby affect the observed score interpretation. Under a strict interpretation of measurement bias conditional probability measurement equivalence [1] and strict measurement invariance needs to be established in order for observed personality assessment scores to be comparable across ethnic groups and for meaningful inferences to be made from the test scores (Foxcroft & Roodt, 2005; Theron, 2007; Lau & Schaffer, 1999; Vandenberg & Lance, 2000).

Informed decisions about individuals can only be made when psychometrically sound measures are used in an appropriate manner. Therefore, Moyo (2009) indicated that evidence on the reliability, validity and measurement equivalence and measurement invariance of an instrument is a necessary but inadequate requirement to justify the use of the instrument in a decision making process. Instruments that render reliable, valid and unbiased measures should in addition also be used in an effective (i.e., value adding) and fair manner which will allow for more appropriate and accurate decision making about individuals, especially in terms of employment, development and promotion decisions.

Measurement equivalence and measurement invariance concerns can be described by the term bias. The absence of bias in the personality assessment indicates measurement equivalence and measurement invariance. Bias refers to all nuisance factors leading to the inability to conduct cross-cultural comparisons (Van de Vijver & Leung, 1997). There are three sources of measurement bias, namely construct bias,

[1]These terms will be defined and discussed in depth in the literature study.

method bias and item bias. Construct bias occurs when the construct being measured by the instrument is not identical across ethnic groups. Method bias arises from particular characteristics of the instrument or its associated administration, and item bias refers to differences in the regression of the observed score and the underlying latent variable at item level (Theron, 2006). The measurement implications of bias in terms of comparability of scores over cultures are termed equivalence (Van De Vijver, 2003a). According to Theron (2006), however, measurement equivalence and measurement invariance represent a different perspective on measurement errors than measurement bias and articulate it in different terms, although both refer to the same issue of the comparability of scores across groups.

There exist a variety of techniques that can be used to assess measurement equivalence and measurement invariance but there seems to be a general line of thinking that multi-group confirmatory factor analysis, originally proposed by Jöreskog and now commercially available through LISREL, represents the most accessible way of testing cross-cultural comparisons of measurement instruments (Steenkamp & Baumgartner, 1998; Byrne, Shavelson & Muthen, 1989). Dunbar et al. (2011) indicated levels of equivalence that must be met before direct comparisons between different ethnic group scores can be made. According to Dunbar et al. (2011) two set of questions emerge when using measurement invariance and equivalence research. The first set of questions include whether a multi-group measurement model with, (a) none of its parameters constrained to be equal across groups or with, (b) equality constraints imposed on some of its parameters or with, (c) all its parameters constrained to be equal across groups, fits the data obtained from two or more samples. The second set of questions ask whether a specific multi-group measurement model with some of its parameters constrained to be equal across groups fits substantially poorer than a multi-group model with fewer of its parameters constrained to be equal across groups. Measurement invariance refers to the first set of questions. Five hierarchical levels of measurement invariance were introduced by Dunbar et al. (2011). Measurement equivalence refers to the second set of questions and four hierarchical levels of measurement equivalence were introduced by Dunbar et al. (2011). Complete measurement invariance and full measurement equivalence is the last step and implies that the observed measurements can be compared directly between the different groups.

This research study aims to address the issue of measurement equivalence and measurement invariance across various ethnic groups in personality assessment. As mentioned above, decisions based on the results of personality assessments affect the individual as well as the organisation. Historically, most personality instruments were developed in western cultures. Hence, the validity of imported personality measures utilized in South Africa's multi-cultural setting needs to be scientifically proven. It should be made clear that this study does not aim to investigate cultural definitions of personality and resulting bias effects. The study merely aims to evaluate the measurement equivalence and measurement invariance of a well-known personality instrument, i.e. the second edition of the Fifteen Personality Factor Questionnaire (15FQ+), across Black, Coloured and White ethnic groups in South Africa. This research study therefore aims to raise awareness about the impact of culture on personality assessments and suggest ways of addressing them.

The 15FQ+ attaches a specific connotative definition to the personality latent variable. Specific latent dimensions are distinguished in terms of this conceptualisation. Specific items have been designed to serve as indicators of these latent dimensions. It would, however, not be possible to isolate behavioural indicators to ensure a reflection of only one single personality dimension (Gerbing & Tuley, 1991). Although the 15FQ+ items were designed to primarily reflect a specific latent dimension, the items also reflect the whole personality. The items placed in a specific subscale are meant to primarily reflect the personality dimension measured by that subscale, but would also be influenced by the remaining factors, albeit to a lesser degree. When computing a subscale total score the positive and negative loading patterns on the remaining factors cancel each other out in what is referred as a suppressor action effect (Cattell, Eber and Tatsuoka, 1970). This design intention is reflected in the scoring key of the 15FQ+. A very specific measurement model is implied by the design intentions and the scoring key of the developers of the 15FQ+ to ensure a true and uncontaminated measure of each personality dimension. A critical question in this study is whether the measurement model reflecting the design intentions of the developers fits data from Black, Coloured and White ethnic groups obtained from the instrument, when a series of multi-group CFAs over these three groups are conducted, at least reasonably well.

1.2 RESEARCH OBJECTIVE

The objective of the research is to evaluate the fit of the measurement model of the 15FQ+ on a South African sample via CFA and to determine whether significant differences in measurement model parameters exist between Black, Coloured and White ethnic groups.

CHAPTER 2
THEORETICAL FRAMEWORK

This section attempts to introduce the field of personality psychology. A brief outline of personality theories with an emphasis on trait theories is presented. Psychological testing is discussed with a specific focus on the measurement of personality constructs. The role of personality testing in the work environment is also discussed. This section also reviews the existing literature in terms of cultural issues in psychological testing and the impact of culture on the inferences made from psychological testing.

2.1 PERSONALITY PSYCHOLOGY

Psychology is defined by Phares and Trull (1997) as a scientific study of behaviour and mental processes. According to Magnusson (1990) the goal of psychology is to understand and explain why individuals think, feel, act and react as they do in real life. Psychology is a broad field with a large number of specialised areas which includes, but is not limited to (a) developmental psychology, (b) social psychology, (c) neuropsychology, (d) industrial and organisational psychology, (e) educational psychology, (f) forensic psychology and (g) personality psychology. Meyer, Moore and Viljoen (2008) define personality psychology, also referred to as personology, as the study of individual characteristics and differences between individuals. Crowne (2007) defined personality psychology as a sub-field of psychology which endeavours to understand human nature. The focal point of personality psychology is on the construct of personality. Personality psychology influences most of the areas of psychology and is described by Meyer (1997) as the most ambitious subfield of psychology.

The word personality has Latin roots. It comes from the word ‘persona’, signifying the theoretical mask worn by actors, which refers to the mask worn by people in dealing with others as they play various roles in life (Pervin & John, 2001). If personality is viewed in this way it refers to the individuals’ behavioural tendency in response to the demands of social conventions and traditions and in response to their inner needs (Hall & Lindzey, 1957). Meyer et al. (2008, p.11) define personality as “the constantly changing but nevertheless relatively stable organization of all physical, psychological and spiritual characteristics of the individual which determine his or her behavior in interaction within the context in which the individual finds himself or herself.”

Many different definitions for the concept of personality exist. However, commonalities between personality definitions include, but are not limited, to the following (a) personality refers to the characteristic structure, combination and organisation of the behavioural patterns, thoughts and emotions that make every human being unique; (b) personality helps the individual to adjust to his or her unique, daily circumstances of life; and (c) personality refers to the dynamic nature of the individual, as well as to his or her tendency to react fairly consistently or predictably in a variety of situations over time (Moller, 1995). Taking these commonalities into account, Maddi (1996, p.8) defines personality as, “a stable set of tendencies and characteristics that define those commonalities and differences in people’s psychological behavior, thoughts, feelings and actions that have continuity in time and that may not be easily understood as the sole result of the social and biological pressures of the moment”.

It is clear that the core function of the construct personality is to find ways in understanding and explaining individual behaviour; this is achieved through the utilisation of personality theories. As researchers attempted to address the nature of personality, personality theories started to evolve (Desai, 2010). A theory can be defined as a set of organized statements intended to clarify certain observations of reality (McAdams, 1994).Personality theories provide a system for psychologists in order to describe, explain and compare individuals and their behaviours. Personality theories are therefore the core element of personology and according to Meyer et al. (2008) the definitions of personality vary in accordance with the different theories of personality. According to Aiken (1997) research findings pertaining to the origins, structure and dynamics of personality is continually changing and improving, and therefore personality theories continues to change over time.

2.2 THEORIES OF PERSONALITY

Meyer et al. (2008, p.5) defined a personality theory as “the outcome of a purposeful, sustained effort to develop a logically consistent conceptual system for describing, explaining and/or predicting human behavior.” Personality theories are not speculative. Initially personality theories are proposed as hypotheses. To earn the status of theory hypotheses need to be subjected to risky empirical tests in which the non-zero probability exists of being refuted (Popper, 1972). When a hypothesis has survived the opportunity to be refuted a sufficient number of times it may be regarded as a valid (i.e., permissible) explanation. This means that the theory will only be accepted if it is consistent with observations made, and it will be subject to change if new observations are made (McAdams, 1994).

There is a great number of different personality theories all based on different assumptions. However, different theories provide different underlying views of humanity with assumptions about the nature and existence of individuals. These core ideas present an understanding of what is universal across individuals and provide a basis for exploring human functioning according to individual differences (Liebert & Spiegel, 1998). Personality theories also provide information regarding how individuals function as a whole and what motivates an individual to behave in a certain manner (Meyer, 1997). Personality theories are therefore used as a frame of reference in providing information of reality since they offer (a) a picture of reality (b) an understanding of well-defined terms that name the major components of the picture of reality (c) specify relationships among the components and (d) specify predictions about how these relationships can be tested in empirical research (McAdams, 1994).

Due to the great number of personality theories it is useful to organize the theories into a system in order to define the different perspectives. There are a number of ways in which one can classify the different theories. In this study the classification of four broad categories as set out by Liebert and Spiegel (1998) will be discussed. These include psychoanalytical theories, phenomenological theories, behavioural theories and trait theories.

2.2.1 Psychoanalytical Theories

Psychoanalytical theories assume that the structure of personality is largely unconscious and emphasise that individuals are mostly unaware of their behaviour. Behaviour is strongly influenced by ongoing conflict between instincts, unconscious motives, past experiences and social norms (Swartz, De la Rey, Duncan & Townsend, 2008). Sigmund Freud is recognized as the first modern personality psychologist and his work is described as the basis of psychoanalytical theory

(Liebert & Spiegel, 1998). In many respects it is still regarded by some as the most comprehensive of all the theories about human functioning (Meyer et al., 2008).

According to Freud behaviour is determined by irrational forces, unconscious motivations, biological and instinctual drives, which evolve through the key psychosexual stages in the first six years of life (Corey, 1996). According to the theory, normal personality development is based on the successful resolution and integration of the psychosexual stages of development, while maladjusted personality development is regarded as the result of the inadequate resolution of one of the psychosexual stages (Swartz et al., 2008).

Freud's theory of psychoanalysis was the dominant theory of personality during the first half of this century (Desai, 2010) and according to Meyer et al. (2008) Freud's theory is so comprehensive and it has had such a wide influence on twentieth century thinking, that it is impossible to present a comprehensive discussion and evaluation of it within the confines of a few pages.

Criticism against Freud's theory originates from his over-emphasis on the psycho-sexual stages of individual development and the difficulty of evaluating the theory[2]. Carl Jung also developed theories of the relationships between the conscious and unconscious aspects of the mind. However, while Freud postulated a psychosexual explanation for human behaviour, Jung perceived the primary motivating force to be spiritual in origin (Meyer et al., 2008). Another theorist that expanded the work of Freud is Erik Erikson. Erikson stressed the importance of growth throughout the lifespan. While he was influenced by Freud's ideas Erikson's theory differed in a number of important ways. Like Freud, Erikson believed that personality develops in a series of predetermined stages (Meyer, 1997). Unlike Freud's theory of psychosexual stages, Erikson's theory describes the impact of social experiences throughout the lifespan (Meyer, 1997). Erikson's psychosocial stage theory of personality still remains influential in our understanding of human development today.

In recent years there have been significant developments in psychoanalytical theory, with other theorists adding important concepts that have expanded the meaning and

[2] In terms of the earlier distinction between hypothesis and theory the question could be asked whether psychoanalytical theories really deserve to be termed as such.

the application of this theory (Phares, 1992). Liebert and Spiegel (1998) have classified these theorists into three broad camps (a) Freudians, who closely subscribe to the work of Freud, (b) ego psychologists, who focus more on adaption and the potential for personality development beyond childhood, and (c) the object-relation theorists, who emphasise interpersonal behaviour and relationships.

Projective techniques have been associated with psychoanalytical perspectives, as researchers and clinicians sought to reveal the deeper psychodynamics of personality. Projective techniques are psychological assessment procedures in which individuals "project" their inner needs, thoughts and feelings onto stimuli shown to them (Aiken, 2000) and where the individual can reflect his or her own perception of the world. Projective tests are focused on the unconscious and covert characteristics of personality and the subject have the opportunity to express his or her mind. This is why some psychologists believe that projective techniques can reach the deeper layers of personality, of which even the respondent may be unaware (Aiken, 2000).

2.2.2 Phenomenological Theories

Phenomenological theorists focus on an individual's subjective perceptions and experiences (Phares, 1992) where the subjective perceptions and experiences refer to the individuals' inner world. The focus of this category of theories is therefore the subjective world of the person, indicating what is real to the individual, which will be used as a frame of reference in determining behaviour (Phares, 1992).

Thus, within this approach subjective reality takes precedence over objective reality, and it is the subjective reality that influences behaviour. Phares (1992) explains that these theories' emphases are on conscious experiences, with the focus being on the 'here and now'. Although the past is considered to influence behaviour, it only becomes important in terms of 'here and now' perceptions.

Phenomenological theorists, as a group, are observed as being holistic due to the fact that they view behaviour in terms of an individual's entire personality. Phares (1992) identified the self-theory of Rogers and the personal construct theory of Kelly as examples of phenomenological personality theories.

2.2.3 Behavioural Theories

Behavioural theories claim that individual behaviour is the product of learning. Personality is therefore described as the total set of learnt behaviours of individuals. Thus the focus for personality study in the behavioural theory becomes the individual's present learnt behaviour and responses in various situations (Liebert & Spiegel, 1998).

The main focus of the behavioural approach is (a) the emphasis on learning and experience, and (b) the situational specificity of the behaviour. Situation specificity refers to the situation where personality traits are highlighted by a particular situation in which an individual finds himself or herself. Behavioural theories are divided into three major approaches, the radical behavioural approaches, the social learning approaches and the cognitive-behavioural approaches (Liebert & Spiegel, 1998).

The radical behavioural approaches only study overt behaviour and external stimuli whilst emphasis is placed on operant and classical conditioning (Liebert & Spiegel, 1998). Skinner was referred to as a radical behaviourist. He described personality as behaviours learned through reward and punishment. Instead of viewing behaviour as the result of internal factors, Skinner attempted to base his explanation on the effect of environmental influences. Although he did not deny the importance of genetic factors nor of maturation, his work was almost exclusively focused on the effect of learning on the development of the behaviour of the individual (Meyer et al., 2008).

The social learning approach shares the premise that learning has taken place in a social context which acknowledges the importance of overt and covert behaviour, and utilises operant, classical and observational learning (Liebert & Spiegel, 1998). Bandura expanded the radical behavioural approaches through including social learning. Bandura's point of view was that the individual's behavior is the outcome of a process of interaction between the person, the environment and the behavior itself. He placed special emphasis on the learning of behavior in which imitation of others plays an important role. Bandura concluded that humans' complex behavior can only be satisfactorily explained by taking into account the interaction between the environment and cognitive processes such as thinking, interpretation of stimuli and expectation of future events (Meyer et al., 2008).

The cognitive-behavioural approaches focus on thoughts or cognitive processes and covert events (Liebert & Spiegel, 1998). Rogers, also known as a cognitive-behavioural theorist,[3] described personality in terms of the 'self' which is seen as the core of personality. Rogers sees the individual person as the central figure in the actualization of his or her own potential, with the environment playing a facilitating or inhibiting role. Potential is actualized, or realized, in an atmosphere in which the individual is unconditionally accepted for what he or she is and when he or she feels free to develop without external restrictions. He based his theory on three central assumptions, (a) the individual has constructive potential; (b) the nature of the individual is basically goal-directed and; (c) that the individual is capable of changing. Rogers also emphasized the importance of people's subjective experience of themselves and its influence on personality (Meyer et al., 2008).

Behavioural theories are marked by a diversity of views. However, the joined central characteristics of all behavioural theories include an orientation towards treatment, a focus on behaviour, an emphasis on learning, and rigorous assessment and evaluation (Corey, 1996).

2.2.4 Trait Theories

The trait approach assumes that it is possible to identify individual differences in behaviours that are relatively stable across situations and over time (Burger, 1993) and that these behavioural differences can be ascribed to differences in traits. Trait theorists portray personality through describing and classifying people according to traits they possess (McCrae, 2000). A trait is a predisposition to react in an equivalent manner to a variety of stimuli. Individuals are assumed to possess traits in varying degrees (Burger, 1993). A combination of traits can lead to a profile or a type of style description. Traits can thus be used to indicate individual differences, possible sources or causes of behaviour, descriptions of characteristics, consistent behaviour, and methods to explain the structure of personality.

Gordon Allport (1937, p.46) is generally viewed as the first trait-theorist and he defined personality as "the dynamic organisation within the individual of those

[3] In terms of the earlier reference to Rogers as an example of a phenomenological perspective on personality Rogers' work can also be interpreted from a cognitive-behavioural perspective. Although his approach differs from the other behavourist viewpoints it still forms part of this section due to emphasis placed on learning. The cognitive-behavioral approach of Rogers attempts to broaden behaviorism so as to involve subjected factors.

psychophysical systems that determines unique adjustment to the environment.” A psychophysical system is a readiness to act in a certain way, and it comprises of physiological and physical components. Allport (1937) argued that if all traits were unique and if individuals could not be compared with each other, then the whole science of personality would be impossible. The challenge facing the science of personality is therefore to identify a trait taxonomy common to all individuals in terms of which individual differences can be described.

The abovementioned, referred to as the classical explanation of trait theory, assumes that characteristics underlying behaviour influence behaviour in a consistent manner across time and situation. However, according to Mischel (2004) it has been difficult to prove this assumption empirically. Mischel (2004) argues that situational characteristics might influence behaviour independently from personality traits and/or in interaction with personality traits. The classical assumption takes the stance that, for example, a conscientious individual is expected to behave conscientiously over many different situations. The finding of Mischel (2004, p.2) however is that “individual’s behaviour and rank order position on virtually any psychological dimension tends to vary considerably across diverse situations, typically yielding low correlations.”

Mischel (2004) explained two different ways of accounting for the variability in behaviour. Firstly, the variability in behaviour across situations can be seen as an influence of extraneous variables and measurement error. The situation signifies one of the extraneous variables and it is seen as a nuisance variable that needs to be controlled if personality wants to be understood. Secondly, the variability in behaviour across situations is not seen as a nuisance factor but as an integral component of the personality theory. In terms of the second approach the interaction between personality and situation is used in understanding personality and predicting behavioural variability across situations (Mischel, 2004). As Moyo (2009) has indicated it is not the objective situation that is seen to be important, but rather the individual’s subjective interpretation of the situation. Mischel’s (2004) argument does not imply that the traditional assumption of personality as we know it is obsolete. It only indicates that the traditional argument of stable personality traits as a sufficient explanation of behaviour is oversimplified.

The major notion of trait theories is that human behaviour can be organised by labelling and classifying observable personality characteristics. The belief among trait theorists is that all human language contains terms that characterise personality traits, which are relatively enduring styles of thinking, feeling and acting (Brunner-Struik, 2001). Trait theorists such as Cattell and Norman proposed that the thousands of adjectives found in the English language could be viewed as an extensive list of personality descriptions. They proposed that by factor analysing ratings on all these adjectives, the structure of personality could be uncovered (Piedmont, 1998). Trait theorists, in contrast to the psychoanalysts like Freud, believe that individuals are rational beings and can be relied on to provide information about their personalities (Desai, 2010).

Raymond Cattell (1946) has probably conducted the most extensive factor analytic studies of personality. Cattell began by analysing the Allport-Odbert list as a starting point in identifying prominent personality descriptions. Allport and Odbert empirically derived a list of approximately 4500 trait adjectives which they grouped into four categories to facilitate classification (Piedmont, 1998). Cattell revised the list to 200 terms by eliminating synonyms and rare words. He then developed a set of 35 highly complex bipolar clusters of related terms. Factor analysis of these variables repeatedly revealed 12 personality factors. Cattell's work was later analysed by others, and only five of the 12 factors proved to be replicable (Goldberg, 1993). Similar five-factor structures based on other sets of variables have been reported by other researchers through the 1960s to the 1990s (e.g. Borgatta, 1964; Digman, 1990; Goldberg, 1981; Goldberg, 1993; McCrae & John, 1992). By the 1990s it was clear that the adjectives identified originally by Allport and Odbert could be explained according to five large factors. This led to the development of the Five Factor Model (FFM) of personality. According to McCrae and Costa (1997), most psychologists are now convinced that personality traits can be described in terms of these five basic dimensions. The five factors are referred to as (a) Extroversion (E), (b) Agreeableness (A), (c) Conscientiousness (C), (d) Neuroticism (N) and (e) Openness to experience (O). These dimensions can be found in trait adjectives as well as in questionnaires created to operationalise a variety of personality theories.

The questionnaire tradition derives considerably from the work of Eysenck who found that two factors, extraversion and neuroticism, were dominant elements in psychological tests (McCrae & John, 1992). These factors were initially referred to as the Big Two. Eysenck later added the factor of psychoticism (Cervone & Pervone, 2008). Eysenck's three factor model of personality answered the scientific call for a simpler trait model with fewer factors to improve practical measurement of traits (Cervone & Pervin, 2008). Eysenck (2008) focussed on constructing a theory of personality that was precise and reliable and because his factors had been scientifically validated as independent, he felt it appropriate that the three basic elements of personality were each rooted in the human biological system.

The trait theory is the theory that most personality assessment instruments are based on. According to Pervin and John (2001) the trait theory serves as a valuable tool in measuring and describing personality. McCrae (2000) holds that trait theory can be applied to both Western and non-Western societies and cultures. Instead of culture being the independent variable influencing variances in personality traits, personality is seen as indicative of values, beliefs and identities created in a cultural system. He concluded that traits can be measured reliably and validly and that the measurement of traits indicating individual differences can be used to a great advantage in the prediction of human behaviour. This study will focus on the cross-cultural portability of a trait personality measure, the second edition of the Fifteen Personality Factor Questionnaire (15FQ+). This instrument, as well as issues regarding cross-cultural psychological assessment, will be discussed in subsequent sections.

2.3 THE ROLE OF TRAIT THEORIES OF PERSONALITY IN THE WORK ENVIROMENT

Over the last few decades, personality testing for occupational purposes has been controversial (Claassen, 1998; Foxcroft & Roodt, 2005; Kahn & Langlieb, 2003). The first phase of personality and performance research spans a relatively long time period and includes studies conducted from the early 1900's through the mid 1980's. Research conducted during this time period investigated the relationship of individual scales from numerous personality inventories to various aspects of job performance. The overall conclusion from this body of research was that personality and job performance were not related in any meaningful way across traits and across situations (Barrick, Mount & Judge, 2001). For many years individuals believed that personality does not significantly affect job performance or any other behavior in the workplace (Barrick & Mount, 2005). However, today it seems that personality is viewed by some researchers as an influential causal antecedent of job performance (Borman & Motowidlo, 1993). Some researchers such as Morgeson et al. (2007a; 2007b) nonetheless today still argue against the current over-enthusiastic acceptance of personality as a predictor of employee performance.

Morgenson et al. (2007a; 2007b) propose careful consideration when using personality in personnel selection because average validity estimates are low. Tett and Christiansen (2007, p.967) in response to Morgenson et al. (2007a; 2007b) conducted a literature review on personality tests and found that “meta-analyses have demonstrated that published personality tests, in fact, yield useful validation estimate when validation is based on confirmatory research using job analysis and taking into account the bi-directional nature of trait performance linkages.” Barrick et al. (2001) have acknowledged and documented the fact that personality matters because it predicts and explains bahaviour at work. According to Ones, Viswesvaran and Dilchert (2005), personality variables have substantial validity and utility for the prediction and explanation of behaviour in organisational settings. The meta-analyses found in research indicate that personality traits are effective predictors of employee performance but also other workplace behavior which influence the effectiveness of organisations.

Barrick et al. (2001) did a study in which they summarized the results of 15 prior meta-analytical studies that have investigated the relationship between the Five Factor Model (FFM) personality traits and job performance. They reported conscientiousness and emotional stability to be positively related to overall performance across jobs. It was also found that emotional stability and conscientiousness are positively related to teamwork performance and that conscientiousness is positively related to performance in training. The results for conscientiousness underscore its importance as a fundamental individual difference variable that has numerous implications for work outcomes. The other three FFM dimensions are expected to be valid predictors of performance, but only in some occupational groups or for specific criteria. It was argued that the results of the study are grounds for optimism regarding the utility of personality in the workplace because it reveals that (a) the validities for at least two FFM dimensions generalize for the criterion of overall work performance and (b) that the other FFM dimensions are valid predictors for at least some jobs and criteria (Barrick et al., 2001).

Schmidt and Hunter (1998) conducted a study on the validity and utility of selection methods in personnel psychology. Their study summarized the practical and theoretical implications of 85 years of research in personnel selection. The study clearly indicated that personality variables do contribute to the prediction of work related behavior, especially organisational citizenship behaviour. Although there has been some doubt about the role of personality in the work environment and the importance of measuring it, the use of personality measurements in organisations has developed significantly, especially in the area of selection (Theron, 2007).

The most basic consideration that makes personality important is that it is an enduring predictor of a number of significant behaviours at work, which cannot be predicted adequately by general mental ability, job knowledge or the situation itself (Barrick & Mount, 2005). The reality is that cognitive ability is a stronger predictor of overall performance, but personality also plays an important role in explaining behaviour. Some researchers have argued that personality predicts contextual performance better than cognitive ability, whereas cognitive ability predicts task performance better than personality variables (Ones et al., 2005). Research has also shown that personality and cognitive ability variables are uncorrelated, therefore, a combination of cognitive and personality variables will improve the accuracy of prediction of overall job performance (Hough & Oswald, 2005). Empirical research evidence exists to suggest that personality contributes to incremental validity in the prediction of job performance above and beyond other predictors including mental ability and bio-data (Claassen, 1998).

Tett, Jackson and Rothstein (1991) did a meta-analytical review on personality measures as predictors of job performance. In their study they found that general cognitive ability is an important factor in job performance regardless of the setting and job in question. Personality, however, encompasses a more diverse array of traits that are less highly intercorrelated than are intellectual abilities (Tett, Jackson & Rothstein, 1991). Hence, it is unreasonable to expect validities of personality measures to generalize across different jobs and settings to the same extent as validities of cognitive ability measures (Anastasi, 1997).

One of the most important assets of an assessment method in the industrial psychology field is the ability to predict future job performance. Decisions regarding selection, placement, training and promotions need to be made by all organisations and involves the prediction or/and evaluation of job performance. Employees selected, promoted and chosen for training needs to achieve the maximum level of performance in order for the decision to be cost effective and give organisations a competitive advantage. Therefore, the accuracy with which job performance is predicted is one of the fundamental functions of the industrial psychologist and the Human Resource Department of organisations (Ones, Dilchert, Viswesvaran & Judge, 2007).Consequently personality tests can play an important role in the competitive advantage of organisations in terms of attaining and retaining the best human resources, but the tests that are used should be aligned with the demands and requirements of the changing world of work and the legislative challenges faced in South Africa (e.g. Employment Equity Act 55 of 1998).

2.4 PSYCHOLOGICAL ASSESSMENT

The use of psychological testing in the field of personality psychology has increased and continues to be a useful activity for practising psychologists. Psychological testing is a highly specialized and technical field. Psychological testing, such as personality testing, measures attributes manifested only in the behavior of individuals (Foxcroft & Roodt, 2005). Behaviour also rarely reflects one psychological attribute but rather a variety of attributes caused by different physical, psychological and social forces (Murphy & Davidshofer, 2005).

There was some resistance against the use of psychological tests in the past but the frequency of their use has increased (Foxcroft, Paterson, Le Roux & Herbst, 2004). However, psychological testing only adds value if tests are culturally appropriate and psychometrically sound, and are used in a fair and an ethical manner by well-trained assessment practitioners (Foxcroft et al., 2004).

2.4.1 Personality assessment

The measurement of personality is one of the most complex psychological measurement endeavours, due to the complexity of human personality (Kerlinger & Lee, 2000). Anastasi (1997, p.523) refers to personality assessment as the area of psychometrics concerned with the affective or non-intellectual aspects of behaviour and indicates that in conventional psychometrics terminology, personality tests are "instruments for the measurement of emotional, motivational, interpersonal and attitudinal characteristics as distinguished from abilities, interests and attitudes". Personality psychologists utilize personality theories as tools to assist with the assessment of personality. These theories are unique to the field of psychology (Brunner-Struik, 2001). Personality theories are therefore seen as a frame of reference for interpreting psychological assessment outcomes which are used in predicting human behavior.

Personality assessment allows for understanding the individual and predicting his/her behaviour through organising and clarifying observations made from the behaviour. According to Brunner-Struik (2001) the assessment of personality is very important for the field of personality psychology regardless of the preferred theoretical approach, as the knowledge gained in research and in practice relies on the measurement of personality. This does not only hold true for the field of personality psychology but for all fields in psychology.

2.4.2 Cross-cultural personality assessment

Given the multicultural nature of the South African society and the changes in legislation placing new demands on psychological tests, practitioners are increasingly faced with the challenge of utilizing personality tests in an effective and fair manner on clients from varied ethnic backgrounds (Van de Vijver & Rothmann, 2004). After the abolition of apartheid in 1994 a much stronger emphasis was placed on the cultural appropriateness of psychological tests, used in South Africa, which culminated in the promulgation of the Employment Equity Act 55 of 1998 (Paterson & Uys, 2005).

Paragraph 8 of the Employment Equity Act states that (Republic of South Africa, 1998): "Psychological testing or other similar assessments of an employee are prohibited unless the test or assessment used has been scientifically shown to be valid and reliable, can be fairly applied to all employees, and is not biased against any employee or group". Psychological assessment will not unfairly discriminate if it is used to promote affirmative action consistent with the Act and to reject a person on the basis of an inherent requirement of the job (Republic of South Africa, 1998).

The purpose of the Act is to ensure that psychological assessments do not unfairly discriminate against any employee, directly or indirectly, in any employment policy or practice. The motivation behind the Act is to redress the imbalances of the past, and to achieve equity in the workplace. The above mentioned emphasizes that psychological assessments should be conducted and implemented in a fair and equitable manner to all candidates irrespective of their background, through the elimination of unfair discrimination (Republic of South Africa, 1998).

South Africa consists of many different ethnic groups that compete for opportunities, especially for employment. Therefore it is vital to ensure that test scores that are comparable across groups are used in a fair manner to regulate access to these (employment and development) opportunities. In order to have tests used in a fair and equitable manner as required by the Employment Equity Act, increased research on the cross-cultural applicability of tests is needed. Tests are cross-culturally applicable if, for example, the construct the test intends to measure does not differ across ethnic groups. A test that does not measure the construct that it intends to measure across different ethnic groups in the same manner runs the risk, especially when the test results are clinically interpreted, of drawing wrong inferences from the test results. This emphasizes the importance of the test being cross culturally applicable (Paterson & Uys, 2005).

There has been an increase in the number of studies on the cross-cultural applicability of psychological tests since the promulgation of the Act. Culturally applicable tests are referred to as employment equity act compliant. This is, however, misleading since (a) if a measure is said to be compliant it does not do away with the fact that results can still be used in an unfair manner when, for example, making selection decisions; (b) investigation also needs to be conducted for all possible ethnic groups for the measure to be referred to as employment equity compliant (Moyo, 2009). Cross-cultural studies generally only focus on two ethnic groups; therefore it should be clearly stated, especially within the South African environment, for what ethnic groups the test was found to be applicable (Foxcroft & Roodt, 2005).

According to the Health Professions Counsel of South Africa (2006) the policy of the Professional Board of Psychology on the *Classification of Psychometric Measuring*

Devices, Instruments, Methods and Techniques also demands that scientific proof is provided of an instrument's psychometric properties such as validity, reliability and absence of bias. This, however, does not ensure that the instrument can be used fairly for all groups in the workplace. Practitioners therefore need to take the responsibility to not only ensure that the tests they use are cross-culturally applicable for the groups of interest (Paterson & Uys, 2005) but at the same time practitioners in addition also need to take the responsibility to ensure that the manner in which they derive inferences from test results do not indirectly unfairly disadvantage members of any group.

According to Bedell, Van Eeden and Van Staden (1999) South African tests are generally reliable and valid, but only for the groups on which they are standardised. Human resource practitioners experience and express a need for psychological tests that are Employment Equity Act compliant which can be used with confidence on all ethnic and language groups in South Africa (Meiring, Van de Vijver, Rothman & Barrick, 2005). The psychometric testing fraternity is aware of the need to cross-culturally validate existing tests. The psychometric testing fraternity in addition is aware of the need expressed by practitioners for "cross-culturally fair tests" suitable for the multi-cultural society of South Africa (Bedell et al., 1999). The problem and the need experienced and expressed by human resource practitioners, however, require the industrial psychology fraternity to find creative and efficient solutions that take the complexity of the problem into account (Theron, 2007).

Selection decisions are based on clinically or mechanically derived inferences/predictions of future criterion performance (i.e., job performance or learning performance) and not on the predictor measures as such. The inferences are regarded as valid (i.e., permissible) if the actual criterion performance attained correlates statistically significantly ($p<.05$) with the inferred/predicted performance. Valid criterion inferences are possible under a construct orientated approach to selection (Binning &Barrett, 1989) if valid and reliable measures are obtained of predictor constructs that are systematically related to criterion performance and if the nature of these relationships is validly understood. Valid criterion inferences are, however, not sufficient to ensure that the objective of the Employment Equity Act (Republic of South Africa, 1998) of preventing unfair discrimination in personnel selection will be achieved. One should still be concerned about the possibility that the criterion inferences derived from the measures obtained on a selection battery could unfairly discriminate against members of a specific group if it has been shown that the battery displays predictive validity. Cleary (1968) interprets indirect unfair discrimination as the situation where the criterion estimates contain systematic group-related prediction errors. This will occur when group membership systematically explains variance in the criterion (either as a main effect or in interaction with the composite predictors) that is not explained by the predictors, but this is not acknowledged by the manner in which the inferences are derived. This will happen when the nature of the relationship between the criterion and the composite predictors differ in terms of intercept and/or slope but this is not acknowledged by the manner in which the inferences are derived. This can still happen when the composite predictor significantly correlates with the criterion (Theron, 2007).

Measurement bias (specifically item bias) in the predictor need not invariably result in unfair discrimination. It most probably will when information from such predictors is interpreted clinically, but it need not. If it does, the problem lies with the undifferentiated prediction rule rather than the measurement bias per se. It is thereby not suggested that measurement bias should be condoned. Measurement bias should be avoided in the interest of good workmanship. But even if measurement bias in predictors could be successfully eliminated, unfair indirect discrimination can still occur fundamentally because as argued, earlier inferences derived by the clinical/mechanical prediction rule from predictor information contains systematic group-related prediction error. The expected criterion performance of members of a specific group is then systematically over- or under estimated.

2.4.3 Cross-cultural research on personality measures in South Africa

Quite a few studies have investigated the cross-cultural applicability of different personality measures within the diverse South African environment. For example, Abrahams (1996) conducted a study on the cross-cultural comparability of the Sixteen Personality Factor Questionnaire (16PF) version SA92. She reported little support for the cross-cultural comparability across Black, Coloured, Indian and White ethnic groups in South Africa. In the study it was found that individuals whose first language was not English experienced problems with the comprehensibility of the items (Abrahams, 1996).

In addition, Van Eeden, Taylor, and Du Toit (1996) conducted a feasibility study on the Sixteen Personality Factor Questionnaire – Fifth Edition (16PF5) to determine its reliability and validity for different ethnic groups in South Africa. The sample consisted of three groups: group 1 comprised English and Afrikaans speaking testees, group 2 included African language speakers from the private sector similar to group 1 regarding age and educational qualification and occupation, and group 3 was an African language speaking group from the public sector. It was found that respondents with an African language as mother tongue did not understand some of the words and phrases being used in the test and that they appeared to attach a different meaning to some words/phrases.

Following the study of Van Eeden et al. (1996), Prinsloo et al. (1998) studied the effect of respondent language proficiency on personality profiles in the South African English version of the 16PF5. The sample comprised of students who shared cultural origins and who had English or Afrikaans, and in some cases, an African language as their mother tongue. It was found that these students could complete the English questionnaires fairly easily. Based on the results of the study Prinsloo et al. (1998) concluded that the South African English version of the 16PF5 is valid in terms of the measured constructs and does not show any great extent of differential item functioning in terms of sub-groups based on gender and home language.

Van Eeden and Prinsloo (1997) conducted a study on the second-order factors of the Sixteen Personality Factor Questionnaire South African 1992 version (16PF form SA92). A cultural distinction was made using home language as a basis. They concluded that separate norms should be used for different population groups in specific occupational contexts, and that certain cultural and gender-specific trends needed to be taken into account when interpreting results on the test. Abrahams and Mauer (1999) reported similar concerns with regard to the 16PF form SA92. They found that the 16PF form SA92 does not function properly for Black respondents, which could affect the applicability or interpretation of their results on this test.

Prinsloo and Ebersohn (2002) questioned the methodological and statistical techniques used in the studies conducted by Abrahams (1996) and Abrahams and Mauer (1999). They stated that due to the methods used in the study and the subjective ratings, the language problem identified in these studies may have been over emphasized (Prinsloo & Ebersohn, 2002; Abrahams, 2002).

In 2005 Meiring et al. (2005) conducted a study to examine the cross-cultural applicability of the Fifteen Factor Questionnaire Second Edition (15FQ+) at construct and item level. An English spelling test and two cognitive instruments that measured reading and comprehension were also utilized in the study. Meiring et al. (2005) concluded in their study that the usefulness of the 15FQ+ was limited, and that certain semantic revisions of items needed to take place in order for the items to be more easily understood. Further to this, Moyo (2009) conducted a preliminary factor analytical investigation into the first-order factor structure of the 15FQ+. The study was conducted on a sample of Black South African managers. The magnitude of the estimated model parameters suggested that the items generally do not reflect the latent personality dimensions they were designed to reflect with a great degree of success (Moyo, 2009). Although the measurement model did succeed in reproducing a co-variance matrix that closely approximates the observed co-variance matrix the results obtained in this study did point to some reason for concern regarding the use of the 15FQ+ for personality assessment, specifically on Black South African managers (Moyo, 2009). Given the concerns raised, based on the research evidence above, it is clear that psychological measures imported from Western nations, such as the15FQ+, should be investigated for their suitability in the multicultural South African context (Meiring et al., 2005).

Heuchert, Parker, Strumf, and Myburg (2000) investigated the structure of the Five Factor Model of Personality (FFM) in South African university students across different cultures. They utilized a commonly applied measure of the Big Five, the NEO-Personality Inventory-Revised (NEO-PI-R). The students were asked to complete the NEO-PI-R. It was found that the structure of the five-factor model was highly similar across ethnic groups. The only difference found was in the Openness to Experience dimension, particularly in the Openness to Feelings facet. The White subgroup scored relatively high, the Black subgroup scored relatively low, and the Indian subgroup scored in an intermediate range. The authors speculated that these differences are primarily the result of social, economic, and cultural differences between the ethnic groups. Taylor (2000) conducted a construct comparability study of the NEO-PI-R for Black and White employees in a work setting in South Africa.

She also found that the NEO-PI-R did not work as well for Blacks as it did for Whites, in particular, the Openness factor was not replicated in the Black sample.

Furthermore, Taylor and Boeyens (1991) investigated the cross-cultural applicability of the South African Personality Questionnaire's (SAPQ). They investigated the psychometric properties of the SAPQ using two Black and two White groups of participants. Modest support for the construct comparability between the groups was found (Van der Vijver & Rothmann, 2004). Taylor and Boeyens (1991) concluded that while there was some support for cross-cultural comparability of constructs between Black and White respondents, the analysis indicated that the questionnaire is not an applicable instrument for the use across different ethnic groups. Retief (1992) agrees that the SAPQ should not be used in a multicultural context. The authors recommended a 'clean-sheet' approach to personality measurement in South Africa which would entail the creation of a new personality measure suitable for cross-cultural use in South Africa (Taylor & Boeyens, 1991).

In a recent effort to this end, a collaborative research program between various universities in South Africa and Tilburg University in the Netherland, has undertaken the development of a single, unified personality inventory that takes into consideration both universal and unique personality factors to be found across the eleven official language groups in South Africa. This research project is referred to as the South African Personality Inventory (SAPI) Project. According to Nopote (2009) the personality inventory will be developed, standardized and submitted for classification to the Psychometrics Committee of the Professional Board for Psychology (HPCSA) in South Africa. This personality inventory will have to comply with the Employment Equity Act 55 of 1998 (Republic of South Africa, 1998) in order to have the expected impact. The researchers working on this project combine their knowledge of cross-cultural assessment, personality theory and sensitivity for, and knowledge of, the ethnic differences in South Africa in order to achieve successful completion of the project.

Personality tests are widely used in South Africa. It is evident from the aforementioned research studies that some of the personality tests used in South Africa have not yet been proven sufficiently suitable for the country's multicultural and multilingual society. Even the adaptation of imported tests, has not come without problems. Research regarding the cross-cultural transportability of personality tests in South Africa is still in its infancy stage. Clearly, much more research is needed on the cross-cultural applicability of assessment tools used in South Africa before psychology as a profession can live up to the demands imposed by the Employment Equity Act 55 of 1998 (Republic of South Africa, 1998).

CHAPTER 3

LITERATURE REVIEW OF THE 15FQ+ PERSONALITY MEASURE

This section reviews existing literature on the Sixteen Personality Factor Questionnaire (16PF), the Fifteen Personality Factor Questionnaire (15FQ) and the second edition of the Fifteen Personality Factor Questionnaire (15FQ+) in an attempt to clarify the purpose for which the 15FQ+ was developed. This section further outlines the processes followed in the development of the 15FQ+, evaluates the success with which the 15FQ+ measures personality as it is constitutively defined, and presents empirical evidence to argue that the 15FQ+ is a reliable and valid measure of personality. The 16PF, 15FQ and the 15FQ+ was developed from the trait theory, which was discussed in the previous section.

3.1 BACKGROUND

The second edition of the Fifteen Personality Factor Questionnaire (15FQ+) was developed by *Psytech International* as an update of the original version of the 15FQ. According to Psychometrics Limited (2002) the 15FQ was first published in 1992 as an alternative to the Sixteen Personality Factor Questionnaire (16PF). The 16PF personality test was originally developed by Raymond Cattell and his colleagues in 1946 (Psychometrics Limited, 2002). The definition of personality, as constitutively defined by the 16PF, was adopted in 1937 from Allport with the intention of developing a simplified typology of understanding the intra-psychic characteristics and tendencies that define individuals (Moyo, 2009).

Both versions of the 15FQ and the 15FQ+ were designed specifically for use in industrial and organisational settings. The 15FQ and 15FQ+ applies Cattell's personality dimensions directly to the workplace. This provides a more occupational orientated personality test as an alternative to the 16PF series of tests which are traditionally more clinically based. The 15FQ+ is therefore based on well researched traits as identified by Cattell and his colleagues (Meiring et al., 2005).

3.2 OVERVIEW OF THE 16PF

The Sixteen Personality Factor Questionnaire (16PF) was developed by Raymond Cattell in 1946 and first published commercially in 1949 (Davidshofer & Murphy, 2005; Psychometrics Limited, 2002). According to Moyo (2009) Cattell made use of a lexical approach during the development of the 16PF on the notion that the more important a word is in any language, the more often it will be utilized in the specific language. According to Carver and Scheier (2000) Cattell believed that each language contains words describing everyday behavior and that a trait is reflected in the number of words that describe it within the sphere of any language. Cattell (1979) used three sources of data in the development of his theory. These included test data (T-data), life data (L-data) and questionnaire data (Q-data). His personality theory contains an integrative review of research done through these three sources of data (Psychometrics Limited, 2002).

On the basis of the data collected, factor analysis was used to build a taxonomy of basic traits (Cattell, 1979). Factor analysis provides valuable information regarding the conceptual nature of factors; indicates the convergence between observers and instruments, and facilitates the prediction of psychological outcomes (Costa & McCrae, 1992). Cervone and Pervin (2008) consider Cattell's contribution as important for trait psychology. They believed that he was responsible for many psychometric advances through the refinement of factor-analytical methodology. This led to the development of an array of factor-analytical tests and statistical techniques (Cervone & Pervin, 2008). The 16PF South African test manual reports the results of the original factor analysis conducted by Raymond Cattell (cited in Moyo, 2009). The factor analysis identified 16 primary factors, also referred to as first order factors, which were considered to be the core personality structure in Cattell's theory of personality. Further correlation studies on the first order factors showed five major global factors also referred to as second order factors. The 16 factors are regarded as source traits of the normal personality structure which are suitably measured through a self-report inventory (Moyo, 2009). Cattell (1979) believed that source traits are stable and determine an individual's consistent behaviour. The 16PF will therefore lead to an accurate prediction of behaviour due to the identified source traits.

The identified sixteen primary traits are self-rated by the individual being tested. Table 3.1 presents the 16 primary traits and their corresponding behavioural dimensions at the high and low ends as measured by the 16PF.

Extended factor analysis of the basic scales listed in Table 3.1 revealed five second-order factors; also referred to as global factors. The global factors of the 16PF are closely related to the Big Five dimensions of personality as identified in the 1950's (Psychometrics Limited, 2002). Table 3.2 presents the global factors of the 16PF which represents broader aspects of personality.

Specific correlations exist between the primary personality factors (Moyo, 2009). The 5 global factors help to explain the relationships observed among the primary factors. The global factors signify common themes shared by some of the primary factors which indicate that the global factors are broader and more general constructs (Moyo, 2009). According to McAdams (1992) the global factors operate at a general level of analysis, scores on the global factors may not be useful in prediction of specific behaviour in particular situations, though they may be valuable in the prediction of general trends across many different kinds of situations. The narrower primary personality traits are more homogenous and better predictors of behaviour in the everyday context (McAdams, 1992). Therefore the global traits are better suited for predicting behavioural trends in broad, generic situations where the narrow primary traits work better for narrowly defined situations. Table 3.3 presents a brief depiction of how the 16 primary factors load on the five global factors.

Table 3.1

CATELL'S 16 FIRST-ORDER FACTORS MEASURED BY THE 16PF

Descriptions of Low Range	Factor Primary Scales	Descriptions of High Range
Reserved, impersonal, distant	Warmth (A)	Warm, participating, attentive
Concrete, lower mental capacity	Reasoning (B)	Abstract, bright, fast-learner
Reactive, affected by feelings	Emotional Stability (C)	Emotionally stable, adaptive, mature
Deferential, cooperative, avoids conflict	Dominance (E)	Dominant, forceful, assertive
Serious, restrained, careful	Liveliness (F)	Enthusiastic, animated, spontaneous
Expedient, nonconforming	Rule- Consciousness (G)	Rule conscious, dutiful
Shy, timid, threat sensitive	Social boldness (H)	Socially bold, venturesome, thick-skinned
Tough, objective, unsentimental	Sensitivity (I)	Sensitive, aesthetic, tender-minded
Trusting, unsuspecting, accepting	Vigilance (L)	Vigilant, suspicious, skeptical, wary
Practical, grounded, down to earth	Abstractedness (M)	Abstracted, imaginative, idea orientated
Forthright, genuine, artless	Privateness (N)	Private, discreet, non-disclosing
Self-assured, unworried, complacent	Apprehension (O)	Apprehensive, worried, self doubting
Traditional, attracted to familiar	Openness to change (Q1)	Open to change, experimenting
Group orientated, affiliative	Self-Reliance (Q2)	Self-reliant, solitary, individualistic
Tolerates disorder, unexcting, flexible	Perfectionism (Q3)	Perfectionist, organized, self- disciplined
Relaxed, placid, patient	Tension (Q4)	Tense, high energy, driven

(Catell & Scherger, 2003, p5)

Table 3.2

GLOBAL FACTORS MEASURED BY THE 16PF

Descriptions of Low Range	Factor Primary Scales	Descriptions of High Range
Introverted, socially inhibited	Extraversion	Extroverted, socially participating
Low anxiety, imperturbable	Anxiety	High anxiety, perturbable
Receptive, open minded, intuitive	Tough-mindedness	Tough-minded, resolute, unempathetic
Accommodating, agreeable, selfless	Independence	Independent, persuasive, willful
Unrestrained, follows urges	Self-control	Self-controlled, inhibits urges

(Cattell & Scherger, 2003, p5)

Table 3.3

HOW THE 16PF PRIMARY FACTORS LOAD ON THE FIVE GLOBAL FACTORS

	16PF Global Factors
Global Factors	Primary First-order factors loading on the global second-order factors
Extraversion	Warmth(A+), Liveliness(F+), Social Boldness(H+), Privateness (N-), Self-reliance(Q2-)
Anxiety	Emotional Stability(C-), Vigilance(L+), Appreciation(o+), Tension(Q4+)
Tough Mindedness	Warmth(A-), Sensitivity(I-), Abstractedness(M), Openness to Change(Q1+)
Independence	Dominance(E+), Social Boldness(H+), Vigilant(L+), Openness to Change(Q1+)
Self-Control	Liveliness(F-), Rule Consciousness(G+), Abstractedness(M-), Perfectionist(Q3-)

Note: The "+" and "-" signs indicate the direction of the relationship of the primary factors to the Global factors.

(Adapted from Conn & Rieke, 1994, p7)

The 16PF is a self-descriptive questionnaire which measures the normal range of personality. The test was originally available in three forms including form A, form B and form C. Forms A and B contained 187 items and form C, the shorter version, contained 105 items (Moyo, 2009). These items are grouped together into the 16 primary factor scales representing the dimensions of personality initially identified by Cattell (1979). Since the initial development of the 16PF it has undergone four revisions (Davidshofer & Murphy, 2005). Although the basic nature of the test has remained unchanged, a number of modifications have been made resulting in updated norms, language, lower reading level, new response-style indices, and easier hand scoring and improved psychometric qualities of the tool.

Due to South Africa's multicultural and multilingual context the 16PF was adapted for the South African population in 1992 and the SA92 form was developed. The 16PF SA92 form was developed in order to be applicable to all ethnic groups in South Africa. The SA92 form of the 16PF consists of 160 items. Each item has a statement with three possible options. The norms of the test were based on 6922 respondents from the academic and industrial field (Taylor, 2004).

Although evidence in support of the appropriate cross-cultural use of the 16PF is somewhat lacking, it has been used extensively throughout South Africa's multicultural and multi-lingual population (Foxcroft & Roodt, 2007). Some research has shown that language preference and ethnic group membership has appears to have an influence on tests scores. For example, Abrahams (1996) found little support for construct equivalence across Black, Coloured, Indian and White ethnic groups. Furthermore, Abrahams and Mauer (1999) argued, based on the results of a qualitative analysis that many of the 16PF items appear to be biased. Their research also highlighted numerous interpretational problems with items, revealing both cultural and language discrepancies. Cattell, Eber and Tatsuoka (1970) cautioned about implicitly assuming adequate cross-cultural portability of the instrument, although the questionnaire type of the personality test is convenient, and therefore widespread in its use, it would be a mistake to assume that it can be employed without caution as a universally valid instrument. According to Abrahams (1996) mean differences in test scores could be due to real differences, but can only be concluded if the test has been shown to be suitable in the given context. Hence, evidence that variables such as language and race do not influence test scores should be collated, before it is concluded that mean differences are due to real differences in the latent trait of personality.

3.3 OVERVIEW OF THE 15FQ+

The 15FQ+ is a normative, trichotomous response personality test developed by *Psytech International* as an update to their original version the 15FQ (Tyler, 2003). The 15FQ was first published by *Psytech* in 1992 as an alternative to the 16PF series of tests. It was designed to assess fifteen of the sixteen personality dimensions that were first identified by Cattell and his colleagues (Psychometrics Limited, 2002). The factor excluded from the 15FQ was factor B, i.e. reasoning ability (or intelligence). There was general agreement that reasoning ability can only be reliably measured by reasoning items included in a timed personality test (Tyler, 2003). It was argued that the 16PF, an untimed test, is therefore unable to assess factor B (intelligence) with acceptable reliability and validity, and hence it was omitted from the 15FQ.

The second edition of the 15FQ named the 15FQ+ resembles the original version, which measures 15 of the core personality factors identified by Cattell. However, *Psytech International* took advantage of recent developments in psychometrics and information technology which allowed for the inclusion of factor B that was excluded from the original version (Psychometrics Limited, 2002). A completely new item set was developed for the 15FQ+ and factor B was reintroduced as a meta-cognitive personality variable, rather than an ability variable (Tyler, 2003). The meta-cognitive personality variable assesses cognitive style, namely individual differences in how people approach cognitive tasks, instead of cognitive ability (Psychometrics Limited, 2002). Factor B was officially termed intellectance, and refers to a person's confidence in their intellectual ability as opposed to intelligence per se, which allow the inclusion of this important factor within the untimed 15FQ+ personality questionnaire (Tyler, 2003; Psychometric Limited 2002). The term intellectance is defined in the 15FQ+ manual as, "a self-reported superior level of intellectual capacity, a preference for, and enjoyment of, complex arguments and ideas. A self-reported superior level of verbal ability, abstract reasoning ability and numerical ability" (cited in Tyler, 2003, p. 7).

3.4 DEVELOPMENT OF THE 15FQ+

According to Tyler (2003) the 15FQ+ is a full revision of the original 15FQ with a completely new item set that was developed from extensive item trailing. The main aim of the 15FQ+ was to produce a relatively short, yet robust measure of Cattell's primary personality factors (Meiring et al., 2005).

The 15FQ+ has been written in simple, clear and concise modern European business English whilst attempting to avoid cultural, age and gender bias in items. The technical manual states that the items have been selected to maximize reliability, while maintaining the breadth of the original personality factors at the same time as avoiding the production of narrow, highly homogenous 'cohesive' scales that measure nothing more than surface characteristics (Psycometric Limited, 2002; Tyler, 2003).

The 15FQ+ technical manual summarizes the process followed in the development of the questionnaire as follows (Psychometrics Limited, 2002):

- Cattell's 15 factors (excluding intelligence) were defined through extensive research. A panel of psychologists experienced in personality test construction captured the full breadth of the behavioural manifestations and dispositions of each trait for trailing of test items. Care was taken to ensure that these trail items reflected Cattell's definitions of each of the test's factors. All the trial items were written in business English that avoided cultural and gender bias. Wherever possible existing 15FQ items that fulfilled these criteria were used.
- Data on the trial item set were collected in conjunction with data on Form A of the 16PF4. These data sets were analyzed to ensure that the 15FQ+ items occupied the same position in the personality factor space as the factors measured by the 16PF4 (Form A).
- Those items that yielded poor psychometric properties were removed and new items were constructed based on the guidelines set above. Those items that had acceptable item-total correlations, and correlated substantially higher with their target scale than with any other scale, were retained for inclusion in the final test.

- Steps 2 and 3 were repeated until 12 items with acceptable psychometric properties were retained for each of the 15 dimensions assessed by the 15FQ+, excluding intellectance and the Social Desirability scale. A panel of psychologists experienced in test construction generated initial item sets for the intellectance (B) and social desirability scales. Step 3 was repeated until 12 items with acceptable psychometric properties were obtained for each of these scales.
- The 16 scales including intellectance were then factor-analysed using the total standardization sample. Five global factors similar to the original big five factors were identified and extracted.
- After achieving a satisfactory final item set, the faking good and faking bad, work attitude and emotional intelligence scales were constructed using criterion keying against well validated scales that assess these constructs.
- Through the selection of the best six items from each item set for each of the 16 scales, a short form of the 15FQ+ was created.

The development of the 15FQ+ is based on Cattell's factor perspective. Cattell's factor perspective includes the construction of subscales in which certain items are allocated to primarily represent a specific personality dimension. However the items also reflect the remaining personality dimension, albeit to a lesser degree, comprising the personality domain. Therefore each of the 15FQ+ items indicates a pattern of small positive and negative loadings on the remaining factors. These patterns of positive and negative loading cancel each other out in a suppressor action effect (Gerbing & Tuley, 1991). The measurement model of the 15FQ+ therefore ideally should make provision for each latent personality dimension reflecting itself primarily, but not exclusively, in the items written for that specific subscale. The more problematic question, however, is exactly how this should be achieved. This question will be further considered in Chapter 3.

3.4.1 First - and - Second Order Factors

All the factors of the 15FQ+ have retained their original definitions as defined by Cattell in his research of the 16PF with exception of factor B, the intelligence factor. As with the 16PF the identified16 primary scales were factor analysed which resulted in the detection of five second-order factors, also referred to as global factors. The global factors are similar to the big five factors originally identified in the late 1950's. The global factors represent the broader aspects of personality, therefore, only indicating the general personality orientation (Psychometrics Limited, 2002). The 15FQ+ therefore consists of sixteen primary scales and five global factors which are reported in Tables 3.4 and 3.5 respectively.

Table 3.4

15FQ+ PRIMARY FACTORS

Descriptions of Low Range	Factor Primary Scales	Descriptions of High Range
Distant Aloof	Factor A	Empathic
Low Intellectance	Factor B	High Intellectance
Affected by Feelings	Factor C	Emotionally Stable
Accommodating	Factor E	Dominant
Sober Serious	Factor F	Enthusiastic
Expedient	Factor G	Conscientious
Retiring	Factor H	Socially bold
Hard-headed	Factor I	Tender-minded
Trusting	Factor L	Suspicious
Concrete	Factor M	Abstract
Direct	Factor N	Restrained
Confident	Factor O	Self-doubting
Conventional	Factor Q1	Radical
Group orientated	Factor Q2	Self-sufficient
Informal	Factor Q3	Self-disciplined
Composed	Factor Q4	Tense- driven

(Adapted from Moyo, 2009, p30)

Table 3.5

15FQ+ GLOBAL FACTORS

Descriptions of Low Range	The Global Factors	Descriptions of High Range
Orientated to the outer world of people, events and external activities. Needing social contact and external stimulation	Extraversion Vs Introversion	Orientated towards their own inner world of thoughts, perceptions and experiences. Not requiring much social contact and external stimulation
Well adjusted, calm, resilient and able to cope with emotionally demanding situations	Low Anxiety Vs High Anxiety	Vulnerable, touchy, sensitive, prone to mood swings, challenged by emotionally grueling situations
Influenced more by hard facts and tangible evidence than subjective experiences. May not be open to new ideas and may be insensitive to subtleties and possibilities	Pragmatism Vs Openness	Influenced more by ideas, feelings and sensations than tangible evidence and hard facts. Open to possibilities and subjective experiences
Self-determined with regard to own thoughts and actions. Independent minded. May be intractable, strong-willed and confrontational	Independence Vs Agreeableness	Agreeable, tolerant and obliging. Neither stubborn, disagreeable nor opinionated. Is likely to be happy to compromise
Exhibiting low levels of self-control and restraint. Not influenced by social norms and internalized parental expectations	Low Self-control Vs High Self-control	Exhibiting high levels of self control. Influenced by social norms and internalized parental expectations

(Adapted from Psychometrics Limited, 2002, p11)

Identical to the 16PF, the global factors in the 15FQ+ signify common themes shared by some of the primary factors. This indicates that the global factors are broader and more general constructs. Table 3.3 presents a brief depiction of how the 16 primary factors load on the five global factors, indicating that a number of different primary traits contributes to the same global factors. The general belief is that the primary factors will vary in a consistent manner. This is, however, not always the case. There might be some inconsistencies in the personality profile. This is where the richness of the 15FQ+ model becomes apparent. Such a profile will not be a contradiction but simply indicate that the meaning of the profile should be interpreted according to the broader primary personality scales (Psychometrics Limited, 2002).

3.4.2 New features of the 15FQ+

The 15FQ+ incorporates the same personality factors as in the 15FQ, 15 of the 16PF factors with the exception of intelligence, as well as a number of recent psychometric innovations. The instrument includes, for example, the additional measure of factor B (intellectance) which was originally excluded from the first edition of the 15FQ for theoretical and practical reasons as mentioned above. In addition to the intellectance scale, the 15FQ+ now includes criterion referenced scales for both emotional intelligence and work attitude. These scales are calculated from a sub-set of the 15FQ+ items and have been found, through research, to be well-validated measures of the relevant constructs (Psychometrics Limited, 2002; Tyler, 2003).

Furthermore, the 15FQ+ now incorporates an extensive range of response style indicators, some of which are only available via the computer generated narrative report. These include a dedicated social desirability scale, non-dedicated faking good and faking bad scales, impression management scale, as well as measures of central tendency and frequency (Tyler, 2003). The social desirability scale is available for both the pencil and paper and the computer scored versions of the long form. The faking good and faking bad scales are only available for the computer scored version of the long test (Psychometric Limited, 2002). According to Psychometrics Limited (2002) the central tendency and frequency scales highlights the possibility of indecisive decision making while completing the questionnaire.

3.4.3 Administration of the 15FQ+

The questionnaire is available for pencil and paper, as well as computer administration. Besides producing a brief standard length test, which contains 12 items per scale (200 items in total), the latest version also offers a short form, which contained six items per scale (100 items in total) (Psychometrics Limited, 2002). The short form has been developed for situations where speed of completion is more important than high reliability and validity. Given the short scales and low reliabilities the short form of the 15FQ+ is not used in the South African context.

3.5 RELIABILITY OF THE 15FQ+ MEASURE

According to Kerlinger and Lee (2000) reliability of a measuring instrument refers to the degree that a measure is free from measurement error. Classical measurement theory view reliability in a more technical manner as the proportion of systematic observed score variance (Theron, 1999). This part of the research study presents information regarding the reliability of the 15FQ+ as reported in current available literature by Psychometrics Limited (2002), Tyler (2003) and other scholars. These authors have reported sufficient reliability of the 15FQ+ on a variety of samples which will be discussed in this section.

Reliability of an instrument is generally assessed using (a) the stability of scale scores over time and/or (b) the internal consistency of the constituent items that form a scale score. The stability of scale scores are assessed with the stability coefficient which provides information determining the usefulness of the test in terms of what it measures. A low coefficient will be approximately < .60 which indicates that the behaviours being measured are volatile or situation specific, and changes over time, which makes the scale(s) less useful (Psychometrics Limited, 2002).

Internal consistency is measured with the Cronbach's coefficient alpha. A high coefficient alpha indicates that the items on a scale have high correlations with each other and with the total score, indicating that the items are measuring the same underlying phenomenon. A low coefficient alpha would be suggestive of either scale items measuring different attributes, or the presence of random measurement error (Psychometrics Limited, 2002).

The 15FQ+ has been used within a variety of samples. For example, the technical manual developed by Psychometrics Limited (2002) reports alpha coefficients for a

UK professional sample, as well as two student samples. Tyler (2003) presented results for a South African study on managers in a manufacturing company. Tables 3.6 and 3.7 present the results reported by these studies respectively. Table 3.6 presents the alpha coefficients for each of the sixteen personality factors for both the standard (form A) and the short form (form C) of the 15 FQ+ on the UK samples. Table 3.7 presents the alpha coefficients for each of the sixteen personality factors of the 15FQ+ on the South African sample.

Table 3.6

RELIABILITY COEFFICIENTS (ALPHA) FOR THE 15FQ+ SCALES BASED ON A UK SAMPLE

15FQ+ Scales	Form A student sample (n=183)	Form A professional Sample (n=325)	Form C student sample (n=183)	Form C professional sample (n=325)
Factor A	.83	.78	.64	.64
Factor B	.77	.80	.62	.71
Factor C	.80	.77	.60	.63
Factor E	.80	.79	.60	.66
Factor F	.75	.78	.63	.63
Factor G	.85	.81	.60	.64
Factor H	.85	.81	.68	.68
Factor I	.74	.77	.64	.63
Factor L	.78	.77	.66	.62
Factor M	.80	.79	.64	.64
Factor N	.79	.78	.67	.67
Factor O	.82	.83	.67	.69
Factor Q_1	.81	.79	.60	.72
Factor Q_2	.82	.78	.67	.62
Factor Q_3	.78	.76	.66	.63
Factor Q_4	.84	.81	.60	.62

(Adapted from Tyler, 2003, p. 3)

Table 3.7

RELIABILITY COEFFICIENTS (ALPHA) FOR THE 15FQ+ SCALES BASED ON A SAMPLE OF SOUTH AFRICAN MANAGERS IN A MANUFACTURING COMPANY

15FQ+ Scales	Scale description	Coefficient alpha
Factor A	Distant Aloof- Empathic	.60
Factor B	Intellectance	.53
Factor C	Affected by feelings-emotionally stable	.73
Factor E	Accommodating - Dominant	.66
Factor F	Sober serious – Enthusiastic	.80
Factor G	Expedient – Conscientious	.74
Factor H	Retiring – Socially bold	.83
Factor I	Tough minded – Tender minded	.72
Factor L	Trusting – Suspicious	.73
Factor M	Concrete – Abstract	.61
Factor N	Direct – Restrained	.74
Factor O	Self-assured – Apprehensive	.71
Factor Q_1	Conventional – Radical	.73
Factor Q_2	Group orientated – Self sufficient	.66
Factor Q_3	Informal – Self-disciplined	.52
Factor Q_4	Composed – Tense driven	.77

(Adapted from Tyler, 2003)

According to Tyler (2003) the results obtained in the South African study indicated acceptable levels of internal consistency. The results of Form A for both UK samples specify high levels of reliability that according to Moyo (2009, p. 33) indicates that “the responses to these items were the result of the systematic working of a stable set of latent variables”. All scales in Table 3.6 demonstrate good levels of internal consistency, when the length of the scales (e.g. for form C) is taken into account. According to Psychometrics Limited (2002) the longer version (form A) is generally more reliable due to the larger amount of items used in this version of the test. Consequently, the shorter 100-item version (form C) is less reliable than form A, but still indicates sufficient reliability. For example, Moyo (2009) stated that the reliability of form C is acceptable but not impressive for the UK samples. According to Tyler (2003) the lower levels of reliability found in the short-form scales reflect the relative brevity (six versus twelve items) of the form C scales. Schmitt (1996) agrees with this view through stating that generally alpha increases as a function of test length.

Tyler (2003) provides further evidence of acceptable levels of reliability for the 15FQ+ scales on South African samples, including a sample of South African professional and management development candidates. The results of the study on the South African professional and management development candidates are summarized in Table 3.8. *Psytech South Africa* conducted a reliability study on respondents that have completed a Verbal Reasoning Test in 2004 (cited in Moyo, 2009). Table 3.9 provides the results of the reliability analysis of the 15FQ+ where all respondents used in the sample also completed a verbal reasoning test.

Table 3.8

RELIABILITY COEFFICIENTS (ALPHA) FOR THE 15FQ+ BASED ON A SAMPLE OF SOUTH AFRICAN PROFESSIONAL AND MANAGEMENT DEVELOPMENT CANDIDATES (N=226)

15FQ+ Scales	Scale description	Coefficient alpha
Factor A	Distant Aloof- Empathic	0.71
Factor B	Intellectance	0.67
Factor C	Affected by feelings-emotionally stable	0.76
Factor E	Accommodating - Dominant	0.75
Factor F	Sober serious – Enthusiastic	0.71
Factor G	Expedient – Conscientious	0.81
Factor H	Retiring – Socially bold	0.82
Factor I	Tough minded – Tender minded	0.71
Factor L	Trusting – Suspicious	0.75
Factor M	Concrete – Abstract	0.68
Factor N	Direct – Restrained	0.73
Factor O	Self-assured – Apprehensive	0.81
Factor Q_1	Conventional – Radical	0.80
Factor Q_2	Group orientated – Self sufficient	0.72
Factor Q_3	Informal – Self-disciplined	0.77
Factor Q_4	Composed – Tense driven	0.78
Mean alpha		0.75

(Adapted from Tyler, 2003, p. 9)

On the sample presented in Table 3.8, both factor B (intellectance) and factor M (concrete-abstract) obtained reliabilities that fall slightly below acceptable levels of reliability, if the .70 cutoff point as stated in Nunnally (1978) is applied. Gliem and Gliem (2003) indicated that an alpha of .80 is a reasonable goal and George and Mallery (2003) provide the following rules of thumb: > .90 = excellent; > .80 = good; > .70= acceptable; > .60 = questionable; > .50 = poor; and < .50 = unacceptable. Based on the reported studies, the alpha coefficients of the 15FQ+ are not as high. Psychometrics Limited (2002) suggests that this is due to the factors of the 15FQ+ not measuring narrow surface traits.

Table 3.9

RELIABILITY COEFFICIENTS (ALPHA) FOR THE 15FQ+ FOR RESPONDENTS GROUPED ACCORDING TO GRT2 VERBAL REASONING SCORES

15FQ+ Scales	1 Stanine 1-2	2 Stanine 3-4	3 Stanine 5	4 Stanine 6-7	5 Stanine 8-9
Factor A	0.485	0.612	0.688	0.700	0.709
Factor B	0.691	0.722	0.708	0.709	0.702
Factor C	0.730	0.723	0.738	0.719	0.713
Factor E	0.482	0.586	0.635	0.714	0.735
Factor F	0.735	0.735	0.773	0.760	0.760
Factor G	0.542	0.657	0.769	0.759	0.780
Factor H	0.735	0.784	0.700	0.823	0.830
Factor I	0.625	0.697	0.706	0.754	0.720
Factor L	0.617	0.672	0.713	0.729	0.743
Factor M	0.346	0.442	0.562	0.648	0.640
Factor N	0.532	0.693	0.728	0.761	0.752
Factor O	0.485	0.657	0.747	0.718	0.789
Factor Q1	0.352	0.533	0.633	0.721	0.757
Factor Q2	0.622	0.683	0.718	0.770	0.724
Factor Q3	0.506	0.426	0.568	0.648	0.658
Factor Q4	0.554	0.720	0.761	0.782	0.819
SD(Social desirability)	0.714	0.713	0.703	0.692	0.676

(Adapted from Moyo, 2009, p34)

In the study presented in Table 3.9 the coefficient alphas for respondents were calculated for each of the 15FQ+ scales according to the respondent's GRT2 verbal reasoning scores. Individuals were classified on the basis of their verbal reasoning ability into five stanine intervals (Moyo, 2009). The results of this study, presented in Table 3.9, clearly suggest that the reliability of the 15FQ+ scales increases as the verbal ability of testees increase. Moyo (2009) did a preliminary factor analytical investigation into the first-order factor structure of the 15FQ+ on a sample of Black South African Managers. In his study reliability analyses were conducted for all the subscales of the 15FQ+. A variety of item statistics were calculated for the items of each subscale. A summary of the item analysis results for each of the 15 FQ+ sub-scales is presented in Table 3.10.

Table 3.10

A SUMMARY OF RESULTS OF THE ITEM ANALYSES OF THE 15FQ+ SUBSCALES

Subscale	Sample size	Mean	Variance	Standard deviation	Cronbach alpha
Factor A	241	19.3	8.831	2.895	0.455
Factor B	241	19.3	11.685	3.187	0.586
Factor C	241	17.5	17.558	4.19	0.689
Factor E	241	16.7	14.457	3.802	0.601
Factor F	241	13.8	24.694	4.969	0.683
Factor G	241	19.2	17.283	4.157	0.725
Factor H	241	15.5	30.368	5.511	0.765
Factor I	241	14.3	22.738	4.768	0.658
Factor L	241	8.98	21.879	4.677	0.699
Factor M	241	10.4	15.655	3.957	0.558
Factor N	241	19.9	12.885	3.59	0.661
Factor O	241	11.9	23.908	4.89	0.631
Factor Q1	241	10	24.208	4.92	0.658
Factor Q2	241	6.96	16.482	4.06	0.607
Factor Q3	241	19.6	11.944	3.456	0.654
Factor Q4	241	7.89	22.163	4.708	0.654

(Adapted from Moyo, 2009)

Table 3.10 represents a disappointing psychometric picture. The coefficients of internal consistency for most subscales were much lower than those reported in Table 3.7 and Table 3.8 for a sample of predominantly White South African managers and a sample of predominantly White South African professional and management development candidates (Moyo, 2009). Factor G (Expedient-Conscientious) and Factor H (Retiring-Socially bold) were the only two subscales in this study that met the benchmark reliability standard of .70. Factor I (Tough minded-Tender minded) and Factor C (Affected by feelings – emotionally stable) almost approached the .70 standard. However, according to Smit (1996) personality measures generally do tend to display somewhat lower coefficients of internal consistency. The available item statistic evidence for this particular study would, however, suggest that the items of the 15FQ+ do not successfully represent the underlying personality dimensions they were meant to measure in a sample of Black South African Managers (Moyo, 2009).

Overall it may be concluded that the 15FQ+ can be assumed to be a reliable measure of personality in South Africa, although alpha levels are generally lower than those obtained in UK samples (Psychometrics Limited, 2002; Tyler, 2003). Despite the slightly lower levels of reliability the alphas do compare favorably to those obtained within South Africa from other measures of personality (Tyler, 2003). The biggest challenge in terms of the reliability of the 15FQ+ would be the lower levels of internal consistency obtained for a Black South African sample than for a predominantly White sample. *Psytech South Africa,* however, acknowledges that "literacy, educational levels and cultural factors do place constraints upon the test's use and interpretation which play a role in lowering the reliability coefficients" (Tyler, 2003 p. 9).

3.6 VALIDITY OF THE 15FQ+

Evidence of high internal consistency and stability coefficients simply guarantees that a test is measuring something consistently. It does not provide a guarantee that the test is in fact measuring what it claims to measure, or that the test will be useful in a particular situation. Concerns of whether a test actually measures what it claims to measure, and its significance in a particular situation, are dealt with by looking at the test validity (Kline, 1993). Validity of test scores refers to the extent to which they satisfy their intended purpose (Tyler, 2003). Reliability is usually investigated before validity for the reason that the reliability of the test places an upper limit on its validity; this can also be demonstrated in mathematical terms where a validity coefficient for a particular test cannot exceed the square root of that test's reliability coefficient. Two key areas of validation are known as criterion validity and construct validity (Psychometrics Limited, 2002).

When the scores on a test provide a meaningful interpretation of an external criterion of interest the test demonstrates criterion validity. Two forms of validity can be distinguished in terms of criterion validity, namely predictive and concurrent validity. Predictive validity is achieved when a test successfully predicts an agreed criterion, which will be available at some future time - e.g. can a test predict the likelihood of someone successfully completing a training course. Concurrent validity is achieved when the scores on the test can successfully predict an agreed criterion, which is available at the time of the test - e.g. can a test predict current job performance (Psychometrics Limited, 2002).

For a test to be a valid predictor the test should successfully provide information regarding the predictor construct of interest that is systematically related to the criterion construct. The constructs of interests are by definition abstract and cannot be measured directly (Theron, 2006). The construct is constitutively defined by describing the internal structure of the construct and the manner in which the construct is embedded in a larger nomological network of constructs. Moyo (2009) explains that the abstract construct has to be translated into concrete, behavioural terms through the process of construct explication before it can be measured. He described construct explication as a detailed description of the relationship between specific behaviours or experiences and abstract constructs. The construct is then indirectly measured via the identified behavioural indicators in which the construct expresses itself (Moyo, 2009). Once the behavioural items have been identified, the question that arises is whether these indicators provide reliable, valid and unbiased reflections of the construct of interest (Theron, 2006). The construct validity of a test is assessed by determining whether a measurement model reflecting the constitutive definition of the construct and the design intention of the instrument fits empirical data. The construct validity of a test is in addition assessed by determining whether a structural model reflecting the manner in which the construct is embedded in a larger nomological network of constructs according to the constitutive definition fits empirical data. The construct validity of a test is in addition evaluated by determining whether the scores from the test are consistent with those from other major tests that measures similar constructs and are dissimilar to scores on tests that measure different constructs (Psychometrics Limited, 2002).

The 15FQ+ was developed to measure the original source traits identified by Cattell and his colleagues. Therefore, one would expect to find evidence of construct validity when comparing the 15FQ+ with versions of the 16PF, especially the most recent 16PF5 and 16PF (form A). The Sixteen Personality Factor Questionnaire – Fifth Edition (16PF5) is one of the most widely used, extensively researched and highly reputed tools for measuring personality throughout the world (Davidshofer & Murphy, 2005). Table 3.11 provides data from a student sample of 183 individuals supporting the construct validity of the 15FQ+. This table includes both the corrected and uncorrected correlations for attenuation due to measurement error between the 16PF (two versions) and the 15FQ+.

Table 3.11

CORRELATIONS OF THE 15FQ+ FACTORS WITH 16PF (FORM A) AND 16PF5 (STUDENT SAMPLE = 183)

15FQ+ Scales	16PF (FormA) Uncorrected	16PF (FormA) corrected	16PF5 uncorrected	16PF5 corrected
Factor A	0.31	0.37	0.55	0.70
Factor B	0.10	-	0.34	-
Factor C	0.59	1	0.81	1
Factor E	0.68	0.99	0.82	1
Factor F	0.72	0.98	0.81	1
Factor G	0.55	0.89	.79*	0.75
Factor H	0.78	0.99	0.88	1
Factor I	0.50	0.75	0.47	0.56
Factor L	0.29	0.52	0.60	0.79
Factor M	0.26	0.65	0.79	1
Factor N	0.30	0.70	0.25	0.31
Factor O	0.68	0.99	0.83	1
Factor Q_1	0.29	0.43	0.60	0.84
Factor Q_2	0.51	0.85	0.81	1
Factor Q_3	0.30	0.50	.57#	1
Factor Q_4	0.69	0.94	0.69	0.89
Factor FG	0.49	0.72	-	-
Factor FB	0.48	0.73	-	-

** Correlation with 15FQ+ Factor Q_3*

 # Correlation with 15FQ+ Factor G

(Adapted from Tyler, 2003, p. 11)

From Table 3.11 it is evident that most of the correlations are substantial and many of the corrected correlations approach unity. This demonstrates that the 15FQ+ is measuring factors that are broadly equivalent to those originally identified by Cattell and colleagues. According to Psychometrics Limited (2002) this provides evidence that the 15FQ+ is measuring the original traits as identified Cattell and his colleagues.

The 15FQ was developed to assess the personality factors measured by the 16PF. The 15FQ manual has given sufficient evidence indicating equivalence between the 16PF and the 15FQ. As such the correlations between the 15FQ and 15FQ+ factors represent an important additional test of the construct validity of the 15FQ+. Table 3.12 shows the results of the correlations between the 15FQ+ factors and the personality dimensions assessed by the 15FQ on a sample of 70 delegates who completed the 15FQ and 15FQ+ (Psychometrics Limited, 2002).

Table 3.12

CORRELATIONS BETWEEN THE 15FQ+ FACTORS AND THE ORIGINAL 15FQ

15FQ+ Factors	Correlation with the 15FQ Factors Uncorrected	corrected
Factor A	0.32	0.43
Factor B	-	-
Factor C	0.54	0.75
Factor E	0.65	0.93
Factor F	0.76	1
Factor G	0.74	0.97
Factor H	0.88	1
Factor I	0.71	0.98
Factor L	0.78	1
Factor M	0.63	0.84
Factor N	0.55	0.77
Factor O	0.74	0.95
Factor Q_1	0.86	1
Factor Q_2	0.78	1
Factor Q_3	0.80	1
Factor Q_4	0.29	0.4

(Adapted from Tyler, 2003, p10)

Ten of the sixteen correlations between the 15FQ+ factors and their corresponding 15FQ factors approach unity, providing strong evidence of the validity of the 15FQ+ factors. Four of the remaining six factors correlated substantially with their corresponding 15FQ factors. Factor A (empathic) and factor Q_4 (Tense-driven) only correlates moderately with their corresponding 15FQ factors. Psychometrics Limited (2002) argues that the moderate correlation reflects the fact that factor A of the 15FQ+ assesses warm-hearted, empathic concern for, and interest in other people rather than assessing sociability and interpersonal warmth, as measured by the corresponding 15FQ factor. Similarly, the moderate correlation of factor Q_4 reflects that the 15FQ+ assesses a tense, competitive, hostile interpersonal attitude rather than assessing emotional tension and anxiety as the corresponding 15FQ factor (Psychometrics Limited, 2002).

The 15FQ+ manual presents the relationship between the 15FQ+ global factors and their corresponding global factors in the 16PF4 and the 16PF5. Tables 3.13 and 3.14 represents these correlations based on undergraduate samples of 82 and 85 participants, respectively. These correlations serve as evidence that there is a considerable amount of overlap between the global factors of the 15FQ+ and these two forms of the 16PF personality questionnaire (Psychometrics Limited, 2002).

Table 3.13

CORRELATIONS BETWEEN THE 15FQ+ AND THE 16PF4 GLOBAL FACTORS

	16PF4 Global Factors				
15FQ+ Global Factors	Extraversion	Anxiety	Tough-mindedness	Independence	Self-control
Extraversion	**0.76**	-0.29	-0.01	0.41	-0.03
Anxiety	-0.22	**0.84**	-0.04	-0.08	-1.70
Openness	0.27	0.10	**-0.48**	0.25	-0.02
Agreeableness	-0.28	0.14	0.16	**-0.71**	-0.05
Self-Control	-0.05	0.14	0.09	-0.12	**0.59**

(Psychometrics Limited, 2002, p38)

From the table it is evident that there are substantial correlations between the 15FQ+ and the 16PF4, especially between the extraversion, agreeableness and anxiety global factors, indicating that these global factors are measuring comparable constructs across these tests.

Table 3.14

CORRELATIONS BETWEEN THE 15FQ+ AND THE 16PF5 GLOBAL FACTORS

	16PF5 Global Factors				
15FQ+ Global Factors	Extraversion	Anxiety	Tough-mindedness	Independence	Self-control
Extraversion	**0.88**	-0.27	-0.12	0.45	-0.29
Anxiety	-0.22	**0.87**	-0.04	-0.05	-0.03
Openness	0.11	0.14	**-0.65**	0.29	-0.29
Agreeableness	-0.03	0.08	0.29	**-0.81**	0.19
Self-Control	-0.08	0.13	0.43	-0.21	**0.79**

(Psychometrics Limited, 2002, p38)

Overall, the correlations between the global factors of the15FQ+ and the 16PF5 are substantially higher than for the correlations observed with the 16PF4. The median correlation between the respective global factors is .81. The lowest correlation is with the openness global factor, which still is highly significant. Psychometrics Limited (2002) noted another feature of these correlations presented in Table 3.13 and Table 3.14; the global factors of the 15FQ+ demonstrate excellent levels of convergent and divergent validity with the global factors of the 16PF4 and the 16PF5.

In addition to the data referred to above, the technical manual developed by Psychometric Limited (2002) presents further construct validity data. For example, relationships exist between the 15FQ+ factors and the Bar-on Emotional Quotient Inventory scores (Bar-On, 1997), the Jung Type Indicator (JTI) scores (Psychometrics Limited, 1989) and the NEO PI-R scores (Costa & McCrae, 1992). The tables below indicate the correlations between the 15FQ+ factors and the dimensions assessed by the Bar-On EQi Inventory (Table 3.15), the JTI (Table 3.16) and the NEO PI-R (Tables 3.17 and 3.18). Inspection of these tables provides further evidence to support the construct validity of the 15FQ+.

Table 3.15

CORRELATIONS BETWEEN THE 15FQ+ AND THE Bar-ON EQI

BAR-ON EQ1 Scales	15FQ+ Dimensions
Emotional self-awareness	Factor A(.51); Factor I(.36); Factor N(.40);
Assertiveness	Factor Q4(.38) Factor B(.36); Factor E(.53); Factor H(.34); Factor Q1(.36)
Self-regard	Factor C(.52); Factor O(-.52); Factor Q4(-.39) Factor A(.48); Factor I(.44)
Self-actualization	Factor E(.48); Factor O(-.31); Factor Q1(.36)
Independence	Factor A(.66); Factor N(.36)
Empathy	Factor A(.55); Factor N(.41)
Interpersonal Relationships	Factor A(.52); Factor N(.45)
Social responsibility	Factor A(.33); Factor G(.39); Factor N(.31)
Problem solving	Factor A(.41); Factor C(.42); Factor N(.36)
Reality testing	No 15FQ+ scales correlate.
Flexibility	Factor C(.48)
Stress tolerance	Factor N(.52); Factor Q4(.68)
Impulse control	Factor A(.39); Factor C(.39); Factor F(.41);
Happiness	Factor Q2(.32)
Optimism	Factor O(.49)

(Psychometrics Limited, 2002, p. 38)

Table 3.16

CORRELATIONS BETWEEN THE 15FQ+ AND THE JTI

15FQ+ Dimensions	JTI Dimensions			
	Extraversion-Introversion	Sensing-Intuition	Thinking-Feeling	Judging-Perceiving
Factor A	0.52	-	-0.53	-
Factor B	-	-	-	-
Factor C	0.38	-	-	-
Factor E	0.39	-	-	-
Factor F	0.68	-	-	-
Factor G	-	-	-	0.78
Factor H	0.62	-0.37	-	-
Factor I	-	-0.55	-0.46	-
Factor L	0.47	0.32	0.45	-
Factor M	-	-0.68	-0.43	-
Factor N	-	-	-	-
Factor O	-	-	-	-
Factor Q1	-	-0.33	-	-
Factor Q2	0.48	-	-	-
Factor Q3	-	-	-	-0.46
Factor Q4	-	-	-	-

N=57 all correlations are significant at the 5% level or less.

(Psychometrics Limited, 2002, p39)

Table 3.17

CORRELATIONS BETWEEN THE 15FQ+ AND THE NEOPI-R DIMENSIONS

15FQ+ Dimensions	NEO PI-R Dimensions
Factor A	Warmth .46, Tender-minded .45, Angry hostility -.38
Factor B	Competence .52, Assertiveness .50, Modesty -.41
Factor C	Anxiety -.69, Depression -.69, Vulnerability -.60
Factor E	Assertiveness .69, Modesty -.60, Compliance -.55
Factor F	Gregariousness .63, Positive emotion .45, Excitement seeking .41
Factor G	Order .75, Fantasy -.46, Achievement .44
Factor H	Self-consciousness -.57, Modesty -.50, Activity .46
Factor I	Aesthetics .44, Warmth .30
Factor L	Trust -.74, Angry hostility .40, Vulnerability .33
Factor M	Fantasy .67, Ideas .39, Impulsiveness .38
Factor N	Compliance .46, Angry hostility -.45, Deliberation .40
Factor O	Self-consciousness .62, Anxiety .57, Vulnerability .48
Factor Q1	Actions .46, Values .46, Ideas .44
Factor AQ2	Gregariousness -.67, Warmth -.43, Dutifulness .36
Factor Q3	Feelings -.54, Values -.51, Fantasy -.41
Factor Q4	Angry hostility .80, Compliance -.67, Impulsiveness .45

(Psychometrics Limited, 2002, p41)

Table 3.18

CORRELATIONS BETWEEN THE 15FQ+ AND THE NEO PI-R GLOBAL FACTORS

15FQ+ Global Factor	r
E Extraversion with NEO-Extraversion	0.74
N anxiety with NEO-aNxiety	0.77
O Openness with NEO-Openness	0.66
A Agreeableness with NEO-Agreeableness	0.61
C Control with NEO-Control	0.67

p<.001for all correlations

(Psychometrics Limited, 2002, p41)

Table 3.18 presents the correlations between the 15FQ+ global factors and the Big Five personality factors assessed by the NEO PI-R. Inspection of this table indicates statistically significant correlations, indicating broad equivalence between the 15FQ+ global factors and the Big Five personality factors as defined by Costa and McCrae (Psychometrics Limited, 2002).

Further evidence of the construct validity of the 15FQ+ lies in the results obtained by Moyo (2009). Moyo (2009) performed a confirmatory factor analysis on a sample of Black South Africa managers by fitting the measurement model underlying the 15FQ+ using two item parcels per first-order factor.The substantive hypothesis tested in the Moyo (2009) study was that the 15FQ+ provides a valid and reliable measure of personality amongst Black South African managers. The operational hypothesis that was tested was that the measurement model implied by the scoring key of the 15FQ+ can closely reproduce the co-variances observed between the item parcels (2 item parcels per first-order factor) formed from the items comprising each of the 16 sub-scales, that the factor loadings of the item parcels on their designated latent personality dimensions are significant and large, that the measurement error variances associated with each parcel are significant but small, that the latent personality dimensions explain large proportions of the variance in the item parcels that represent them and that the latent personality dimensions correlate low-moderately with each other (Moyo, 2009).

Moyo (2009) found that all of the 16 subscales failed the uni-dimensionality test. Moyo and Theron (2011) argued that the result obtained in the exploratory factor analysis performed on each subscale are problematic not so much because more than one factor was required to satisfactorily account for the observed inter-item correlations but rather the fact that all twelve items of each subscale did not show at least reasonably high loadings on the first factor. Moyo and Theron (2011) argued that in terms of the suppressor action principle underlying the construction of the 15FQ+ it could be expected to either extract a single factor or to extract multiple factors but with all items showing larger loadings on the first factor. When forcing the extraction of a single factor Moyo (2009) found that the extracted solution provided an unsatisfactory explanation of the observed correlation matrix in the case of all sixteen subscales. In the case of all sixteen subscales the majority of items had loadings of less than 0.50 when forcing the extraction of a single underlying factor (Moyo, 2009).

Moyo (2009) speculated that one possibility is that a fission of the primary factors occurred. He could, however, not establish any meaningful identity for the extracted factors. No common theme was apparent in the items loading on the extracted factors. The failure of the uni-dimensionality test on the sixteen subscales could therefore not convincingly be explained by a splitting of the primary factors (source traits) into narrower sub-factors. The theory underlying the 15FQ+ also does not make provision for a finer dissection of personality.

In assessing the measurement model fit Moyo (2009) found that the model's overall fit was acceptable. The null hypothesis of close fit was not rejected, the basket of fit indices reported by LISREL indicated close to reasonable fit, a small percentage of the standardized co-variance residuals were large and a small percentage of the modification indices calculated for the Λ_X and Θ_δ matrices were large. The measurement model parameter estimates, however, were not satisfactory. Moderate, although statistically significant ($p<.05$) factor loadings were obtained, the measurement error variances were worryingly large and the proportion variance explained in the item parcels disappointingly low. Moyo (2009) concluded that the claim made by the 15FQ+ that the specific items included in each subscale reflect one of the 16 specific latent personality dimensions collectively comprising the personality domain as interpreted by the 15FQ+ is tenable, but that 15FQ+ provides a noisy measure of personality amongst Black South African managers with moderate reliability and validity.

Conversely, little criterion-related validity is available for the 15FQ+. Two studies are reported by *Psytech South Africa*; one highlights the ability of the 15FQ+ to predict performance appraisal outcomes for managers, supervisors and equity managers from a manufacturing company; while the other shows how various scales of the 15FQ+ were able to predict insurance policy sales (cited in Tyler, 2003).

CHAPTER 4
BIAS, MEASUREMENT EQUIVALENCE AND MEASUREMENT INVARIANCE

This part of the thesis aims to critically review literature on the methodology of bias, measurement equivalence and measurement invariance with the purpose of describing and justifying the investigation of measurement equivalence and measurement invariance. The research methodology which this study will pursue and the research objective will be presented in Chapter 5.

4.1 MEASUREMENT

Latent variables are distinguishing attributes characterising individuals, groups and/or organisations and are used in organisational science to describe individuals, groups and/or organisations. Latent variables are the basis of industrial psychology and cannot be directly observed and as a result cannot be quantified directly. Measuring instruments attempt to measure these distinguishing attributes. If people did not systematically differ on specific attributes there would have been little sense in measurement. The measuring instrument has the goal of translating these individual differences into quantitative terms; measurement is therefore used to assign numbers to these variables (VandenBerg & Lance, 2000).

The information received from measurement instruments is usually used with the intention of making decisions regarding appropriate interventions. The quality of the intervention depends on the information received from the measuring instrument; poor measurement can sometimes lead to incorrect decisions and interventions. Valid psychological measurement instruments provide extremely important information about individuals, especially if decisions need to be made that will affect the individuals' lives. One of the primary concerns in industrial psychology in terms of measurement is to ensure that the instrument does provide the appropriate information in order to make effective decisions and be able to predict future behaviour (Theron, 2006).

Measurement has historically been, and continues to be, an important topic in research. This can be seen in the number of articles regarding measurement practices and the amount of scientific journals dedicated to measurement issues. An increasing important measurement issue found in research is the cross-cultural applicability of measurement instruments. (Van de Vijver & Leung, 1997; VandenBerg & Lance, 2000)

4.2 CROSS-CULTURAL MEASUREMENT

We live in a world of increased cross-cultural encounters, more organizations operate at an international level, and increased migration has transformed monocultures into multi-cultures. South Africa is often referred to as the rainbow nation. This is because South Africa consists of a diversity of cultural, religious and linguistic communities. South Africa is a truly multicultural society, which makes for interesting cross-cultural studies. The ability to operate in this multicultural society becomes increasingly important for South African organizations due to the implications of the Employment Equity Act (Van de Vijver & Poortinga, 1997). The Employment Equity Act prohibits the use of psychological assessments unless it can be shown that the assessment is not biased and does not discriminate against any group (Deparment of Labour, 1997). The increase in cross-cultural societies and the implications of the Employment Equity Act most definitely has an impact on the field of psychological assessments. Psychological measurement instruments are being used extensively around the world and many tests have been translated into different languages. South Africa has 11 official languages and measurement instruments were initially developed separately for Afrikaans and English speaking groups (Claassen, 1997), but excluded the speaker of African languages, who comprise the largest population group. This is because psychological measurement instruments were initially developed with White test takers in mind which consist of Afrikaans and English speaking groups (Huysamen, 2002). More attention has been given to the applicability of measurement instruments to speakers of the African language. The demand for appropriate cross-cultural measurement instruments can be seen in the increased research interest in the cross-cultural applicability of psychological tests (Donnelly, 2009; Cheung & Rensvold, 2002; Van de Vijver & Poortinga, 1997)

Psychological measurement instruments will be cross-culturally applicable if (a) the observed scores on the measurement instruments can be interpreted in the same way across culture groups and (b) if the measurement instruments succeed in measuring the construct of interest across culture groups as it was constitutively defined (Theron, 2009). It seems to be that one of the core issues in cross-cultural-research is the comparability of scores across different ethnic groups. When a measurement instrument is transported from one culture to another, or used in a multi-cultural setting, the comparability of the instrument across cultures should be investigated (Theron, 2006).

The ability to meaningfully interpret latent variable scores across ethnic groups point toward an equal psychological meaning of scores across the different ethnic groups, which means it is free from bias or that equivalence has been established (VandenBerg & Lance, 2000). Measurement bias refers to all systematic factors that could account for variance in observed test scores that cannot be accounted for in terms of the construct of interest (Theron. 2006). The measurement implications of bias in terms of comparability of scores over cultures are termed equivalence (Van De Vijver, 2003b). This implies that measurement instruments should be subjected to a series of statistical tests in order to be validated for use in a cross-cultural society (Theron, 2006). According to Van de Vijver and Poortinga (1997) the investigation of the cross-cultural applicability of a measurement instrument includes empirically demonstrating the psychometric properties of the instruments.

4.2.1 Bias in measurement

Measurement bias is defined as all systematic factors that could account for variance in observed test scores that cannot be accounted for in terms of the construct of interest (Theron, 2006). The instrument measures the construct of interest by requesting testees to respond to a sample of questions or test stimuli under standardized conditions, whilst the assumption is that the responses will be governed by the construct of interest. This is, however, not always the case. Other non-relevant factors may influence the response to test stimuli. These non-relevant factors or systematic forces of unique variance in test scores cannot be explained through variance in the construct of interest (Theron, 2006). Differences in scores of the measuring instrument between ethnic groups therefore might be due to differences in the construct of interest or due to systematic biases in the way the different ethnic groups respond to the items of the measurement instrument. Once the instrument measures different constructs across ethnic groups or measures the same construct differently due to systematic forces of unique variance, the test is biased. Bias therefore refers to a lack of association between the scores of the different ethnic groups (Van de Vijver & Poortinga, 1997). Consequently biased test scores influence the integrity of cross-cultural comparisons, leading to inappropriate comparisons across ethnic groups.

Van De Vijver and Rothmann (2004) refer to bias as the nuisance factors causing inappropriate cross-cultural measurement. According to Theron (2006) measurement bias should not be viewed purely as a nuisance factor. It may also be viewed as information which indicates that different groups respond to the same test stimuli differently, due to possible differences across the groups in question. Such differences should not be simply dismissed as measurement error. Theron (2006) further holds that exploring the reasons for the above mentioned phenomenon would enhance our understanding of group differences.

There exist a variety of reasons why bias can occur. According to Van de Vijver and Poortinga (1997) bias does not occur due to the intrinsic properties of the measuring instrument. Bias exists due to the characteristics and traits of the respondents in the different ethnic groups that utilises the instrument. There are three sources of bias applicable to measurement instruments including (a) the construct of interest, (b) the methodological procedure and (c) the item content (Byrne & Watkins, 2003).

4.2.1.1 Construct Bias

According to Theron (2006) a psychological measurement instrument is designed in order to reveal an individual's standing on a constitutively defined construct of interest. Construct bias refers to an incomparability of test scores across cultures due to the difference between the measured psychological construct (Van De Vijver & Rothmann, 2004). Thus, construct bias occurs when the relevant construct being measured is different across ethnic groups. Stated differently, construct bias occurs when the test scores do not reflect the same construct across groups. Construct bias therefore indicates a substantial difference between the construct of interest across ethnic groups. A construct may differ across groups in terms of the number of sub-constructs / dimensions it consist of, how the constructs are related, the pattern with which the items of the test load on the sub-constructs and how the construct is embedded in the larger nomological network (Theron, 2006).

In addition, Byrne and Watkins (2003) hold that construct bias may occur due to the measuring instrument tapping into behaviour, to measure the construct of interest, which is different across ethnic groups. For example, the sample of behaviours used to represent the construct may be unsuitable for measuring the construct of a specific ethnic group.

Operationally construct bias expresses itself in differences in the factor structures across groups that are required to provide an adequate explanation of the observed inter-item covariance matrices. The same measurement model therefore would not fit the data of all groups. Construct bias also expresses itself in differences in the manner in which the target construct is embedded in a larger nomological network of latent variables. The same structural model therefore would not fit the data of all groups.

4.2.1.2 Item Bias

Item bias occurs when there is score incomparability across cultures at the item level. This signifies that individuals with the same standing on the latent construct which is being measured have not attained similar scores on the item, indicating that they did not have the same probability to give the correct answer (Van de Vijver & Leung, 1997). Hence, group membership explains variance in the responses to items when controlling for the construct of interest. Individuals from different groups with the same standing on the construct of interest will respond differently to items and the observed score will differ across groups. Foxcroft and Roodt (2005) identified that the term item bias have been replaced by the less value-laden term differential item functioning (DIF). Item bias, also known as DIF, is a generic term for all disturbances at item level.

Item bias could occur when there is a misrepresentation of the construct being measured on item level indicating that test items have different meanings across ethnic groups. Other factors that might lead to item bias include the inappropriate translation of psychological measurement instruments and inadequate item formulation, for example, using complex wording, double negatives and idiomatic expressions (Van de Vivjer& Leung, 1997). Van de Vijver and Rothman (2004) also argue that low familiarity of items to certain cultures, ambiguities in the original item, or the appropriateness of the item content for specific groups, also leads to item bias.

Item bias can be said to exist from a somewhat more lenient perspective if the expected observed score differs across groups given a fixed standing on the latent variable being measured. This will happen if the regression of the observed score on the latent variable being measured differs in terms of intercept and/or slope across the different groups. Somewhat more strictly defined item bias can be said to exist if the probability of achieving a specific observed score differs across groups given a fixed standing on the latent variable being measured. This will happen if the regression of the observed score on the latent variable being measured differs in terms of intercept and/or slope and/or measurement error variance across the different groups.

When viewed from the more strict interpretation of item bias three types of item bias can be identified namely non-uniform bias, uniform bias and conditional probability bias[4]. Non-uniform bias occurs when the slope of the regression of one or more of the items of the instrument on the latent variable they were designed to measure differs significantly across groups. Uniform bias occurs when the intercept of the regression of one or more of the items of the instrument on the latent variable they were designed to measure differs significantly across groups (Van de Vijver & Poortinga, 1997). Conditional probability bias occurs when the error variance of the regression of one or more of the items of the instrument on the latent variable they were designed to measure differs significantly across groups.

According to De Beer (2004) item bias should be investigated and corrected during test construction. The identification and elimination of DIF is the first process in ensuring culture appropriate instruments. If measurement bias decreases due to the removal of inappropriate items or indicators, it may be deduced that previously observed score differences were likely due to item bias and not inherent differences across groups in the construct of interest (Van de Vijver& Leung, 1997).

4.2.1.3 Method Bias

Method bias refers to variance in scores of different ethnic groups that are attributable to the measurement method rather than the construct the measurement instrument intends to measure (Byrne & Watkins, 2003). Method bias occurs if the assessment procedure causes unwanted cross-cultural differences in scores. It is important to identify the sources of method bias so that a researcher may avoid the variance caused by it, in the results obtained. According to Van de Vijver and

[4]The latter form of item bias has as yet not been blessed with a specific generally accepted term. The term has been coined as part of the study.

Rothmann (2004) method bias includes sample bias, administration bias and instrument bias.

Sample bias could be attributed to the lack of comparability of the samples on other factors than the construct being assessed for example, biographical and demographic variables. Ideally the samples used in the analyses should be reasonably comparable in terms of biographical and demographic characteristics (Byrne & Watkins, 2003). Administration bias refers to differences in the method used to administer an instrument. For example, one group might have been guided through the practice items and the other group did not receive this practice (Van de Vijver& Leung, 1997). Instrument bias occurs when the measurement instrument causes unintended cross-cultural differences (Van De Vijver & Rothmann, 2004). More specifically instrument bias occurs when different culture groups respond differently to the structured format of the measurement instrument. The four most frequently mentioned instrument biases include differential stimulus familiarity, differential response style, differential social desirability and group differences that affect the response on test items (Berry, Poortinga, Segall & Dasan, 2002; Byrne & Watkins, 2003). Another possible source of method bias may result when respondents respond in their second language to test items (Paterson &Uys, 2005).

Most measurement instruments use a Likert-type scaling format that might be unfamiliar to some ethnic groups causing biasing of item scores (Berry et al., 2002). This is an example of how differential stimulus familiarity may result in method bias. Differential response style for example occurs when a certain group constantly selects one of the extreme scale points (extreme response style) or tends to agree with statement irrespective of the nature of the statements (acquiescence response style), and social desirability occurs when testees consciously or unconsciously convey themselves favorably for social approval and acceptance. These sources are totally independent of the item content but lead to a lack of comparability of scores between samples (Byrne & Watkins, 2003).

Eliminating construct, item and method bias, according to Foxcroft and Roodt (2005) increases the validity and reliability of test scores and test results from different groups will be equivalent and as a result comparable.

4.2.2 Equivalence or Invariance in Measurement

The attainment of equivalent measures and the subsequent comparability of tests scores across ethnic groups (Van de Vijver & Rothmann, 2004) is an important goal of cross-cultural studies. As mentioned above, bias refers to the presence of nuisance factors or systematic error in measurement (Van de Vijver & Leung, 1997). In cross-cultural assessment these ‘disturbances’, or nuisance factors, influence the comparability of scores across cultures (Van de Vijver, 2003b). That is, the measurement implications of bias for comparability are addressed in the concept of equivalence. It relates to the scope for comparing the scores over different cultures. Decisions on the absence or presence of equivalence are grounded in empirical evidence (Van de Vijver, 2003b). In situations where measurement instruments are non-equivalent one cannot conclude that differences or/and similarities on test scores of individuals from different ethnic groups are due to the construct of interest (Foxcroft & Roodt, 2005). Equivalence therefore indicates that scores obtained from the instruments have the same psychological meaning and interpretable intergroup differences are justifiable.

However, recently Theron (2006) argued that measurement equivalence or measurement invariance represents a different perspective on measurement errors than measurement bias and articulates it in different terms, although both refer to the same issue of how comparable scores are across groups. Method bias is excluded from this discussion because it does not translate into unique problems with the measurement characteristics that are not already covered by concepts of item and construct bias. Thus measurement equivalence and measurement invariance express measurement errors in different terms but in essence refer to the same issues as discussed under the headings of construct and item bias. According to Horn and McArdle (cited in Vandenberg & Lance, 2000) scientific inferences drawn from measurement instruments are severely lacking if there is an absence of evidence indicating measurement equivalence and measurement invariance. In the absence of such evidence differences between individuals and groups cannot be interpreted unambiguously. Equivalence and invariance evidence indicates the absence of factors that challenge the validity of cross-group comparisons (Donnelly, 2009). Testing for measurement equivalence and invariance is therefore an important prerequisite for conducting cross-cultural/cross-group comparisons and help to guide the development of more culturally appropriate instruments (Vandenberg & Lance, 2000). Therefore industrial psychologists who detect the absence of non-equivalence can place more confidence in the validity of test results and the comparability of scores across different cultures.

4.2.2.1 Evaluating Measurement Invariance and Equivalence

The quality of psychological tests has historically been evaluated through the classical test theory (CTT) of true and error scores (Crocker & Algina, 1986; Nunnally & Bernstein, 1994). Vandenberg and Lance (2000) acknowledged that CTT provides valuable information regarding the reliability and validity as measurement instrument properties. However, simple reliability and validity studies tend to ignore the issue of equivalent and invariant models of measurement. The main question in terms of measurement equivalence and measurement invariance is to what extent measurement instrument properties are transportable across populations. Vandenberg (2002) argued that a lack of measurement equivalence and measurement invariance threaten the value of measurement instruments that are not directly addressable through the classical test theory approaches, such as the calculation of reliability coefficients. The CTT's primary concern is to what extent the measurement instrument (X) can be used as a representation of the latent variable of interest (ξ). CTT does not test whether there is conceptual equivalence of the construct of interest (ξ) in each group, or equivalent associations (λ and τ) between operationalizations (X) and underlying latent variables (ξ) across groups, and the extent to which the measurement instrument (X) are influenced to the same degree and by the same unique factors (δ) across groups (Vandenberg & Lance, 2000). To this end, Vandenberg and Lance (2000) argued that investigating measurement equivalence and measurement invariance is just as important as providing proof of the reliability and validity of measurement instruments.

Advances in analytical tools have made the investigation of measurement invariance and measurement equivalence possible. This research aims to evaluate measurement invariance and measurement equivalence according to a confirmatory factor analytical (CFA) framework and argues that a number of specific aspects to the measurement invariance and measurement equivalence issues are readily testable within a CFA framework.

Vandenberg and Lance (2000) explained multi-group confirmatory factor analysis through the following mathematical equation (equation 1):

$$\mathbf{X}^g = \boldsymbol{\tau}^g + \boldsymbol{\Lambda}^g \boldsymbol{\xi}^g + \boldsymbol{\delta}^g \text{ -- } (1)$$

$\mathbf{X}^g$ refers to the vector of items comprising the measuring instrument of the g^th^ group, $\boldsymbol{\Lambda}^g$ refers to the matrix of regression slopes relating the vector of items of the g^th^ group (X^g) to the vector of constructs of interest ($\boldsymbol{\xi}^g$). $\boldsymbol{\tau}^g$ refers to the vector of regression intercepts of the regression of $\mathbf{X}^g$ on $\boldsymbol{\xi}^g$ and $\boldsymbol{\delta}^g$ refers to the vector of unique factors or measurement error terms. This equation does not fully capture the measurement model since it fails to identify the manner in which the latent variables and the measurement error terms are related. Assuming that $E(\xi^g,\delta^g) = 0$ (i.e., assuming that the latent variables and measurement error terms are uncorrelated), the covariance equation (equation 2) that follows from the above mentioned equation is (Vandenberg & Lance, 2000):

$$\boldsymbol{\Sigma}^g = \boldsymbol{\Lambda}^g{}_x \boldsymbol{\Phi}^g \boldsymbol{\Lambda}^{g'}{}_x + \boldsymbol{\Theta}_\delta{}^g \text{ -- } (2)$$

$\boldsymbol{\Sigma}^g$ is the matrix of variance and covariance in the g^{th} population group, $\boldsymbol{\Lambda}^g{}_x$ is the matrix of items factor loadings on the latent variables in $\boldsymbol{\xi}^g$. The $\boldsymbol{\Phi}^g$ contains variances and covariances among the latent variables in $\boldsymbol{\xi}^g$ and the $\boldsymbol{\Theta}_\delta{}^g$ is the diagonal matrix of unique or measurement error variances. This is the fundamental covariance equation for factor analysis that models the observed item covariances as a function of common ($\boldsymbol{\xi}^g$) and unique factors ($\boldsymbol{\delta}^g$).

From the above mentioned equations it becomes clear that aspects related to the measurement equivalence and measurement invariance issues are testable within a CFA framework. As stated by Vandenberg and Lance (2000) the equations imply the following as testable hypotheses relating to measurement equivalence and measurement invariance:

- The CFA model holds equivalently and assumes a common form across groups.
- $\boldsymbol{\xi}^g = \boldsymbol{\xi}^{g'}$, this indicates that the items of the measuring instrument evokes the same conceptual framework in defining the construct (ξ) of interest in each group.

- $\Lambda^{g} = \Lambda^{g'}$, the regression slopes linking the measures (X) to the underlying construct of interest (ξ) are invariant across groups.

- $\tau^{g} = \tau^{g'}$, the regression intercepts linking the measures (X) to the underlying construct of interest (ξ) are invariant across groups.

- $\Theta_{\delta}{}^{g} = \Theta_{\delta}{}^{g'}$, unique variances for the measuring instrument are invariant across groups.

- $\Phi^{g} = \Phi^{g'}$, the variances and covariances among the latent variables are invariant across groups.

Given the hypotheses above, it makes sense that establishing the measurement equivalence and measurement invariance of an instrument across groups should be a prerequisite to conducting substantive cross-group comparisons. Without evidence that supports the equivalence of an instrument, the basis for drawing inferences should be considered as severely lacking (Horn & McArdle, 1992). If equivalence is not yet established for a measure such as the 15FQ+, findings of differences between individuals and groups cannot be unambiguously interpreted, which in turn raise questions about using the specific instrument within these groups (Steenkamp & Baumgartner, 1998).

Researchers (e.g., Lubke & Muthen, 2004; Steenkamp & Baumgartner, 1998); Vandenberg & Lance, 2000) have indicated that the lack of invariance studies is attributed to various factors including (a) terminology for the different types of equivalence and/or invariance found in literature differs which causes confusion, (b) the methodological procedure used to test for different types of equivalence and invariance is very complex and researchers are unfamiliar with these procedures and (c) there are only a few guidelines to help determine whether a measure exhibits invariance. This has led researchers to endeavour clarifying key equivalence issues and proposed best practices for establishing invariance and equivalence (e.g. Byrne & Watkins, 2003; Cheung &Rensvold, 2002; Vandenberg, 2002; Vandenberg & Lance, 2000). Dunbar et al. (2011) have proposed a taxonomy of measurement invariance and measurement equivalence which leads to a narrowing towards a uniform understanding of, and approach towards, invariance and equivalence research. Establishing the equivalence of the 15FQ+ across different ethnic group samples will justify future research in which the 15FQ+ may be used for meaningful comparison between groups, provided that evidence of equivalence has been established between the different groups being compared.

4.2.2.2 Taxonomy for Measurement Invariance and Equivalence

Two set of questions emerge when doing measurement invariance and equivalence research. The first set of questions include whether a multi-group measurement model[5] with, (a) none of its parameters constrained to be equal across groups or with, (b) equality constraints imposed on some of its parameters or with, (c) all its parameters constrained to be equal across groups, fits the data obtained from two or more samples. The second set of questions ask whether a specific multi-group measurement model with some of its parameters constrained to be equal across groups fits substantially poorer than a multi-group model with fewer of its parameters constrained to be equal across groups. According to Dunbar et al. (2011), failure to differentiate between the two set of questions significantly contributed to the current semantic confusion regarding measurement invariance and equivalence. Most researchers use the terms measurement invariance and measurement equivalence interchangeably (Vandenberg & Lance, 2000). To assist in separating the two sets of questions referred to above, Dunbar et al. (2011) proposed that the term measurement invariance only refer to the first set of questions. Five hierarchical levels of measurement invariance are distinguished in Table 4.1 which was first introduced by Meredith (1993). These five levels are accepted as relevant to the first set of questions, referring to multi-group measurement models where increasing constraints are placed on the model that fits the data of two or more groups (Dunbar, Theron & Spangenberg, 2011). Table 4.1 presents the various forms of measurement invariance distinguished by Meredith (1993) and provides a definition of each form of invariance.

[5]A multi-group measurement model is defined by equation 1.

Table 4.1

DEGREES OF MEASUREMENT INVARIANCE

Configural invariance	Weak invariance	Strong invariance	Strict invariance	Complete invariance
A multi-group measurement model in which the structure of the model is constrained to be the same across groups fits multi-group data.	A multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which the factor loading matrix (Λ^x) is constrained to be the same across groups fits multi-group data.	A multi-group measurement model in which the structure of the model is constrained to be the same across groups, in which Λ^x is constrained to be the same across groups and in which the vector of regression intercepts (τ^x) is constrained to be the same across groups fits multi-group data.	A multi-group measurement model in which the structure of the model is constrained to be the same across groups, in which Λ^x is constrained to be the same across groups and in which τ^x is constrained to be the same across groups and in which the measurement error variance-covariance matrix (Θ_δ) is constrained to be the same across groups fits multi-group data.	A multi-group measurement model in which the structure of the model is constrained to be the same across groups, in which Λ^x is constrained to be the same across groups and in which τ^x is constrained to be the same across groups and in which $\Theta_\delta$is constrained to be the same across groups and in which the latent variable variance-covariance matrix (Φ) is constrained to be the same across groups fits multi-group data.

(Dunbar et al., 2011, p. 14)

Dunbar et al. (2011) proposed that the term measurement equivalence should be reserved for the second set of questions in which two multi-group measurement models are compared across two or more groups. Dunbar et al. (2011) introduced four hierarchical levels of measurement equivalence and these are distinguished in Table 4.2. Dunbar et al. (2011) argued that there wasn't a similar generally accepted comprehensive taxonomy for the second set of measurement invariance questions as with the first set of questions in the literature. Table 4.2 presents the various forms of measurement equivalence and provides a definition of each form of equivalence.

Table 4.2

DEGREES OF MEASUREMENT EQUIVALENCE

Metric equivalence	**Scalar equivalence**	**Conditional probability equivalence**	**Full equivalence**
A multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which the factor loading matrix (Λ^x) is constrained to be the same across groups does not fit multi-group data poorer than a multi-group measurement model in which the structure of the model is constrained to be the same across groups but all model parameters are freely estimated (i.e., the configural invariant multi-group model).	A multi-group measurement model in which the structure of the model is constrained to be the same across groups, in which Λ^x is constrained to be the same across groups and in which the vector of regression intercepts (τ^x) is constrained to be the same across groups does not fit multi-group data poorer than a multi-group measurement model in which the structure of the model is constrained to be the same across groups but all model parameters are freely estimated.	A multi-group measurement model in which the structure of the model is constrained to be the same across groups, in which Λ^x is constrained to be the same across groups, in which τ^x is constrained to be the same across groups and in which the measurement error variance-covariance matrix (Θ_δ) is constrained to be the same across groups does not fit multi-group data poorer than a multi-group measurement model in which the structure of the model is constrained to be the same across groups but all model parameters are freely estimated.	A multi-group measurement model in which the structure of the model is constrained to be the same across groups, in which Λ^x is constrained to be the same across groups, in which τ^x is constrained to be the same across groups, in which Θ_δ is constrained to be the same across groups and in which the latent variable variance-covariance matrix (Φ) is constrained to be the same across groups does not fit multi-group data poorer than a multi-group measurement model in which the structure of the model is constrained to be the same across groups but all model parameters are freely estimated.

(Dunbar et al., 2011, pp. 16-17)

Dunbar et al. (2011) could not find any literature that referred to a term that described whether a multi-group measurement model in which the measurement model structure,τ, Λ_X and Θ_δ are constrained to be equal across groups (i.e. the strict invariance measurement model) does not fit significantly better than the configural invariance model in which only the structure is constrained to be equal. Therefore the term 'conditional probability equivalence' was coined in the article by Dunbar et al. (2011).The term points to the fact that the conditional probability of exceeding a specific indicator variable score given a specific standing on the latent variable of which X is the indicator will only be the same for members of two groups if the regression of X on ξ coincides in terms of slope and intercept across the two groups, and if the variance of the conditional X distributions are the same across groups (Dunbar et al., 2011).

Research on the various forms of measurement invariance and the various forms of measurement equivalence are evaluated in the hierarchical manner from left to right as presented in Tables 4.1 and 4.2 respectively, once configural invariance has been shown (Dunbar et al., 2011). The test of equivalence at the first three levels is only really meaningful if a finding of invariance has been obtained on the corresponding level of measurement invariance. Dunbar et al. (2011) use the example "it only really makes sense to evaluate metric equivalence if weak invariance has been shown." They further explained that a finding of invariance indicates that the multi-group model with a specific level of constraints imposed is acceptable in the sense that it provides a satisfactory description of the observations made, specifically the observed covariance matrices. Furthermore, a finding of equivalence means the multi-group model with a specific level of constraints imposed, that provides a satisfactory account of the observations made, does not provide a less satisfactory description than the observations made of a multi-group model without the constraints (Dunbar et al., 2011).

CHAPTER 5

RESEARCH METHODOLOGY AND PRELIMINARY DATA ANALYSES

The fundamental hypothesis being tested in this study is that the 15FQ+ measures the personality construct as constitutively defined and that the construct is measured in the same manner across different ethnic groups, specifically Black, Coloured and White South Africans. A series of confirmatory factor analyses (CFA's) is required in order to determine the validity of the above mentioned hypothesis. The CFA's evaluate the fit of the single-group measurement model in the three groups implied by the constitutive definition of personality and the design intention of the 15FQ+ as well as the fit of the multi-group measurement models implied by the various levels of measurement invariance.

The validity and credibility of the implicit claim made by the study on the fit of the measurement model depend on the methodology used to arrive at the verdict. Careless methodology would jeopardize the likelihood of arriving at a valid and accurate conclusion about the measurement invariance of the 15FQ+. This could lead to the inappropriate use of the 15FQ+ across specified ethnic groups included in this study. According to Babbie and Mouton (2001) methodology serves the epistemic ideal of science. To ensure that the epistemic ideal of science is met, the method of investigation used in a study should be made explicit. If very little of the methodology used is made explicit, it is not possible to evaluate the merits of the researcher's conclusions and the verdict therefore simply has to be accepted at face value whilst the verdict might be inappropriate due to incorrect procedures used for investigating the merits of the claims made. The rationality of science thereby suffers, as does ultimately the epistemic ideal of science (Babbie & Mouton, 2001). This chapter therefore focuses on giving a comprehensive description and thorough motivation of how the methodology of this study was approached. Specific attention is focused on the research design, statistical hypotheses, statistical analyses techniques and the nature of the sample.

5.1 RESEARCH HYPOTHESES

The substantive hypothesis tested in this study is that the 15FQ+ provides a valid and reliable measure of the personality construct as defined by the instrument, and that the construct is measured in the same manner across the three ethnic groups including Black, Coloured and White groups. The substantive hypothesis would ideally translate into the following ten specific operational hypotheses:

- Hypotheses 1a, 1b and 1c: A single-group personality measurement model implied by the scoring key of the 15FQ+ can closely reproduce the covariances observed between the items comprising each of the basic scales in the separate ethnic groups.
- Hypothesis 2: A multi-group personality measurement model implied by the scoring key of the 15FQ+ (i.e., a multi-group model in which the structure of the model is constrained to be equal across groups) but in which all freed measurement model parameters are freely estimated within each group, can closely reproduce the covariance observed between the items comprising each of the basic scales in the combined sample (i.e., the multi-group measurement model displays configural invariance).
- Hypotheses 3 - 6: The multi-group personality measurement model implied by the scoring key of the 15FQ+ displays weak invariance, strong invariance, strict invariance and complete invariance across the three ethnic groups.
- Hypotheses 7 - 10: The multi-group personality measurement model implied by the scoring key of the 15FQ+ displays metric equivalence, scalar equivalence, conditional probability equivalence and full equivalence across the three ethnic groups.

5.2 RESEARCH DESIGN

The hypotheses formulated under paragraph 5.1 make specific claims with regards to the 15FQ+ personality measurement model. The personality measurement model implied by the scoring key of the 15FQ+ hypothesizes specific measurement relations between the items comprising the instrument and the personality dimensions measured by the instrument. Stated more explicitly, the 15FQ+ personality measurement model assumes that the slope of the regression of the specific indicator variables (X) on the specific latent variable (ξ) that the indicator variable is meant to represent is positive and significantly greater than zero but that the slope of the regression of those items on all other latent variables that the indicator variables are not meant to represent are zero. Additionally, the 15FQ+ personality measurement model makes assumptions about the covariance between the latent variables (the assumption is that these first-order dimensions correlate moderately positively or negatively) and the covariance between the measurement error terms (the assumption is that the measurement error terms are uncorrelated). To empirically test the assumptions made by the 15FQ+ personality measurement model necessitates a plan or a strategy that will provide unambiguous empirical evidence in terms of which to evaluate the operational hypotheses. According to Kerlinger and Lee (2000) the research design represents this plan or strategy. The research design is a plan and structure of the investigation which is set up to firstly, procure answers to the research question and secondly, to control variance (Kerlinger, 1973). The ability of the research design to maximize systematic variance, minimise error variance and control extraneous variance (Kerlinger, 1973; Kerlinger& Lee, 2000) will ultimately determine the unambiguousness of the empirical evidence.

This study will be utilizing the correlation *ex post facto* research design due to the logic behind the *ex post facto* correlational design. According to Kerlinger and Lee (2000) *ex post facto* research is a systematic empirical inquiry in which the researcher does not have direct control of independent variables as their manifestation have already occurred or because they are inherently not manipulative. When used in a construct validation study of this nature a correlation *ex post facto* research design requires that measures of the observed variables should be obtained and that the observed covariance matrix should be calculated. Estimates for the freed single- or multi-group measurement model parameters are then obtained in an iterative fashion with the objective of reproducing the observed covariance matrix as closely as possible (Diamantopoulos & Siguaw, 2000). The conclusion that would follow if the fitted model fails to accurately reproduce the observed covariance matrix would be that the measurement model underlying the 15FQ+ does not provide an acceptable explanation for the observed covariance matrix (Byrne, 1989; Kelloway, 1998). This finding would mean that the 15FQ+ does not measure the personality domain as proposed over the different South African samples included in the study. The opposite, however, is not true. If the covariance matrix derived from the estimated measurement model parameters closely agrees with the observed covariance matrix it would not imply that the 15FQ+ measures the personality domain as intended. A high degree of fit between the observed and estimated covariance matrices would only imply that the psychological processes portrayed in the measurement model provide one plausible explanation for the observed matrix.

5.3 STATISTICAL HYPOTHESIS

The format in which the statistical hypotheses are formulated depends on the logic underlying the proposed research design as well as the nature of the envisaged statistical analyses. One option to examine the construct validity of the 15FQ+ would have been to use an unrestricted, exploratory factor analytic approach in which no statistical hypotheses would have been formulated (Donnelly, 2009). In an unrestricted, exploratory factor analytic approach no *a priori* stance is taken on the number of factors underlying the observed covariance matrix, their identity and the manner in which the items load on the factors (Ferrando & Lorenzo-Seva, 2000). This option seems inappropriate for this study since it ignores the design intentions of the developers of the 15FQ+.

The test developers of the 15FQ+ took a very specific stance on the number of personality factors underlying the observed covariance matrix, their identity and the manner in which the items load on the personality factors. Personality items were intentionally developed to reflect specific dimensions of the personality construct. Therefore it is clear that the 15FQ+ items were specifically written for test takers to respond with behaviour which would lead to a behavioural expression of a specific latent personality dimensions. The scoring key of the 15FQ+ reflect these design intentions. It is, however, very difficult to isolate behaviour in such a manner that the response on an item will be a behavioural expression of a specific first-order personality factor. Behaviour reflects the whole personality which results in a test taker's response to an item to be positively or negatively affected by all the remaining personality factors as well, albeit to a lesser degree (Gerbing & Tuley, 1991). These patterns of positive and negative loadings on the remaining factors cancel each other out when composite scores are calculated through the suppressor action effect (Gerbing & Tuley, 1991). Therefore the suppressor action allows for a relatively uncontaminated measure of the latent personality variable where variance in the responses of the test takers predominantly reflects variance in the factor of interest.

It seems more reasonable to first evaluate whether the intentional instrument design of the test developers did succeed in providing a comprehensive and relatively uncontaminated empirical grasp on the personality construct as the 15FQ+ manual defines it. Consequently a hypothesis testing, restricted, confirmatory factor analytic approach should rather be followed. In terms of this approach specific structural assumptions with regard to the number of latent variables underlying the 15FQ+, the relations among the latent variables and the specific pattern of loadings of indicator variables on these latent variables are made (Ferrando & Lorenzo-Seva, 2000; Jöreskog & Sörbom, 1993). More specifically assumptions are made on how these structural assumptions apply across the Black, Coloured and White ethnic groups. Moyo (2009) argued that if the verdict would go against the claims made by the test developers it would be more reasonable to use an unrestricted, exploratory factor analytical approach where no priori stance is taken on the number of factors underlying the observed co-variance matrix. This will lead to estimation of the number of factors underlying the observed co-variance and identify the manner in which the items load on the factors (Moyo, 2009).

Moyo (2009) stated that the measurement model should also acknowledge the pattern of positive and negative loadings of the items on the remaining factors. Excluding the suppressor action from the measurement model would not fully acknowledge the design intention of the developers of the 15FQ+ and thereby result in an unfair evaluation of the extent to which the test developers succeeded in their design intention to measure the personality construct as they defined it in the manner that they intended. Excluding the suppressor action from the measurement model could lead to poor model fit which would result in the unwarranted conclusion that the measurement intention of the test developers has failed. The vexing question, however, is how the suppressor effect should be accommodated in the single- and multi-group measurement models that are fitted. The suppressor effect implies that all elements of Λ_X are freed to be estimated but that only the factor loadings of the items on the first-order factor they are meant to reflect are freed unconditionally. The suppressor effect further implies that for the remaining 15 first-order factors the factor loadings of the items of a specific subscale are freed to be estimated but constrained to range in a narrow band straddling zero. Although such a model would still be identified with positive degrees of freedom, the problem is that it is not practically possible to free measurement model parameters in LISREL under a range condition. The amount of memory and processing capacity that would be required would in addition probably exceed even the capabilities of the current 64 bit version of LISREL 9.0. To fix the loadings of items on non-target latent variables to some specific low positive or negative values would be possible in LISREL but would not accurately model the hypothesized suppressor effect.

Moyo (2009) argued that the formation of item parcels presents a way of capturing the suppressor effect in the measurement model in that the item parcels allowed the suppressor action to operate. The suppressor action originates from the fact that the items of the 15FQ+ reflect the whole personality. Although each item is designed to primarily reflect a specific personality dimension, each item simultaneously also reflect, albeit to a lesser degree, positively and negatively, the remaining personality dimensions (Gerbing & Tuley, 1991). Moyo (2009) argued that when fitting the measurement model with the items of a subscale combined into parcels, the suppressor effect that is assumed to operate when calculating the subscale scores should also operate when calculating the item parcels. The greater the number of items that are included in an item parcel the more likely it becomes that the suppressor effect would also operate when calculating the item parcel scores. The disadvantage of using parcels on the other hand is that it offers the opportunity for insensitive, hermit, biased items to hide away in item parcels. Increasing the number of item parcels decreases the latter problem but makes it less likely that the suppressor effect will operate effectively when calculating item parcel scores.

A compromise position was taken in this study, partly because of restrictions imposed by limitations imposed by the LISREL software. Six item parcels containing 2 items each were used to represent each of the 16 first-order personality factors in the single- and multi-group measurement models. The formation of the item parcels are discussed in greater detail in paragraph 5.6.2.1 below.

Structural equation modelling utilizing LISREL 9.0 (Du Toit & Du Toit, 2000; Jöreskog & Sörbom, 1996a) was used to test the operational hypotheses listed in paragraph 5.1.

Hypotheses 1a, 1b and 1c were tested by fitting three single-group measurement models separately to the data of the three ethnic groups. In estimating the hypothesised models' fit the extent to which the model is consistent with the obtained empirical data will be tested. In order to investigate the hypothesised models' fit exact fit null hypotheses and close fit null hypotheses were tested (Diamantopoulos & Siguaw, 2000). The ideal would be to find an exact fit. Exact fit means that the 15FQ+ flawlessly explains the covariances between the indicator variables across the three ethnic groups. More specifically the following exact fit null hypothesis was tested:

H_{01i}: Σ= Σ(Θ); i=1, 2, 3

H_{a1i}: Σ≠ Σ(Θ); i=1, 2, 3

Where Σ is the observed population co-variance matrix and Σ(Θ) is the derived or reproduced co-variance matrix obtained from the fitted model (Kelloway, 1998). In its alternative format the exact fit hypothesis could be formulated as (Browne & Cudeck, 1993):

H_{01i}: RMSEA=0;i=1, 2, 3

H_{a1i}: RMSEA>0i=1, 2, 3;

However, the possibility of exact fit is highly improbable in that models are only approximations of reality and, therefore, rarely exactly fit in the population. The close fit null hypothesis takes the error of approximation into account and is therefore more realistic (Diamantopoulos & Siguaw, 2000). If the error due to approximation in the population is equal to or less than .05 the model can be said to fit closely (Diamantopoulos & Siguaw, 2000).

Therefore the following close fit null hypothesis was also tested:

H_{02i}: RMSEA≤.05; i=1, 2, 3

H_{a2i}: RMSEA>.05; i=1, 2, 3

Conditional on the decision on H_{01} and H_{02} a further series of hypotheses on the slope and intercepts of the regression for the items on the respective latent personality dimensions were tested[6].

[6]Due to the complexity of the model, these hypotheses were not written out individually.

Conditional on the decision on H_{01} and H_{02}, hypothesis 2 was tested by testing the null hypothesis that the multi-group configural invariance model shows close fit.

H_{03}: RMSEA≤.05

H_{a3}: RMSEA>.05

Conditional on the decision on $H_{03,}$ hypotheses 3 - 6 were tested by testing the null hypotheses that the multi-group weak, strong, strict and complete invariance models show close fit.

H_{0j}: RMSEA≤.05; j=4, 5, 6, 7

H_{aj}: RMSEA>.05; j=4, 5, 6, 7

Conditional on the decision on H_{0j}; j= 4, 5, 6, 7 hypothesis 7 - 10 were tested by determining the practical significance of the difference in fit between the multi-group weak, strong, strict and complete invariance models and the multi-group configural invariance model.

H_{0j}: RMSEA≤.05; j=8, 9, 10, 11

H_{aj}: RMSEA>.05; j=8, 9, 10, 11

The results of these analyses formed the basis for examining the merits of the claim made by the developers of the test that the 15FQ+ successfully measures the sixteen primary personality dimensions it intends to measure and in the manner that it intends to do according to the scoring key.

5.4 SAMPLE

The data used for this study was drawn from a large archival database of the 15FQ+ psychometric test scores provided by a test distributor company in South Africa. The database included the following ethnic groups: Blacks, Coloureds and Whites. Item raw scores were provided for all relevant ethnic groups and self-reported biographical information included gender, age, language, education and ethnic group membership. Given the objective of the study the item raw scores for the sample of Black, Coloured and White respondents of the 15FQ+ were needed and therefore separated. The sample could be considered a non-probability sample of respondents comprising of Black, Coloured and White South African test takers who completed the 15FQ+.

The objective of this study was to determine measurement equivalence and measurement invariance of the 15FQ+ across the Black, Coloured and White groups. Respondents qualified for inclusion in the sample if they completed the 15FQ+ and if information was available on the ethnic group they belong to. The total sample size consisted of 10019 respondents of which 4440 were Black (44.3%), 1049 were Coloured (10.5%) and 4532 were White (45.2%). The large sample size and the demographic information available allowed for the generalizations of the results of the study.

5.5 MEASUREMENT INSTRUMENT

This study was conducted on the second edition of the Fifteen Personality Factor Questionnaire (15FQ+). The 15FQ+ is a self-report personality questionnaire which was developed by *Psytech International*. The questionnaire consists of 200 items requiring a response on a three-point Likert scale. The 15FQ+ has been written in simple, clear and concise modern European business English whilst attempting to avoid cultural, age and gender bias in items. The questionnaire is available for pencil and paper, as well as computer administration. Detailed information regarding the structure, as well as up to date reliability and validity information on the instrument, has been provided in Chapter 3 of this thesis.

5.6 STATISTICAL ANALYSIS

The statistical hypotheses presented in paragraph 5.3 were tested to evaluate the operational hypotheses listed in paragraph 5.1. The null hypotheses listed in paragraph 5.3 will be tested through Structural Equation Modelling (SEM) by means of LISREL (Jöreskog & Sörbom, 1996a). SEM is a set of statistical techniques that are used to examine, continuously or discretely, the relationship between one or more independent or dependant variables (Davidson, 2000). SEM allows for the calculation of how well the measures reflect their intended constructs, make provision for the calculation of more complex path models and it offers a flexible but influential method which takes into account the quality of measurement which is essential in the evaluation of the predictive relationships amongst the underlying latent variables (Kelloway, 1998). It is clear from the above mentioned argument as to why this study selected SEM as a statistical analysis technique.

5.6.1 Preparatory Procedures

This section motivates and describes the preparatory procedures that were followed before conducting the SEM analyses. Therefore this section will a) specify the respective models that were subjected to confirmatory factor analyses, b) identify the measurement models that were evaluated, c) indicate how missing values were approached, d) clarify the necessity of performing item and dimensionality analyses and e) discuss and explain the procedure that was followed for investigating measurement equivalence and measurement invariance.

5.6.1.1 Model specification

This section gives a detailed specification of the measurement model in SEM notation. Specification allows for a clear understanding of the complexity of the model as well as the number of parameters that needed to be estimated.

Null hypotheses H_{01i}i=1, 2, 3 and H_{02i}i=1, 2, 3 were tested by fitting the following basic single-group model to the data of each of the three groups:

$$\mathbf{X}_i = \tau_i + \mathbf{\Lambda}^x{}_i \boldsymbol{\xi}_i + \boldsymbol{\delta}_i \text{--} (3)$$

Where:

- $\mathbf{X}_i$ is the column vector of observable indicator scores for group i;
- $\mathbf{\Lambda}^x{}_i$ is the matrix of factor loadings for group i;
- τ_i is the vector of intercept terms;
- $\boldsymbol{\xi}_i$ is the column vector of latent factors for group i;
- $\boldsymbol{\delta}_i$ is the column vector of unique/measurement errors components for group i comprising the combined effect on X of systematic non-relevant influences and random measurement error (Jöreskog & Sörbom, 1996a).

The above indicated measurement model includes two additional matrices. Firstly it includes a symmetrical variance-covariance matrix $\mathbf{\Phi}_i$ and secondly a diagonal variance-covariance matrix$\Theta_{\delta i}$. The symmetrical variance-covariance matrix $\mathbf{\Phi}_i$ describes the variance in and covariance/correlations between the latent variables and the diagonal variance-covariance matrix $\Theta_{\delta i}$ variance-covariance matrix $\mathbf{\Phi}_i$

describes the variance in and covariance/correlations between the latent variables and the diagonal variance-covariance matrix$\Theta_{\delta i.}$ In contrast to the normal single-group measurement model the variances in $\mathbf{\Phi_i}$ are also estimated. The fact that $\Theta_{\delta i}$ is specified as a diagonal matrix implies that the measurement error terms are assumed to be uncorrelated across the indicator variables (Donnelly, 2009). Freeing off-diagonals in the diagonal matrix would imply that the error terms may be correlated indicating the possibility of additional common factors (Donnelly, 2009). Taking into account the design intentions of the test developers and the confirmatory nature of this study freeing the off-diagonals would be impossible to justify.

Null hypotheses H_{03} and H_{0j}j=4, 5, 6, 7 were tested by fitting the following basic multi-group model to the data of the three groups:

$$\mathbf{X^g{}_i} = \tau^g{}_i + \mathbf{\Lambda^{xg}{}_i \xi^g{}_i} + \mathbf{\delta^g{}_i} \text{ --- } (3)$$

Where:

- $\mathbf{X^g{}_i}$ is the column vector of observable indicator scores for group i;
- $\mathbf{\Lambda^{xg}{}_i}$ is the matrix of factor loadings for group i;
- $\tau^g{}_i$ is the vector of intercept terms;
- $\mathbf{\xi^g{}_i}$ is the column vector of latent factors for group i;
- $\mathbf{\delta^g{}_i}$ is the column vector of unique/measurement errors components for group i comprising the combined effect on X of systematic non-relevant influences and random measurement error (Jöreskog & Sörbom, 1996a).

The variance-covariance matrix $\mathbf{\Phi^g{}_i}$ again describes the variance in and covariance/correlations between the latent variables and the diagonal variance-covariance matrix$\Theta^g{}_{\delta i}$ variance-covariance matrix $\mathbf{\Phi_i}$ describes the variance in and covariance/correlations between the latent variables and the diagonal variance-covariance matrix$\Theta_{\delta i.}$ The variances in $\mathbf{\Phi^g{}_i}$ are estimated. The measurement error terms are assumed to be uncorrelated across the indicator variables.

5.6.1.2 Model identification

Model identification allows for determining whether sufficient information is available in order to attain a unique solution for the parameters to be estimated in the measurement model (Diamantopoulos & Siguaw, 2000). The suggestion is to approach model specification in such a manner that a) a definite scale is allocated to each latent variable and b) the number of model parameters to be estimated do not exceed the number of unique variance/covariance terms in the sample observed covariance matrix (MacCallum, 1995). Both requirements have been met in both the single-group and multi-group measurement models. A definite scale has been allocated to each latent variable by fixing the factor loading of the first indicator variable of each latent variable to unity. The scale of the latent variable is thereby set to be equal to that of the first indicator variable of each subscale. The degrees of freedom for each measurement model that was fitted is shown in Table 5.1.

Table 5.1 clearly shows that all measurement models had positive degrees of freedom. The number of model parameters to be estimated therefore did not exceed the number of unique variance/covariance terms in the sample observed covariance matrix.

5.6.1.3 Treatment of missing values

The data might be incomplete due to missing values which can potentially present a problem that will have to be solved. Therefore missing values had to be identified and dealt with prior to conducting the analyses. The method used to impute missing values depended on the number of missing values as well as the nature of the data.

Table 5.1

DEGREES OF FREEDOM FOR EACH OF THE FITTED 15FQ+ MEASUREMENT MODELS

Model/ Hypothesis	# Lambda's	# Tau's	# Theta-delta's	# Phi's	Total # of parameters to be estimated	# Indicator variables	# Groups	# Unique information pieces	Df
Single group measurement model	80	96	96	136	408	96	1	4752	4344
Configural invariance [H_a]	240	288	288	408	1224	96	3	14256	13032
Weak invariance [H_{01}]	80	288	288	408	1064	96	3	14256	13192
Strong invariance [H_{02}]	80	96	288	408	872	96	3	14256	13384
Strict invariance [H_{03}]	80	96	96	408	680	96	3	14256	13576
Complete invariance [H_{04}]	80	96	96	136	408	96	3	14256	13848

Missing values could be dealt with in different ways, these included: (1) listwise deletion, (2) pairwise deletion, (3) mean substitution, (4) group mean substitution, (5) imputation by regression, (6) structural equation modelling approach, (7) hot-deck imputation, (8) expectation maximization, (9) full information maximum likelihood and (10) multiple imputation (Du Toit & Du Toit, 2001).

The most appropriate method to use in this study was the listwise deletion method. All items with missing values were identified through visual inspection and deleted accordingly, leaving only cases with complete data. This method might result in dramatically reducing the sample size which may negatively affect the data (Kline, 2005; Mels, 2003). The success of the statistical analyses is a function of sample size; therefore smaller samples could reduce the power of the statistical analyses (Olinsky, Chen & Harlow, 2003). Listwise deletion can also cause oversight of non-ignorable patterns of missing data (Olinsky et al, 2003). Therefore when data is missing completely at random listwise deletion will be unbiased (Olinsky, 2003). Using listwise deletion in this study still resulted in an effective sample size of 10019 cases and no pattern of missing values was identified. The most appropriate method to satisfy the treatment of missing values for this study was therefore listwise deletion.

5.6.1.4 Item analysis

In this study the overarching purpose of item analysis was to gain a deeper and more penetrating understanding of the 15FQ+. According to Kline (1994) item analysis is a procedure where the correlations between each item and a total score are evaluated as well as the inter-item correlations. The intention of test developers is to construct items of a test in such a way that items allocated to the same subscale correlate higher amongst themselves than with items from others subscales (Donnelly, 2009). Nunnally (1978) indicates that item analysis is the first procedure used in item selection; the selected items will then be subjected to factor analysis.

The 15FQ+ was developed to measure a personality construct carrying a specific constitutive definition. In terms of this definition specific first and second-order latent dimensions are identified. Items have been written to indicate the standing of respondents on these specific latent variables. The items were developed to serve as stimuli to which respondents react with observable behaviour that is a relatively uncontaminated expression primarily of the specific underlying latent variable. The observed behavioural response to these various scale stimuli are recorded on the response sheet. If these design intentions were successful it should reflect in a number of item statistics. Therefore the item analysis facilitates the process of identifying whether the observed variables are consistent measures of the intended latent variable. High reliability of the provided observed latent variable manifestations would give credence to the design intentions of the test developers. If the design intentions succeeded high internal consistency reliability, high item-total correlations, and high inter-item correlations and high squared multiple correlations should be observed for the items of a given subscale. The converse is, however, not true. When high internal consistency reliability, high item-total correlations, high inter-item correlations and high squared multiple correlations are obtained it does not conclusively mean that the design intentions succeeded. It simply means that the design intentions could have succeeded. It means that the position that the design intentions succeeded is a permissible position. If, however, low internal consistency reliability, low item-total correlations, low inter-item correlations and low squared multiple correlations should be observed for the items of a given subscale it does conclusively mean that the design intentions failed (Popper, 1972).

This study utilized item analysis to determine whether the items comprising the various subscales successfully operationalise the latent variables they were tasked to reflect, according to the scoring key, as a forerunner to fitting the *a* priori model to the data. The intention was to retain all items but report on poor items that fail to discriminate between the different levels of latent variables they were designed to reflect, or that fail to respond in harmony with their partner items in the same subscale, both of which could be reasons for poor model fit in subsequent confirmatory factor analyses. Poor items will be identified based on different psychometric evidence. The evidence will include, amongst others, the following classical measurement theory item statistics: the item-total correlation, the squared multiple correlation, the change in subscale reliability when item is deleted, the change in sub-scale variance if the item is deleted, the inter-item correlations, the item mean and the item standard deviation (Murphy & Davidshofer, 2005). In addition, the analyses will also provide initial information regarding the homogeneity of each sub-scale. For these analyses, each ethnic group's data were analysed separately providing information regarding reliability of the observed variables across the ethnic groups. This procedure should provide valuable information regarding the measurement properties of the instrument across the Black, Coloured and White groups. The SPSS Scale Reliability Procedure was used to analyse the sub-scale items.

5.6.1.5 Dimensionality analysis

The 15FQ+ defines the first-order factors that it measures in a manner that does not allow for a splitting of the personality sub dimensions into finer, more specific personality dimensions. It does make provision for factor fusion into second-order factors but not factor fission. Uni-dimensionality occurs when the items selected for each scale, to represent the first-order personality factors, do in fact all measure a single common underlying latent variable (Hair, Black, Babine, Anderson & Tatham, 2006). The architecture of each scale used to measure the latent variables reflects the intention to construct essentially one-dimensional sets of items. These items are meant to operate as stimuli to which test respondents react with observable behaviour that is primarily an expression of a specific uni-dimensional latent variable. It is, however, very difficult to isolate behaviour in such a manner that the response to an item only reflects the latent variable of interest. The behavioural response to each item is never only a reflection of the latent variable of interest but is also influenced by a number of other latent variables and random error influences that are not relevant to the measurement objective (Guion, 1998). Therefore strict uni-dimensionality will seldom, if ever, be achieved. The non-relevant latent variables that influence respondent's reaction to item i do not, however, operate to affect respondent's reaction to item j. The assumption is that only the relevant latent variable is a common source of variance across all the items comprising a scale. Hence, uni-dimensionality would be achieved if the partial inter-item correlations would become negligibly small when controlling for a single underlying factor (Hair et al., 2006). In most other measuring instruments the only source of common variance amongst a set of items is meant to be the latent variable the set of items were designed to measure. Once that single common variable is controlled for the (partial) correlations between the items are meant to approach zero. In such cases one would expect to extract a single underlying common factor on which all the items show reasonably high loadings. In the case of the 15FQ+, however, the response to an item in a specific subscale to varying degrees also reflects the remaining 15 latent variables constituting the personality domain but cancel each other out in a suppressor action. The question is what factor structure should emerge if the design intention of the developers of the 15FQ+ succeeded in developing subscales of items that predominantly reflect a single factor but also, albeit to a much lesser extent reflect the remaining factors comprising the personality space? One position to take is that for all subscales the exploratory factor analysis of the inter-item correlation matrix should result in the extraction of 16 factors but that in the rotated solution all items load strongly on a single (most probably the first) factor. All items display small positive and negative loadings, close to zero on all remaining factors. The other possible position to take is that for all subscales the exploratory factor analysis of the inter-item correlation matrix should result in the extraction of a single factor on which all items load strongly. If, however, exploratory factor analysis of the inter-item correlation matrix would result in the extraction of more than one factor and the items of a specific subscale would load strongly on different factors this would comment unfavourably of the extent to which the design intentions succeeded. Those scales failing the uni-dimensionality assumption would imply that multiple dimensions are specified for the instrument. Testing this assumption does not work against the need for the CFA. It rather provides further insight into the internal function of the *a priori* specified factor structure of the 15FQ+ and reasons for possible poor model fit.

To examine the uni-dimensionality assumption exploratory factor analyses (EFA) were performed on each of the scales of the 15FQ+. Unrestricted principle axis factor analysis was used as extraction technique (Tabachnick & Fidell, 2001) with oblique rotation. This analysis was performed on each of the 16 basic scales individually for all three ethnic groups (Black, Coloured and White). Principle axis factor analysis was chosen over principle components analysis as the former only analyses common variance (Tabachnick & Fidell, 2001). Principle axis analysis allows for the presence of measurement error while according to Kline (1994) principle components analysis does not separate error and specific variance. Measurement of human behaviour and characteristics without measurement error is unlikely (Steward, 2001), consequently principal axis analysis is the preferred method. When uni-dimensionality was not met, the possibility of meaningful factor fission was investigated. The ability of a single factor to account for the observed inter-item correlation matrix was also investigated when the uni-dimensionality assumption was challenged, irrespective of whether meaningful factor fission was found. This investigation allowed the determination of the magnitude of the factor loadings when a single factor (as per the *a priori* model) was forced, and the examination of the magnitude of the residual correlations. The magnitude of the latter can be regarded as reflecting on the credibility of the extracted single factor solution as an explanation for the observed correlation matrix. To meet the requirements of the suppressor principle the extraction of a single factor or the extraction of multiple factors with satisfactory loadings on the first factor was considered sufficient. The latter was considered to be the more realistic possibility.

SPSS was used for the principal factor analyses as described above. The eigenvalue-greater-than-unity rule of thumb was used to determine the number of factors to extract. A factor loading will be considered acceptable if $\lambda_{ij} \geq .50$. Hair et al. (2006) recommended in the context of confirmatory factor analysis that factor loadings should be considered satisfactory if $\lambda_{ij} \geq 0.71$. The critical factor loading cut-off value suggested by Hair et al. (2006) is considered somewhat stringent in the case of individual items. EFA results for the separate ethnic group samples will be presented. Differences between each ethnic group sample will also be discussed. While this does not provide information regarding the configural invariance of the 15FQ+, it does provide valuable information that could be returned to when wanting to identify reasons for poor CFA model fit.

5.6.2 Evaluation of the 15FQ+ Measurement model

5.6.2.1 Variable type

The appropriate moment matrix to analyse and the appropriate estimation technique to use to estimate freed model parameters depend on the measurement level on which the indicator variables are measured. The 15FQ+ utilises a three-point Likert-type response scale. This data are referred to as ordinal data. Bontempo and Mackinnon (2006) report that CFA models assume continuous and normally distributed data and if these assumptions are not met and the data are not appropriately analysed, distorted estimates of the measurement model parameters would be obtained. There is one possible strategy that can be used to convert ordered categorical data to continuous data, which includes using item parcels rather than item level raw data. Sass and Smith (2006, p. 568) maintain that item parcels are “nothing more than subsets of items (or observations) from a common measure”. Item parcelling reduces the number of indicators in lengthy scales (Bandalos & Finney, 2001).

There is, however, disadvantages of using item parcelling which argues against the use of item parcelling in this study. Marsh, Hau, Balla and Grayson (1998) cautioned that solutions in confirmatory factor analysis tend to be better when larger numbers of indicator variables are used to represent latent variables. Item parcelling decreases the number of indicator variables used to represent latent variables. Meade and Lautenschlaeger (2004) reported in their study that measurement invariance and equivalence tests of equality of factor loadings are more likely to be precise when using item level data. Meade and Kroustalis (2006) found in their study that model fit could be poorer when using item data but that lack of equivalence may be masked through the utilisation of item parcels. Therefore they concluded that the use of items is preferred when conducting tests of measurement invariance and equivalence. Further to this Kim and Hagtvet (2003) indicated that the use of item parcels may lead to a misrepresentation of the latent construct. The data should therefore be analysed appropriately without distorting the measurement model parameters obtained.

A further consideration is how the measurement model should be specified so that it satisfactorily accommodates the suppressor principle when using individual items. The single- and multi-group measurement models should represent the design intention that the items of each subscale should also display a random pattern of small positive and negative loadings on the other latent variables comprising the personality domain. The suppressor principle is a core design feature of the 15FQ+ and reflects the fundamental assumption that when human behaviour is affected by personality it reflects the whole personality. Although each item was designed to mainly reflect a specific latent personality variable in actual fact they simultaneously also reflect to a limited degree the influence of all the remaining latent personality dimensions as well (Gerbing & Tuley, 1991).The suppressor principle is more easily accommodated in the single- and multi-group measurement models when item parcels are used since the same principle that operates when calculating the subscale dimension score also operates when calculating the item parcel scores. This line of reasoning becomes more convincing as the number of items included in each parcel becomes larger and the number of parcels becomes less.

Hardware limitations (i.e. computer processing ability) forced the decision in favour of item parcelling in this study. Initially it was attempted to fit the single- and multi-group 15FQ+ measurement models with the individual items using the standard 32 bit version of LISREL 8.8 running on a 64 bit computer[7].The programme issued warning messages that were interpreted by Scientific Software International (SSI) as indicating memory problems. They advised the use of the 64 bit version of LISREL 8.8 running on a 32 bit computer. The warning messages persisted. SSI subsequently advised the use of LISREL 9.0. The warning messages still persisted. To solve the problem it was decided to use item parcels. Because of the warnings issued by Marsh et al. (1998), Meade and Lautenschlaeger (2004), as well as Meade and Kroustalis (2006) on the use of item parcelling in measurement invariance and equivalence studies, 6 item parcels were calculated for each subscale containing the mean of two items. The first and the last item in a subscale were combined, the second and the second last *etcetera*. This solved the problem[8]. This solution had the added advantage that it allowed the suppressor action effect to operate to some degree at least.

5.6.2.2 Measurement model fit

Measurement model fit refers to the ability of the fitted single- or multi-group model to reproduce the observed covariance matrix or matrices. The model can be said to fit well if the reproduced covariance matrix/matrices approximates the observed covariance matrix/matrices. The single-group measurement model fit was interpreted by inspecting the full spectrum of goodness of fit indices provided by LISREL (Diamantopoulus & Sigauw, 2000). The magnitude and distribution of the standardized residuals and the magnitude of model modification indices calculated for Λ_x, and Θ_δ were also examined to assess the quality of the model fit. Large modification index values indicated measurement model parameters that, if

[7]From the outset LISREL was ran from the disk operating system (DOS) on advice from Scientific Software International.

[8]The single- and multi-group measurement models now converged. In the case of the multi-group measurement models each analysis took approximately two weeks (336 hours) to run.

unconstrained, would improve the fit of the model. Large numbers of large and significant modification index values commented negatively on the fit of the model in as far as it suggested that numerous possibilities exist to improve the fit of the model proposed by the researcher. Inspection of the model modification indices for the aforementioned matrices here served the sole purpose of commenting on the model fit. The multi-group measurement model fit was evaluated by testing the close fit null hypothesis H_{0j}; j=4, 5, 6, 7.

In order to meet the measurement invariance and equivalence research objectives of this study, LISREL 9.0 (Du Toit & Du Toit, 2001, Jöreskog & Sörbom, 1996a) was used to determine the fit of: (i) the basic single-group 15FQ+ measurement model on the three samples separately and (ii) the four multi-group 15FQ+ measurement models when fitted in a series of multi-group analyses.

5.6.2.3 Testing for measurement equivalence and measurement invariance

This study uses the specific measurement invariance and equivalence series of tests set out by Dunbar et al. (2011) to answer a sequence of questions that examined the extent to which the measurement model may be considered measurement invariant and measurement equivalent or not, and to determine the source of the variance if it existed (Vandenberg & Lance, 2000). The following series of steps capture the essential logic underlying the investigation of measurement invariance and measurement equivalence as set out by Dunbar et al. (2011).

Step 1: Establish if the single-group measurement model when fitted to each sample independently displays reasonable fit.

Prior to establishing the source of measurement equivalence and invariance it was necessary to first establish whether the model fits on all three groups independently. This step determined whether the measurement model displayed reasonable fit when fitted to each group independently (Dunbar et al., 2011). Rejecting the null hypothesis of close fit (H_{02i}: RMSEA ≤ .05; i=1, 2, 3) for i=1, 2 or 3 would imply that the measurement model does not adequately fit the data of one sample, two samples or all three samples, and any further examination of measurement invariance and equivalence would be questionable (Dunbar et al., 2011). Satisfactory model fit for all three samples will justify further measurement invariance and equivalence analysis.

Initially the general agreement among researchers was that an omnibus test of the equality of covariance matrices should be the first step in determining measurement equivalence and measurement invariance (Vandenberg & Lance, 2000). The popularity of the omnibus test has however declined (Dunbar et al., 2011). The assumption was that if covariance matrices do not differ across groups, measurement invariance and measurement equivalence are established and further testing is unnecessary. If the covariance matrices do differ then further testing will allow for determining the source of lack of measurement equivalence and measurement invariance. However according to Meade and Lautenschlager (2004) the confidence in the outcome of the omnibus test has been eroded because the test sometimes indicate full equivalence when subsequent tests indicate lack of equivalence. If the verdict of the omnibus test cannot be trusted (e.g., Byrne, 1998; Dunbar & Theron; Meade & Lautenschlager) and subsequent tests of specific hypotheses regarding equivalence are required, irrespective of the results of the omnibus test, there is little point in performing the test as an initial screening to determine whether further analyses is required (Dunbar et al., 2011).

It is highly unlikely in social science research that full measurement equivalence and complete measurement invariance will be displayed because some differences between samples are to be expected (Steenkamp & Baumgartner, 1998).

Step 2: Establish if the multi-group measurement model in which the structure of the model is constrained to be the same across groups, but with no freed parameters constrained to be equal across groups, display reasonable fit when fitted to the samples simultaneously in a multi-group analysis.

The next step involved the investigation of configural invariance (Dunbar et al., 2011). Configural invariance is a prerequisite for evaluating further aspects of measurement invariance and measurement equivalence. If there is a lack of configural invariance, other tests of measurement invariance and equivalence are unnecessary because it indicates that the measuring instrument represents different constructs across groups. Finding support for configural invariance signifies that the different groups used the same conceptual frame of reference when they responded to the items, the measuring instrument therefore reflects the same underlying construct across the groups. Thus, configural invariance focuses on the theoretical structure of the measurement instrument. The underlying theoretical structure of the instrument refers to the manner in which the subscales of the instrument tap into the same underlying construct across groups (Theron, 2006). Configural invariance will most probably not be achieved if the constructs are very abstract and culture specific and when different groups uses different frames of references when attaching meaning to the construct of interest (Cheung & Rensvold, 2002). Other reasons why configural invariance may not be attained include data collection problems and translation errors. The configural invariance model is used as the baseline model against which further nested models are evaluated (Vandenberg & Lance, 2000) when evaluating measurement equivalence.

Step 3a: Establish whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are estimated freely across the samples, but for the slope of the regression of the indicator variables on the latent variables which is constrained to be equal, demonstrates acceptable fit when fitted to the samples simultaneously in a multi-group analysis.

Upon (a) finding acceptable model fit on all three samples independently and (b) when configural invariance is supported, the question then needs to be asked whether non-equivalence exist in the factor loadings of the items on the latent variables across samples. Subsequently weak invariance was tested. Weak invariance was tested by testing H_{04}: RMSEA$\leq$.05. A lack of weak invariance would imply that the slope of the regression of at least some of the items on the latent variable they represent, differ across samples. This indicates that the item content is being perceived and interpreted differently across samples (Byrne & Watkins, 2003). This would be a disappointing result of measurement invariance research as the factor loadings is the core of the measurement process (Dunbar, et al., 2011). Finding support for weak invariance would be a suitable result as it would support the position that the items operate in approximately the same way across samples in the way they reflect the underlying latent variables they are meant to reflect (Dunbar et al., 2011). A finding of weak invariance implies that the claim that the factor loadings are the same across groups is a tenable position to hold since the multi-group weak invariance model was able to closely reproduce the observed covariance matrices. The fact that weak invariance is a tenable position does, however, not mean that differences in one or more factor loadings is not a more tenable position. Therefore if weak invariance had been established metric equivalence was subsequently tested.

Step 3b: Establish whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are estimated freely across the samples but, for the slopes of the regression of the indicator variables on the latent variables, fits the multi-group data poorer than a multi-group measurement model in which the structure of the model is constrained to be the same across groups but all parameters are estimated freely.

Step 3b is conditional on a finding of weak invariance (Dunbar et al., 2011). Metric equivalence would be indicated if a change of -.01 or less in the CFI fit index, a change of -.001 or less in the Gamma Hat fit index (Γ_1) and a change of -.02 or less in the McDonald Non-centrality index (Cheung & Rensvold, 2002) between configural multi-group model and the weak invariance multi-group model is observed (Dunbar et al., 2011). The evaluation of measurement model equivalence fit can be based on the chi-square difference test. If the chi-square difference value is statistically non-significant it provides strong evidence for an equivalent measurement model. The chi-square difference statistic may, however, be statistically significant even if there exist only minor differences between groups due to its sensitivity to sample size. The decision on measurement equivalence was therefore not based on the statistical significance of the Satorra-Bentler scaled chi-square difference statistic. The Satorra-Bentler scaled chi-square difference statistic and its significance was nonetheless reported in all measurement model equivalence tests.

If metric equivalence was found significant differences in factor loadings do not exist between the three groups. Weak invariance is a tenable position to hold and differences in one or more factor loadings do not offer a more tenable position. If metric equivalence is found further tests of measurement invariance and measurement equivalence still need to be conducted to determine if there exist differences in the parameters estimates elsewhere in the measurement model.

Additional tests of measurement invariance are therefore required (Vandenberg & Lance, 2000).

Step 4a: Establish whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are estimated freely across the samples, but for the factor loadings and the vector of regression intercepts, demonstrates acceptable fit when fitted to the samples simultaneously in a multi-group analysis.

The test of strong invariance determined whether the regression slopes and intercepts were the same across groups. Strong invariance was tested by testing H_{05}: RMSEA≤.05. A lack of strong invariance would imply that the regression slopes and intercepts of at least some of the items on the latent variable they represent differ across samples. Finding support for strong invariance would be a suitable result as it would support the position that the items operate in approximately the same way across samples in the way they reflect the underlying latent variables they were meant to reflect (Dunbar et al., 2011). A finding of strong invariance implies that the claim that the intercept terms in the vectors τ^g are the same across groups is a tenable position to hold. The fact that strong invariance is a tenable position does, however, not mean that differences in one or more intercept terms is not a more tenable position. Therefore if strong invariance has been established scalar equivalence (step 4b) was tested.

Step 4b: Establish whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are estimated freely across the samples, but for the slope and the intercepts of the regression of the indicator variables on the latent variables, fits multi-group data poorer than a multi-group measurement model in which the structure of the model is constrained to be the same across groups but all parameters are estimated freely.

Step 4b is conditional on a finding of strong invariance (Dunbar et al., 2011). Scalar equivalence would be indicated if a change of -.01 or less in the CFI fit index, a change of -.001 or less in the Gamma Hat fit index (Γ_1) and a change of -.02 or less in the Mcdonald Non-centrality index (Cheung & Rensvold, 2002) between configural multi-group model and the strong invariance multi-group model is observed (Dunbar et al., 2011).

The test of scalar equivalence tests the hypothesis that the vector of item intercepts is invariant across groups. Scalar invariance means that the position that the intercepts of the regression of X_i on ξ_j is the same across groups is a tenable position and that the position that one or more intercept terms differ across groups is not a more credible position. In the case where intercept differences are not due to biases but due to threshold differences that are based on known/expected group differences, which are not seen as undesirable, a test of scalar equivalence is not suitable (Vandenberg & Lance, 2000).

Step 5a: Establish whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are estimated freely across the samples, but for the factor loadings, the vector of regression intercepts and the measurement error variances of the indicator variables, demonstrates acceptable fit when fitted to the samples simultaneously in a multi-group analysis.

The test of strict invariance determines whether the regression slope, intercept and error variances of indicator variables are the same across groups. Strict invariance was tested by testing H_{06}: RMSEA$\leq$.05. A lack of strict invariance (assuming that weak and strong invariance have been shown) would imply that the error variance of indicator variables of at least some of the items on the latent variable they represent differ across samples. Strict invariance indicates that the respondents from the different ethnic groups respond to the instrument in such a manner that no significant variance exists across samples in terms of error terms associated with the indicator variable (Dunbar et al., 2011). A finding of strict invariance implies that the claim that the measurement error variances in the main diagonal of the $\Theta_\delta{}^g$ matrices are the same across groups is a tenable position to hold. The fact that strict invariance is a tenable position does, however, not mean that differences in one or more error variance terms is not a more tenable position. Therefore if strict invariance had been established conditional probability equivalence was tested.

Step 5b: Establish whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are estimated freely across the samples, but for the factor loadings, regression intercepts and measurement error variances of the indicator variables, fits multi-group data poorer than a multi-group measurement model in which the structure of the model is constrained to be the same across groups, but all parameters are estimated freely.

Step 5b is conditional on a finding of strict invariance (Dunbar et al., 2011). Conditional probability equivalence would be indicated if a change of -.01 or less in the CFI fit index, a change of -.001 or less in the Gamma Hat fit index (Γ_1) and a change of -.02 or less in the Mcdonald Non-centrality index (Cheung & Rensvold, 2002) between the configural multi-group model and the strict invariance multi-group model is observed (Dunbar et al., 2011).

Step 6a: Establish whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are constrained to be the same across the samples demonstrates acceptable fit when fitted to the samples simultaneously in a multi-group analysis.

Given a finding of conditional probability equivalence the question was asked whether the latent variable variances and covariance's are invariant across groups. Complete invariance was tested by testing H_{07}: RMSEA≤.05. According to Vandenberg and Lance (2000) the test of complete invariance determines whether the samples use "equivalent ranges of the construct continuum to respond to the indicators reflecting the construct". If the null hypothesis of close fit cannot be rejected, measurement invariance across samples is indicated.

This is the most stringent test of measurement invariance testing the null hypothesis (H_{01}: $\Sigma^{g}= \Sigma^{g'}$) that the 15FQ+ measurement model fits the data the same way across the ethnic groups (Vandenberg & Lance, 2000). The null hypothesis implies that the observed covariance matrices ($\Sigma^{g}= \Sigma^{g'}$) are the same across the ethnic groups, which will indicate that the measurement models are the same across ethnic groups in terms of structure and all measurement model parameters. If different measurement model parameters estimates are required to account for the observed covariance matrices across samples it would imply that the covariance matrices differ and therefore that the underlying measurement models differ. Failure to reject the null hypothesis would mean a finding of strong invariance which in turn implies that the claim that all the measurement model parameters are the same across groups is a tenable position to hold. The rejection of the null hypothesis would imply that significant differences exist between groups in either one or more latent variable variances and/or one or more correlations between the latent variables. This test is referred to as the omnibus test of measurement invariance.

Step 6b: Establish whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are constrained to be equal across the samples fits the multi-group data poorer than a multi-group measurement model in which the structure of the model is constrained to be the same across groups but all parameters are estimated freely.

Step 6b is conditional on a finding of complete invariance (Dunbar et al., 2011). Full measurement equivalence would be indicated if a change of -.01 or less in the CFI fit index, a change of -.001 or less in the Gamma Hat fit index (Γ_1) and a change of -.02 or less in the Mcdonald Non-centrality index (Cheung & Rensvold, 2002) between the configural multi-group model and the complete invariance multi-group model is observed (Dunbar et al., 2011).

If complete measurement invariance and full measurement equivalence has been found the model may be said to be equivalent and further tests would not be required. If complete invariance has failed and full measurement equivalence cannot be shown the model is non-equivalent (Dunbar et al., 2011).

CHAPTER 6
RESEARCH RESULTS

The 15FQ+ test developers hypothesized specific intended relationships between the indicator variables and the latent personality variables of the 15FQ+. The measurement model of the 15FQ+ depicts these intended relationships. Indicator variables were written to function as stimulus sets to which test takers respond, which would constitute a behavioural expression of the specific latent personality variable. The measurement model hypothesizes that the 16 latent personality variables will systematically affect the manner in which the respondents respond to the indicator variables. It should also be acknowledged that the items of each of the 15FQ+ subscales primarily reflect a specific personality dimension i.e., the items load reasonably strongly on a specific dimension of the personality space. However, the items are also scattered throughout the remainder of the personality space with random low positive and negative loadings on the remaining 15 dimensions. It is very difficult to isolate specific dimensions of the personality construct; behaviour tends to reflect the whole personality construct. The measurement model of the 15FQ+ acknowledges that the 15FQ+ is based on the design principle that the indicator variables of each subscale would primarily reflect the specific personality dimension they were designed to measure. However, the suppressor action assumes that the remaining personality dimensions in the scale would also to a limited degree influence the same indicator variables.

The overarching substantive hypothesis tested in this research study was that the 15FQ+ measures the personality construct as constitutively defined by the test developers of the 15FQ+ and that the construct is measured in the same manner across different ethnic groups, specifically Black, Coloured and White South Africans. Ten specific operational research hypotheses were developed in chapter 5. Operational research hypotheses 1 – 6 were translated into seven statistical hypotheses in chapter 5. Operational hypotheses 7 - 10 were tested by determining the practical significance of the difference in fit between the multi-group weak, strong, strict and complete invariance models and the multi-group configural invariance model and were translated in to four statistical hypotheses in Chapter 5. The aim of this chapter is to present the results of the statistical analyses aimed at testing the operational research hypotheses formulated in chapter 5.

A series of confirmatory factor analyses (CFA's) was required in order to determine the validity of the above mentioned hypotheses. The CFA's evaluated the fit of the implied measurement model which is necessary in evaluating the measurement equivalence and invariance of the 15FQ+. However, prior to conducting the series of CFA some other analyses had to be conducted in order to assist in determining the psychometric integrity of the indicator variables which were designed to represent the various latent personality variables of the15FQ+. This chapter will, therefore, firstly discuss the results of the item and dimensionality analyses. Thereafter the results of the CFA will be discussed.

6.1 ITEM ANALYSIS

Item analysis is a procedure where the correlations between each item and a total score are evaluated as well as the inter-item correlations (Kline, 1994). The design intention of test developers was to construct essentially one-dimensional sets of items that would reflect variance in the 16 latent variables which were identified to collectively constitute the personality domain as measured by the 15FQ+ (Donnelly, 2009).

The success with which the design intention of the test developers has been achieved will be reflected in a number of item statistics. The function of the item analysis was to facilitate the process of identifying whether the observed variables are consistent measures of the intended latent variable. High reliability of the observed latent variable manifestations would provide credibility to the claim of the test developers that the 15FQ+ measures the intended latent variable in accordance with the design intention. Therefore the item statistics were calculated, through the item analysis, to determine how well the items represent the content of any particular factor.

The purpose of determining how well the items represent the content of any particular factor was to detect poor items. A particular set of items are meant to reflect a common latent variable of interest. Poor items are those items that fail to discriminate between the different levels of latent variables they were designed to reflect. Generally the objective of detecting poor items would be to rewrite them, and if not possible, to delete them from the subscale. The rewriting and/or deletion of items were not a viable solution for this study. This research was aimed at psychometrically evaluating the existing 15FQ+ as it is currently being used and not to revise the current instrument. Therefore the intention of this study was to retain all items in the scale but to report on poor items. This information could then be used to evaluate possible poor model fit achieved in subsequent analyses.

The analyses also provided initial information regarding the homogeneity of each sub-scale. For these analyses, the data of each ethnic group were analysed separately providing information regarding reliability of the observed variables in each of the ethnic groups. This procedure also provided valuable information regarding the measurement properties of the instrument across the different ethnic groups included in this study (Black, Coloured and White).

6.1.1 Item analysis results

Item analyses were conducted on each ethnic group separately. The SPSS Scale Reliability Procedure was used to analyse the sub-scale items. A summary of the item analyses results for the respective groups is available in Appendix 1 (item statistics results), Table 6.1 (internal consistency results) and Appendix 2 (inter-item correlations results).

Firstly, the Cronbach's alpha was calculated in order to measure the internal consistency of a particular scale. The Cronbach alpha indicates the degree to which a set of items measure one or more common underlying latent variables or constructs. A high coefficient alpha indicates that the items on a scale have high correlations with each other and with the total score, indicating that the items have a common source of variance. The common source of variance need, however, not necessarily be a single unidimensional latent variable. A low coefficient alpha would be suggestive of either scale items measuring different attributes, or the presence of random measurement error (Psychometrics Limited, 2002). The internal consistency results for all the subscales for all three groups are available in Table 6.1.

Table 6.1

SUMMARY OF THE ITEM ANALYSES RESULTS OF THE 15FQ+ PER SUBSCALE OVER THE THREE GROUPS

			WHITE GROUP				**BLACK GROUP**				**COLOURED GROUP**			
Subscale	Number Of Items	Sample Size	Mean	Variance	Standard Deviations	Cronbach Alpha	Mean	Variance	Standard Deviations	Cronbach Alpha	Mean	Variance	Standard Deviations	Cronbach Alpha
FA	12	4531	18.37	18.36	4.29	.72	19.00	9.30	3.05	.51	19.26	10.91	3.30	.58
FB	12	4531	19.73	18.59	4.31	.74	19.20	14.99	3.87	.65	20.07	15.79	3.97	.71
FC	12	4531	16.97	26.30	5.13	.78	17.51	18.76	4.33	.70	17.41	19.21	4.38	.70
FE	12	4531	16.52	24.11	4.91	.73	16.40	14.65	3.83	.55	16.55	16.40	4.05	.61
FF	12	4531	14.59	32.90	5.74	.78	14.38	27.32	5.23	.72	15.19	27.35	5.23	.73
FG	12	4531	18.79	25.49	5.05	.79	19.98	14.86	3.80	.68	19.39	18.21	4.27	.72
FH	12	4531	14.28	41.93	6.48	.83	16.58	27.57	5.25	.75	15.69	33.59	5.80	.79
FI	12	4531	14.27	29.30	5.41	.75	14.65	21.93	4.68	.62	15.11	25.93	5.09	.71
FL	12	4531	8.39	26.26	5.12	.74	10.64	20.27	4.50	.65	9.15	24.22	4.92	.71
FM	12	4531	10.33	21.13	4.60	.67	10.35	11.35	3.37	.40	10.25	15.19	3.90	.53
FN	12	4531	18.07	25.39	5.04	.77	20.29	10.09	3.18	.55	19.21	16.36	4.05	.68
FO	12	4531	12.76	35.33	5.94	.77	11.89	23.67	4.87	.61	12.13	28.72	5.36	.70
FQ_1	12	4531	8.70	27.69	5.26	.72	9.09	18.47	4.30	.53	8.90	22.94	4.79	.65
FQ_2	12	4531	8.56	30.13	5.49	.76	6.97	18.38	4.29	.64	7.41	21.87	4.68	.68
FQ_3	12	4531	20.05	12.75	3.57	.66	20.39	7.45	2.73	.47	20.67	9.01	3.01	.56
FQ_4	12	4531	10.96	38.03	6.17	.80	7.72	19.56	4.42	.58	8.15	29.31	5.41	.74

FA - Factor A; FB - Factor B; FC - Factor C; FE - Factor E; FF - Factor – F; FG - Factor G; FH - Factor H; FI - Factor I; FL - Factor L; FM - Factor M; FN - Factor N; FO - Factor O; FQ1 - Factor Q1; FQ2 - Factor Q2; FQ3 - Factor Q3; FQ4 - Factor Q4

The question that arises is how an acceptable level of reliability is defined. This study utilised the critical cut-off value of .70 (Nunnally, 1978) when interpreting the results of the item analysis. Nunnally (1978) argued that establishing acceptable levels of reliability depend on the purpose of the instrument. Nunnally (1978) recommended that measurement instruments used in basic research should obtain reliability scores of about .70 or better. Alternatively, measurement instruments used in applied settings should possess reliability scores of .80 or higher. Moreover, he further argued that where important decisions about the fate of individuals are made based on the information derived from the instrument, the reliability should at least be .90 or better (Nunnally, 1978). Smit (1996) argued that personality measures do tend to display a somewhat lower coefficient of internal consistency. It is further argued here that the suppressor effect could have a negative influence on the internal consistency results. Therefore, the lower boundary of acceptable levels of reliability (.70) will be utilized as the cut-off value in this study.

Secondly, items were identified as potentially poor items based on psychometric evidence that the item failed to sensitively distinguish between different levels of the underlying variable as reflected in the following item statistics a) a higher reliability coefficient if the item is deleted, b) low and at times negative inter-item correlations, c) extreme means and small standard deviations, and d) corrected item-total correlations and squared multiple correlations that are substantially smaller than those of the majority of the items in the subscale. Visual inspection of these item statistics revealed the need to flag some items as possible poor items. There were a number of items that were flagged as poor items which will be discussed in the subsequent sections. The item statistic information is available in Appendix 1.

Due to the confirmatory nature of this study all items will be retained for subsequent CFAs. The rewriting and/or deletion of items were not a viable solution for this study.

6.1.1.1 Subscale reliabilities for the White sample

In the White sample it was evident that fourteen of the sixteen subscales obtained a coefficient alpha above the cut-off value of .70 (see Table 6.1). Only two coefficient alpha values were less than .70, but still greater than .60. Overall, the results of the reliability analyses suggested satisfactory levels of internal consistency of the various subscales within this ethnic group.

6.1.1.2 Subscale reliabilities for the Black sample

In the Black sample a clearly different picture emerged. Only three of the sixteen subscales obtained coefficient alphas above the cut-off value of .70. Thirteen of the subscales obtained values below the .70 benchmark. Moreover, two of these thirteen subscales obtained values below .50. Table 6.1 clearly indicates that most subscales for the Black group obtained alpha values lower than those reported for the White group. From these results it can be deduced that the items comprising each subscale do not seem to operate as stimulus sets to which respondents in the Black sample react with behaviour that is primarily an expression of a specific underlying personality factor. Measurement error seems to play a much more prominent role in the observed item responses of Black respondents than in the case of White respondents. This in turn raises the concern that a lack of strict invariance might exist or a lack of conditional probability equivalence. Overall, the results indicate generally unsatisfactory levels of internal consistency obtained for the Black sample.

6.1.1.3 Subscale reliabilities for the Coloured Sample

Somewhat similar to the results obtained for the Black sample, the results for the Coloured sample revealed that only nine of the sixteen subscales obtained alpha values above the specified cut-off point. However, none of subscales obtained coefficient alpha values below .50. Table 6.1 portrays a less favourable psychometric picture for the Coloured sample than for the White sample, but a more favourable psychometric picture than for the Black sample. Overall, the results indicate moderately satisfactory levels of internal consistency.

6.1.1.4 Integrated discussion of the item statistics results per subscale over the three ethnic groups

6.1.1.4.1 Factor A

The results from the *Distant Aloof – Empathic* subscale analysis conducted on the White sample indicated items, which showed a tendency to respond relative moderately in unison to systematic differences in the latent personality variable of interest. This was evident from the inter-item correlations (see Appendix 2) and Cronbach's alpha of .720 for the subscale. The absence of extreme means and small standard deviations indicated the absence of poor items. The item means ranged from .98 to 1.86[9] and the standard deviations from .425 to .966. With the exception of item Q2 no exceptionally small or large increases in scale mean or small increases or decreases in scale variance[10] was evident if any items were to be deleted from the scale. Item-total correlations below .30 were obtained for items Q2, Q26, Q27 and Q126. Item Q2 had the lowest correlation of .095. The squared multiple correlations ranged from .023 to .372 with only three items obtaining a correlation greater than .30. Items Q2 and Q26 obtained correlations of .023 and .094 respectively. Furthermore it was indicated that the deletion of item Q2 would increase the subscale Cronbach alpha from .720 to .750 whilst none of the other items, if deleted, would result in an increase in the current Cronbach alpha. With all the above mentioned evidence it was decided to flag item Q2 as a possible poor item which might lead to poor model fit.

The results of the item analysis for this subscale on the Black sample were strikingly different from the results obtained for the White sample. The results indicated a set of incoherent items. This was evident in the general pattern of low and sometimes negative inter-item correlations (see Appendix 2). Item means ranged from .57 to 1.95 with item Q2 obtaining the smallest mean. The standard deviations ranged from .275 to .883 with items Q1, Q27 and Q126 obtaining the smallest standard deviations. However, with the exception of item Q2 no exceptionally small or large decreases in scale mean or small decreases or increases in scale variance if any items were to be deleted would be obtained. Item-total correlations below .30 were obtained for the majority of the items (Q1, Q2, Q26, Q27, Q51, Q76, Q101, Q126 and Q176). Only the remaining three items in the scale obtained correlations greater than .30. Item Q2 obtained an item-total correlation of -.005. This negative item-total correlation indicated that there existed a negative correlation between this item and the total score calculated from the remaining items. This suggested that item Q2 does not reflect the same underlying factor as the rest of the items. All squared

[9] Item responses are measured on a three-point likert scale. Item means can be considered extreme if distribution is restricted.

[10] An item can be considered to be a poor item if its deletion would result in either a small or large decrease in the scale mean. A large decrease would imply an extreme low item mean and a small decrease in the scale mean would imply an extreme high item mean. Extreme item means are considered problematic because the restrict item variance. An item can be considered a poor item if its deletion would result in a small decrease or even an increase in the scale variance. A small reduction in scale variance would imply that the item correlates low with the remaining items in the subscale. This follows from the fact that the subscale variance (assuming p items) $S^2 = S^2_1 + \ldots + S^2_p + 2r_{12}S_1S_2 + \ldots + 2r_{p-1,p}S_{p-1}S_p$. An increase in the subscale variance implies that the item correlates negatively with at least some of the items.

multiple correlations obtained were low and ranged from .018 (Q2) to .169. The subscale alpha would increase from .513 to .566 if item Q2 would be deleted. The substantial increase in the Cronbach alpha, along with the above mentioned item statistics indicated that item Q2 does not reflect the same underlying factor as the rest of the items. Item Q2 was flagged as a possible poor item. However, it should be noted that even if this item would be deleted from the scale, the internal consistency is still questionably low. This raises the question as to the suitability of this set of items as indicators for this particular latent trait.

A similar trend to the one observed in the Black sample emerged for the Coloured sample. The subscale Cronbach alpha of .578 pointed towards the fact that the items do not seem to respond in unison to systematic differences in the latent personality variable, although all the items were designed with the intent to measure Factor A. This was evident from the low and sometime negative, inter-item correlations (see Appendix 2).The item statistics showed means ranging from .86 to 1.95 and standard deviations from .303 to .974. Items Q1, Q27 and Q126 obtained the smallest standard deviations. With the exception of Q2 no substantially small or large increase in scale mean or small decreases or increases in scale variance would be obtained when any items would be deleted. Only five items obtained item-total correlations greater than .30. Items Q2 (.027) and Q126 (.098) obtained the smallest item-total correlations. The squared multiple correlations ranged from .025 (Q126) to .254. Items Q2 (.033), Q26 (.042), Q27 (.098), Q126 (.025) and Q176 (.067) obtained the lowest correlations. The results suggest that items Q2 and Q126 should be flagged as poor items. It was evident from the results that the subscale Cronbach alpha will increase with the deletion of both these items. The deletion of item Q126 would incur a very small increase in the alpha (Δ = 0.001). However, the deletion of item Q2 would have a bigger effect (Δ =0.053). The internal consistency remains questionably low even after the deletion of poor items which again raises the question as to the suitability of this set of items as indicators for this particular latent trait.

Overall it would seem that item Q2 could in general be considered as a problematic item. The results over all three groups provided similar evidence to suggest that this item does not seem to respond in unison with the rest of the items in the scale in terms of systematic differences in the latent personality variable of interest. However, clear evidence exists to suggest that the set of items is more internally consistent for the White, than the Coloured or Black sample groups.

6.1.1.4.2 Factor B

The results from the *Intellectance* subscale for the White sample indicated items which seem to respond in relative unison to systematic differences in the latent personality variable of interest. This was evident from the moderate inter-item correlations (see Appendix 2) and Cronbach alpha of .740 for the subscale. Furthermore, the absence of any extreme means and small standard deviations indicated the absence of possible poor items. The item means ranged from 1.34 to 1.85 and the standard deviations ranged from .502 to .920. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Ten items obtained item-total correlations greater than .30 the remaining two items Q28 (.288) and Q103 (.293) obtained item-total correlations smaller than .30. The squared multiple correlations ranged from .106 to .353. No substantial increases in the subscale Cronbach alpha would be obtained by deleting any of the items. None of the items were flagged as poor items in the White sample.

A similar trend in the results, as observed for the White sample, emerged for the Black sample. This was evident from the moderate inter-item correlations (see Appendix 2) and Cronbach alpha of .654 for the subscale. An absence of extreme means and small standard deviations indicated the absence of possible poor items. The results suggested that no unusual small or large increases in scale mean or small increases or decreases in scale variance would be gained by deleting any item. Eight items obtained item-total correlations greater than .30 the remaining items including items Q53 (.236), Q103 (.213), Q128 (.283) and Q152 (.225) obtained item-total correlations less than .30. The squared multiple correlations ranged from .064 (Q103) to .208. No increase in the subscale Cronbach alpha would be obtained by deleting any of the items. Given the results none of the items were identified as poor items.

A similar trend also emerged for the Coloured sample. This was evident from in the moderate inter-item correlations (see Appendix 2) and moderately high Cronbach alpha of .741 obtained for the subscale. The absence of any extreme means and small standard deviations indicated the absence of possible poor items. The item means ranged from 1.29 to 1.85 and standard deviations from .461 to .928. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. The scale mean if items deleted ranged from 18.21 to 18.78 and the scale variance if item deleted ranged from 12.337 to 14.528 given a current scale mean of 20.07 and a current scale variance of 15.79. Ten of the items obtained item-total correlations greater than .30 with items Q103 (.234) and Q128 (.299) obtaining item-total correlations smaller than .30. The squared multiple correlations ranged from .069 (Q103) to .332. No increase in the subscale Cronbach alpha would be obtained by deleting any of the items.

The results indicated that the items are internally consistent across the three groups. It is evident from the results that the set of items is more internally consistent for the White and Coloured sample than for the Black sample. Overall, none of the items were flagged as poor items in any of the three samples.

6.1.1.4.3 Factor C

The results from the item analysis for the *Affected by feelings – emotionally stable* subscale for the White sample indicated a definite set of coherent items (α = .783 with reasonably high inter-item correlations (see Appendix 2). The absence of any extreme means and small standard deviations underscored this conclusion. The item means ranged from 1.10 to 1.80 and the standard deviations ranged from .569 to .973. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. All the items obtained item-total correlations greater than .30. The squared multiple correlations ranged from .149 to .291. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. None of the items were identified as poor items.

The results of the item analysis for the Black sample were slightly less positive than the results obtained for the White sample. The Cronbach alpha of .703 along with the inter-item correlations (see Appendix 2), nonetheless, indicated a coherent set of items. An absence of any extreme means (ranging from .91 to 1.89) and small standard deviations (ranging from .455 for Q54, to .901) indicated the absence of any poor items. Nine items showed item-total correlations greater than .30 with items Q5 (.211), Q29 (.278) and Q30 (.200) obtaining item-total correlations smaller than .30. The squared multiple correlations ranged from .062 to .289 with items Q5 (.066) and Q30 (.062) obtaining the smallest correlations. The results suggested that the Cronbach alpha would increase from .703 to .709 if item Q30 would be deleted. This, along with the other item statistics, indicated the need to identify item Q30 as a poor item.

A similar trend in the results, as observed for the Black sample, emerged for the Coloured sample. The Cronbach alpha of .697 along with the inter-item correlations (see Appendix 2) indicated a reasonably coherent set of items. The item analysis results for the Coloured sample indicated the absence of any extreme means and small standard deviations which indicated the absence of any possible poor items. Item means ranged from 1.08 to 1.84 and the standard deviations from .484 to .983. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. The scale mean if item deleted ranged from 15.57 to 16.33 and scale variance if item deleted from 15.550 to 17.722 given a current scale mean of 17.41 and a current scale variance of 19.21. Ten of the items obtained item-total correlations greater than .30 with only items Q5 (.275) and Q30 (.207) obtaining item-total correlations smaller than .30. The squared multiple correlations ranged from .065 (Q30) to .221. The deletion of item Q30 would incur a very small increase in the current alpha (Δ = 0.003). The above mentioned item statistics along with the inter-item correlations (see Appendix 2) indicated item Q30 should be flagged as a poor item.

The results indicated that all the items in this subscale are internally consistent across the three groups, with the exception of item Q30. It is evident from the results that item Q30 could be considered as a problematic item in the Black and Coloured groups. The results over the Black and Coloured groups provided similar evidence to suggest that this item tends not to respond in unison with the rest of the items in the scale in reflecting systematic differences in the latent personality variable of interest.

6.1.1.4.4 Factor E

The *Accommodating – Dominant* subscale for the White sample obtained a satisfactory Cronbach alpha of .734 as well as generally higher inter-item correlations (see Appendix 2). The presence of an extreme mean indicated the presence of a possible incoherent item. The means ranged from 1.05 to 1.86 with item Q105 obtaining a mean of .47. The standard deviations ranged from .481 (Q105) to .944. There would be a slightly smaller decrease in scale mean when item Q105 (16.05) were to be deleted and the smallest decrease in scale variance when item Q181 (22.565) were to be deleted. The scale mean if item deleted ranged from 14.66 to 16.05 and the scale variance if item deleted ranged from 19.783 to 22.565 from their current values of 16.52 and 24.11. The item-total correlations were greater than .30 for most of the items but for items Q105 (.218) and Q181 (.288) which were smaller than .30. It was evident from the squared multiple correlations that item Q105 (.072) was a possible poor item. The remaining squared multiple correlations ranged from .149 to .293. Furthermore, the deletion of item Q105 would incur a very small increase in the alpha (Δ = 0.001). Although the incurred increase would be small, item Q105 was flagged as a poor item.

The results for the Black sample indicated a somber psychometric picture in that the subscale returned a low Cronbach alpha of .552. This, along with the low, and at times negative, inter-item correlations (see Appendix 2) indicated a set of incoherent items. It was also evident from the results that item Q105 (.36) and item Q180 (.57) obtained substantially smaller means than the remaining items and item Q56 (1.90) obtained an extreme mean (the remaining item means ranged from 1.31 to 1.81). The standard deviations ranged from .403 (Q56) to .957. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Only item Q155 obtained an item-total correlation greater than .30. Item-total correlations below .30 were obtained for items Q6, Q31, Q56, Q81, Q105, Q106, Q130, Q131, Q156, Q180, and Q181, with item Q105 obtaining the lowest correlation of .129. Item Q105 obtained the lowest squared multiple correlations of .034. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. None of the items could be individually identified as poor items. For the Black sample all the items fail to function in the manner that the test developer intended

A trend similar to that observed for the Black sample, emerged for the Coloured sample. The results of the item analysis for the subscale indicated a set of rather disjointed items. This was evident from the low, and at times negative, inter-item correlations (see Appendix 2) and the low Cronbach alpha of .608. The item means ranged from .34 (Q105) to 1.90 (Q181). The standard deviations ranged from .418 (Q181) to .957. The scale mean if item deleted ranged from 14.66 to 16.22 (Q105) and scale variance if item deleted ranged from 13.22 to 15.886 (Q181) given a current scale mean of 16.55 and current scale variance of 16.40. Item-total correlations below .30 were obtained for items Q31, Q56, Q81, Q105, Q106, Q131, Q156, Q180, Q181 with items Q105 (.107), Q106 (.187) and Q181 (.102) obtaining the lowest correlations. The remaining three items obtained item-total correlation greater than.30. The squared multiple correlations ranged from .033 to .217. Items Q105 (.033) and Q181 (.035) obtained the lowest correlations. An increase in the Cronbach's alpha from .608 to .615 would be obtained if item Q105 would be deleted.

Overall it would seem that item Q105 could in general be considered as a problematic item. The results over all three groups provided similar evidence to suggest that this item did not respond in unity with the rest of the items of the subscale to systematic differences in the latent personality variable.

6.1.1.4.5 Factor F

The results from the item analyses for the *Sober serious – Enthusiastic* subscale for the White sample indicated a definite set of coherent items which respond in unity to the systematic differences found in the latent *Sober serious – Enthusiastic* personality dimension. This was evident from the satisfactory Cronbach alpha of .784 and the moderately high inter-item correlations for the subscale (see Appendix 2). The item means ranged from .55 to 1.69 (Q7) and the standard deviations ranged from .684 to .963. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Eleven items obtained item-total correlations greater than .30. Only item Q83 obtained an item-total correlation of .242. The squared multiple correlation ranged from .125 (Q83) to .455. An increase in the Cronbach's alpha from .784 to .785 would be obtained if item Q83 would be deleted. Item Q83 was therefore flagged as a poor item.

The results for the Black sample also indicated a set of coherent items. This can be seen in the moderate inter-item correlations (see Appendix 2) and the satisfactory Cronbach alpha of .719 for the subscale. The item means ranged from .50(Q58) to 1.64 (Q7) and the standard deviations ranged from .725 to .973. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Eight of the items obtained item-total correlations greater than .30. Items Q33 (.254), Q58 (.269), Q83 (.231) and Q157 (.259) obtained item-total correlations smaller than .30. The squared multiple correlations ranged from .062 to .259. Item Q83 (.062) and item Q33 (.079) revealed the lowest squared multiple correlations. It is also evident that no substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. None of the items were consequently flagged as poor items.

A similar trend in the results, as observed for the Black sample, emerged for the Coloured sample. This was revealed in the satisfactory Cronbach alpha of .730 and the moderate inter-item correlations (see Appendix 2). The item means ranged from .58 (Q58) to 1.77 (Q7). The item analysis results indicated an absence of any small standard deviations which indicated the absence of poor items. The scale mean if items deleted ranged from 13.42 to 14.60 and the scale variance if item deleted ranged from 21.830 to 24.519 given a current scale mean of 15.19 and a current scale variance of 27.35. Ten of the items obtained item-total correlations greater than .30, the remaining items Q33 (.280) and Q83 (.248) obtained correlations smaller than .30. The squared multiple correlations ranged from .084 (Q83) to .393. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. None of the items were consequently flagged as poor items.

The results indicated that the set of items are generally internally consistent across the three groups. It is evident from the results that item Q83 could be considered as a problematic item. However the overall results over all three groups provided similar evidence to suggest that the items generally do tend to respond in unity to systematic differences in the latent personality variable.

6.1.1.4.6 Factor G

The *Expedient - Conscientious* subscale for the White sample obtained a satisfactory Cronbach alpha of .785. This, along with the moderately high inter-item correlations (see Appendix 2) indicated items which respond in unison to systematic differences in the latent personality variable of interest. The absence of any extreme means and small standard deviations indicated the absence of poor items. The item means ranged from 1.22 to 1.79 and standard deviations ranged from .634 to .937. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. All items obtained item-total correlations greater than .30. The squared multiple correlations ranged from .116 to .366 with no exceptionally low or high correlations. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. None of the items were flagged as poor items.

The results from the Black sample returned a somewhat less satisfactory Cronbach alpha of .684. This, along with the modest inter-item correlations (see Appendix 2) indicated to some degree a lack of coherence in the items. The absence of any extreme means and small standard deviations indicated the absence of poor items. The item means ranged from 1.09 to 1.92 and the standard deviations ranged from .386 (Q183) to .972. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Seven items obtained item-total correlations greater than .30. Item Q84 (.258), Q108 (.239), Q134 (.191), Q159 (.276) and Q183 (.234) obtained item-total correlations smaller than .30. The squared multiple correlations ranged from .059 (Q134) to .273. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. None of the items were flagged as poor items.

The results from the Coloured sample for this subscale returned a satisfactory Cronbach alpha of .716. The low, and at times negative, inter-item correlations (see Appendix 2) however indicated that the subscale contain a rather incoherent set of items. The absence of any extreme means and small standard deviations indicated the absence of poor items. The item means ranged from 1.10 to 1.79 and the standard deviation ranged from .446 to .964. The scale mean ranged from 17.51 to 18.29 and the scale variance if item deleted ranged from 14.544 to 17.234 (Q183) given a current scale mean of 19.39 and a current scale variance of 18.21. Eight of the items obtained item-total correlations greater than .30. The remaining four items, item Q84 (.201), Q108 (.251), Q134 (.271) and Q183 (.209), obtained item-total correlations smaller than .30. The squared multiple correlations ranged from .060(Q84) to .327. The deletion of item Q84 would result in an increase in the current alpha (Δ = 0.011, α = .727). The above mentioned item statistics along with the inter-item correlations (see Appendix 2) indicated that item Q84 should be flagged as a poor item.

The results indicated that in general that the items are internally consistent across the three groups with the exclusion of item Q84. It is evident from the results that item Q84 could be considered as a problematic item in the Coloured group. The results from the Coloured sample provided evidence to suggest that this item does not respond in unison with the rest of the items in the scale in response to systematic differences in the latent *Expedient - Conscientious* personality dimension.

6.1.1.4.7 Factor H

The item analysis results for the *Retiring – Socially bold* subscale for the White sample indicated a definite set of coherent items which respond in unity to the systematic differences found in this latent personality dimension. This subscale revealed the most positive psychometric picture for the subscales analysed thus far in the White group. The high Cronbach alpha of .832 and the higher inter-item correlations (see Appendix 2) support the above conclusion. The absence of any extreme means and small standard deviations indicated the absence of poor items. The item means ranged from .84 to 1.52 and standard deviations ranged from .741 to .979. The scale mean if items deleted ranged from 12.67 to 13.45 and the scale variance if items deleted ranged from 34.320 to 37.321 (Q60) given a current scale mean of 14.28 and a current scale variance of 41.93. All items obtained item-total correlations greater than .30. The squared multiple correlations ranged from .151 to .413. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. None of the items were identified as poor items.

A similar trend as that observed in the White sample emerged for the Black sample. This was evident in the moderate inter-item correlations (see Appendix 2) and the satisfactory Cronbach alpha of .748 for this subscale. The absence of any extreme means and small standard deviations indicated the absence of poor items. The item means ranged from .85 to 1.86 and the standard deviations from .477 to .976. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Eleven items obtained item-total correlations greater than .30. Item Q61 obtained an item-total correlation of .270. The squared multiple correlations ranged from .104 to .281. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items.

The results from the Coloured group revealed similar trends as the results observed for the White and Black samples. The satisfactory Cronbach alpha of .791 and the higher inter-item correlations (see Appendix 2) indicated a set of coherent items. The item means ranged from .88 (Q110) to 1.59 (Q86) and the standard deviations ranged from .531 to .987. The scale means ranged from 13.87 to 14.81 given a current scale mean of 15.69. The scale variance if item deleted ranged from 27.614 to 31.192 (Q60) given a current scale variance of 33.59. Eleven of the items obtained item-total correlations greater than .30. Item Q110 revealed an item-total correlation below .30. The squared multiple correlations ranged from .111 to .360. Furthermore, the deletion of item Q110 would incur a small increase in the alpha (Δ = 0.007). Although the incurred increase would be small, item Q110 was flagged as a poor item.

The results showed all three groups obtained satisfactory Cronbach alpha's indicating that the set of items are internally consistent across the three groups. Item Q110 could be regarded as a possible problematic item in the Coloured group. The results from the Coloured sample provided evidence to suggest that this item does not seem to respond in unison with the rest of the items in the scale in terms of systematic differences in the latent *Retiring – Socially* personality dimension. Q110 did not stand out as a particularly problematic item in the other two groups.

6.1.1.4.8 Factor I

The results from the *Tough minded – Tender minded* subscale for the White group returned a satisfactory Cronbach alpha of .747. This, along with the moderate inter-item correlations (see Appendix 2) revealed items which respond in reasonable unity to systematic differences in the latent personality variable of interest. The item means ranged from .63 to 1.89 (Q187) and the standard deviations ranged from .435 (Q187) to .972. The scale mean if item deleted ranged from 12.38 to 13.64 and the scale variance if item deleted ranged from 24.264 to 28.365 (Q187) given a current scale mean of 14.27 and a current scale variance of 29.30. Ten items obtained item-total correlations greater than .30. Items Q161 (.285) and Q187 (.160) obtained item-total correlations smaller than .30. Items Q161 (.097) and Q187 (.071) also revealed the lowest squared multiple correlations. The squared multiple correlations ranged from .071 to .358. An increase in the Cronbach's alpha from .747 to .749 would be obtained if item Q187 would be deleted. Item Q187 was identified as a poor item.

The results from the Black sample revealed a somewhat less satisfactory Cronbach alpha of .618. This, along with the low inter-item correlations (see Appendix 2) indicated the possibility of an incoherent set of items. However, the absence of any extreme means and small standard deviations indicated the absence of poor items. The item means ranged from .89 to 1.84 and standard deviations ranged from .514 to .980. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Item-total correlations below .30 were obtained for items Q12 (.291), Q37 (.257), Q87 (.282), Q112 (.219), Q136 (.246), Q161 (.216), Q186 (.166) and Q187 (.228). The remaining four items obtained item-total correlations greater than .30. The squared multiple correlations ranged from .73 to .193. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. Given the basket of evidence gleaned from the item statistics, no individual item could be identified as a poor item. Even so the set of items cannot be judged as satisfactory measures of the latent *Tough minded – Tender minded* personality dimension for the Black sample.

The results from the Coloured sample indicated a reasonably incoherent set of items. This was evident from the moderate inter-item correlations (see Appendix 2) and the satisfactory Cronbach alpha of (.705) for the subscale. However, item Q187 revealed an extreme mean and small standard deviation. The item means ranged from .71 to .1.88 (Q187) and standard deviations ranged from .463 (Q187) to .984. The scale means if items deleted ranged from 13.24 to 14.40 and the scale variance if items deleted ranged from 21.067 to 24.842 (Q187) given a current scale mean of 15.11 and a current scale variance of 25.93. Eight items obtained item-total correlations greater than .30. Items Q37 (.294), Q161 (.290), Q186 (.233) and Q187 (.187) obtained item-total correlations smaller than .30. The squared multiple correlations ranged from .099 (Q187) to .278. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. None of the items were identified as poor items.

Overall, the results indicated that the set of items are reasonably internally consistent across the three groups.

6.1.1.4.9 Factor L

It was evident from the results that the *Trusting - Suspicious* subscale for the White sample revealed items which had the tendency to respond in reasonable unity to systematic differences in the latent personality variable of interest. This subscale obtained modest inter-item correlations (see Appendix 2) and a satisfactory Cronbach alpha of .742. Item means ranged from .06 (Q188) to 1.38 (Q13). Item Q188 revealed a standard deviation of .340 while the remaining items revealed standard deviations ranging from .621 to .978. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Ten items obtained item-total correlations greater than .30 while item Q63 (.268) and Q188 (.206) obtained item-total correlations smaller than .30. Item Q188 revealed the lowest squared multiple correlation of .062. The remaining items obtained squared multiple correlations ranged from .101 to .325. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. None of the items were identified as poor items.

The results from the Black sample indicated a set of incoherent items. This was revealed in the low inter-item correlations (see Appendix 2) for this subscale. A modest and somewhat unsatisfactory Cronbach alpha of .646 was obtained for this subscale. Item means ranged from.10 (Q188) to 1.64 (Q138). The standard deviations ranged from .416 (Q188) to .969. The scale mean if item deleted ranged from 9.00 to 10.54 and the scale variance if item deleted ranged from 16.446 to 19.739 (Q188) given a current scale mean of 10.64 and a current scale variance of 20.27. Six items obtained item-total correlations greater than .30. The remaining six items revealed item-total correlations smaller than .30. Item Q188 revealed the lowest item-total correlation of .096. The squared multiple correlations ranged from .016 (Q188) to .306. The deletion of item Q63 would incur a very small increase in the alpha (Δ = 0.001). The deletion of item Q188 would have a slightly bigger effect

(Δ =0.003). This along with the other item statistics resulted in item Q188 being flagged as a poor item.

The results from *Trusting - Suspicious* subscale for the Coloured group returned a borderline satisfactory Cronbach alpha of .708. The low inter-item correlations (see Appendix 2), however, indicate a reasonably incoherent set of items. The item means ranged from .08 (Q188) to 1.41 and the standard deviation ranged from .378 (Q188) to .978. The increases in scale mean if items deleted ranged from 7.74 to 9.07 (Q188) and the increases in scale variance if items deleted ranged from 19.149 to 23.457 (Q188) given a current scale mean of 9.15 and a current scale variance of 24.22. The squared multiple correlations ranged from .56 (Q188) to .277. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. Nonetheless given the results on the remaining item statistics item Q188 still had to be flagged as a poor item.

The results indicated that the items are internally consistent across the three groups with the exception of item Q188. Item Q188 did not reveal an increase in the subscale Cronbach alpha in the White and Coloured group but given the basket of evidence provided, item Q188 was nonetheless identified as a poor item. Therefore it is evident from the results that item Q188 could be considered as a problematic item across all three groups.

6.1.1.4.10 Factor M

The results from the *Concrete - Abstract* subscale for the White group indicated a somewhat incoherent set of items. This was revealed in the low, and sometime negative, inter-item correlations (see Appendix 2) and the somewhat unsatisfactory Cronbach alpha of .665 for the subscale. Item means ranged from an extreme low .18 (Q140) to 1.49 (Q114). The absence of any small standard deviations indicated the absence of poor items. The scale means if item deleted ranged from 8.85 to 10.16 (Q140) and the scale variance if item deleted ranged from 17.217 to 19.707 given a current scale mean of 10.33 and a current scale variance of 21.13. Six items obtained item-total correlations greater than .30. The remaining six items Q15, Q90, Q115, Q164, Q189 and Q190 obtained item-total correlations ranging from .226 to .286. The squared multiple correlations ranged from .91 to .235. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items.

The results from the Black group revealed a definitely incoherent set of items. This was evident from the low, and negative, inter-item correlations (see Appendix 2) and extremely low Cronbach alpha of .400 obtained for the subscale. Item means ranged from .an extreme low of 22 (Q90) to 1.70 (Q65). However, the absence of any small standard deviations indicated the absence of any poor items, relative to the rest of the items. The standard deviations ranged from .566 to .900. The increase in scale means if items deleted ranged from 8.65 to 10.13 (Q90) and the scale variance if items deleted would increase from 9.324 to 11.176 (Q90) given a current scale mean of 10.35 and a current scale variance of 11.35. All items obtained item-total correlations smaller than .30. Item Q90 revealed the smallest correlation of .038. The squared multiple correlations were low for all the items ranging from .045 to .145. Deletion of item Q90 would increase the Cronbach's alpha from .400 to .424. The deletion of item Q140 would also result in an increase in the alpha (Δ = 0.007), as well as the deletion of item Q164 (Δ =0.006). Item Q140 and item Q164 was flagged as poor items. The low internal consistency of this subscale along with the low item statistics raises the question as to the suitability of all these items as indicators for this particular latent trait.

The results from the Coloured sample also indicated a set of incoherent items. This was revealed in the low, and sometime negative, inter-item correlations (see Appendix 2) and low Cronbach alpha of .531 obtained for the subscale. The presence of extreme means and small standard deviations indicated the possibility of poor items. Item means ranged from .11 to 1.52 with items Q140 (.11) and Q90 (.15) revealing extreme means. Standard deviations ranged from .439 to .966 also with items Q140 (.439) and Q90 (.472) revealing relatively small standard deviations. Scale means if items deleted ranged from 8.65 to 10.13 and scale variance if items deleted ranged from 12.354 to 14.743 (Q90) given a current scale mean of 10.25 and a current scale variance of 15.19. Item-total correlations below .30 were obtained for eleven items. Items Q140 (.121) and Q90 (.063) obtained the lowest item-total correlations. The squared multiple correlations ranged from .053 (Q90) to .202. An increase in the Cronbach's alpha from .531 to .535 would be obtained if item Q90 would be deleted. Item Q90 was identified as a poor item.

Overall it would seem that the set of items could in general be considered as a problematic set of items. The results over all three groups provided similar evidence to suggest that the items do not seem to respond in unison to systematic differences in the latent personality variable, although the items were meant to all measure Factor M. However, clear evidence exists to suggest that the set of items is slightly more internally consistent for the White, than the Coloured or Black sample groups.

6.1.1.4.11 Factor N

The results from the *Direct - Restrained* subscale for the White group returned a satisfactory Cronbach alpha of .768. This, along with modest inter-item correlations (see Appendix 2) indicated items with the tendency to respond in unison to systematic differences in the latent *Direct - Restrained* personality dimension. The absence of any extreme means and small standard deviations indicated the absence of poor items. Item means ranged from .95 to 1.88 and standard deviations ranged from .468 to .972. The scale means if items deleted ranged from 16.20 to 17.12 (Q41) and the scale variance if items deleted ranged from 20.596 to 23.681 (Q17) given a current scale mean of 18.07 and a current scale variance of 25.39. All twelve items obtained item-total correlations greater than .30. The squared multiple correlations ranged from .156 to .314. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. Given the above mentioned basket of evidence none of the items were flagged as poor items.

The results of the item analysis for this subscale on the Black sample were strikingly different from the results obtained for the White sample. The unsatisfactory subscale Cronbach alpha of .550 pointed towards the fact that the items do not respond in unity to systematic differences in the latent *Direct - Restrained* personality dimension, although all the items were designed with the intent to measure Factor N. This was evident from the low and sometime negative, inter-item correlations (see Appendix 2). However, the absence of extreme means indicated the absence of poor items. Item means ranged from 1.16 to 1.93. Standard deviations ranged from .361 (Q17) to .957. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Two items obtained item-total correlations greater than .30. Item-total correlations below .30 were obtained for items Q16 (.153), Q17 (.159), Q41 (.230), Q42 (.258), Q66 (.272), Q67 (.278), Q116 (.239), Q141 (.270), Q166 (.107) and Q191 (.248). The squared multiple correlations ranged from .040 to .189.

The deletion of both item Q16 and item Q166 revealed an increase in the alpha from .550 to .557 (Δ = 0.007). These items were identified as poor items.

The results from the Coloured sample revealed a somewhat unsatisfactory Cronbach alpha of .679. This, along with the modest inter-item correlations (see Appendix 2) indicated a set of items which have the tendency to struggle to respond in unity to systematic differences in the latent personality variable of interest. The absence of any extreme means and small standard deviations indicated the absence of poor items. Item means ranged from .88 to 1.91 and standard deviations ranged from .402 to .974. The scale mean if items deleted ranged from 17.3 to 18.33 and the scale variance if item deleted ranged from 12.895 to 15.401 (Q17) given a current scale mean of 19.21 and a current scale variance of 16.39. Seven items revealed item-total correlations greater than .30. Items Q17, Q41, Q67, Q166 and Q191 obtained item-total correlations smaller than .30 with item Q166 (.145) obtaining the lowest correlation. The squared multiple correlations ranged from .044 (Q166) to .302. An increase in the Cronbach's alpha from .679 to .688 would be obtained if item Q166 would be deleted. Once again, item Q166 were identified as a poor item.

Overall it would seem that item Q166 could be considered as a problematic item across the Black and Coloured sample groups. The results over these two groups provided similar evidence to suggest that this item does not respond in unison with the rest of the items in the scale in response to systematic differences in the latent personality variable of interest. However, clear evidence exists to suggest that the set of items is internally consistent for the White, and albeit to a lesser degree, so also to some degree for the Coloured sample group, but not for the Black sample.

6.1.1.4.12 Factor O

The results from the *Self-assured - Apprehensive* subscale for the White sample indicated items which have the tendency to respond in relative unity to systematic differences in the latent *Self-assured - Apprehensive* personality dimension. This was evident from the satisfactory Cronbach alpha of .769 and the moderately high inter-item correlations (see Appendix 2) for this subscale. The item means ranged from .44 (Q143) to 1.45 and the standard deviations ranged from .807 to .972. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Eleven items obtained item-total correlations greater than .30 Item Q168 revealed an item-total correlation of .281. Squared multiple correlations ranged from .109 to .321. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. None of the items were identified as poor items.

For this subscale the results of the item analysis on the Black sample were different from the results obtained for the White sample. The subscale Cronbach alpha of .609 pointed towards the fact that some of the items do not seem to respond in unity to systematic differences in the latent *Self-assured - Apprehensive* personality dimension. This was evident from the low and sometime negative, inter-item correlations (see Appendix 2). Item means ranged from a somewhat worrisome low .31 (Q143) to 1.41 (Q193). However, the absence of any small standard deviations indicated the absence of poor items. Standard deviations ranged from .714 to .982. The scale mean if item deleted ranged from 10.48 to 11.57 given a current scale mean of 11.89. The scale variance ranged from 18.972 to 22.843 with items Q93 (22.843) and Q118 (22.130) revealing the largest increase if deleted given a current scale variance of 23.67. Six items obtained item-total correlations greater than .30. Five items obtained item-total correlation smaller than .30 with item Q93 revealing an item-total correlation of -.006. The negative correlation indicated a negative relationship between item Q93 and the remaining items. Squared multiple correlations ranged from .14 to .279. The deletion of item Q93 revealed an increase in the alpha (Δ = 0.030, α = .639) and the deletion of item Q118 also revealed an increase in the alpha (Δ =0.020, α = .629). These two items were identified as poor items.

The results from the Coloured sample indicated a moderate tendency for the items of this subscale to respond in unity to systematic differences in the latent *Self-assured - Apprehensive* personality dimension. This was evident from the modest inter-item correlations (Appendix 2) and the Cronbach alpha value of .699 obtained for the subscale. The absence of small standard deviations indicated the absence of poor items. The standard deviations ranged from .715 to .983. One item indicated an extreme mean with the item means ranging from .32 (Q143) to 1.37 (Q168). The scale mean if item deleted ranged from 10.76 to 11.81 and the scale variance if item deleted ranged from 23.295 to 26.140 given a current scale mean of 12.13 and a current scale variance of 28.94. Six items obtained item-total correlations greater than .30. Items Q18 (.200), Q43 (.282), Q93 (.246), Q118 (.242), Q143 (.247) and Q168 (.230) obtained correlations smaller than .30. The squared multiple correlations ranged from .050 (Q18) to .293. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. None of the items were identified as poor items.

The results indicated that the set of items have a fair amount of internal consistency across the White and Coloured sample groups. The results from the Black sample group revealed that items Q93 and Q118 should be flagged as unsuitable indicators for this particular latent trait. Clear evidence exists to suggest that the set of items is more internally consistent for the White and Coloured sample groups, than for the Black group.

6.1.1.4.13 Factor Q_1

The results from the *Conventional - Radical* subscale for the White sample revealed a satisfactory Cronbach alpha of .723 indicating a set of reasonably coherent items. The low, and sometimes negative, inter-item correlations (see Appendix 2) indicated a different picture than the subscale Cronbach alpha. The low and negative correlations indicated that items do not seem to respond in unison to the systematic differences in the latent *Conventional - Radical* personality dimension. Item means ranged from .40 (Q194) to 1.37 with items Q94 (1.37) and Q44 (1.04) revealing the largest means. The absence of any small standard deviations indicated the absence of any possible poor items. Standard deviations ranged from .752 to .961. The scale mean if item deleted ranged from 7.33 to 8.11 and the scale variance if items deleted ranged from 22.865 to 25.129 (Q95) given a current scale mean of 8.70 and a current scale variance of 27.69. Ten items obtained item-total correlations greater than .30. Items Q20 (.253) and Q95 (.244) obtained item-total correlations smaller than .30. The squared multiple correlations ranged from .092 (Q95) to .313. Somewhat surprisingly no substantial increase in the subscale Cronbach alpha would be obtained by deleting any items.

The results from the Black sample returned an unsatisfactory Cronbach alpha of .531. This, along with the low, and sometimes negative, inter-item correlations (see Appendix 2) indicated a set of incoherent items. Item means ranged from .38 to 1.21 with items Q44 (1.21) and Q94 (1.13) revealing the largest means. However, the absence of any small standard deviations indicated the absence of any possible poor items. The standard deviations ranged from .737 to .966. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Items Q69, Q144 and Q194 showed item-total correlations greater than .30. The remaining nine items revealed item-total correlations smaller than .30. Items Q169 (.037), Q95 (.063) and Q20 (.044) obtained the lowest squared multiple correlations (all correlations ranged from .037 to .244). The results revealed that an increase in the Cronbach's alpha from .531 to .534 would be obtained if item Q119 would be deleted. Item Q119 was consequently identified as a poor item.

It was evident from the results of the Coloured sample that the items in this subscale do not seem to respond in unison to the systematic differences in the latent *Conventional - Radical* personality dimension. The Cronbach alpha of .647 and the low, and sometime negative, inter-item correlations (see Appendix 2) served as evidence of this. Item means ranged from .37 to 1.33 (Q94) and standard deviations ranged from .738 to .962. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Item-total correlations below .30 were obtained for items Q19 (.192), Q20 (.209), Q45 (.283), Q94 (.266), Q95 (.292), Q119 (.239) and Q169 (.289). The remaining five items obtained item-total correlations greater than .30. The squared multiple correlations ranged from .096 (Q19) to .260. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items.

Overall it would seem that the set of items could in general be considered as a set of somewhat incoherent items. The results over all three groups provided similar evidence to suggest that the items seem to fail to respond in unity to the systematic differences in the latent *Conventional - Radical* personality variable. However, clear evidence exists to suggest that the set of items is relatively more internally consistent for the White and Coloured sample groups than for the Black sample group.

6.1.1.4.14 Factor Q_2

The results from the *Group orientated – Self sufficient* subscale for the White group indicated items which showed the tendency to respond in relative unity to systematic differences in the latent *Group orientated – Self sufficient* personality variable. This was evident from the modest inter-item correlations (see Appendix 2) and satisfactory Cronbach alpha of .757. Item means ranged from .27 to 1.45 with items Q21 (1.45) and Q71 (1.01) obtaining the largest means. The absence of any small standard deviations indicated the possible absence of poor items. The standard deviations ranged from .670 to .972. The scale mean if item deleted ranged from 7.11 to 8.29 and the scale variance if items deleted ranged from 24.036 to 28.302 (Q120) given a current scale mean of 8.56 and a current scale variance of 30.13. Item-total correlations below .30 were obtained for items Q21 (.194), Q46 (.289) and Q120 (.193). The remaining nine items obtained item-total correlations greater than .30. The squared multiple correlations ranged from .040 (Q120) to .361. The deletion of item Q120 would incur a very small increase in the alpha (Δ = 0.002, α = .759). The deletion of item Q21 would have a bigger effect (Δ =0.006, α = .763). Based on the results the suitability of these items as indicators for this particular latent trait was questionable. Therefore, these items were flagged as possible poor items.

The results from the Black group revealed a set of incoherent items. This was revealed in the unsatisfactory low Cronbach alpha of .636 and low inter-item correlations (see Appendix 2) obtained for the subscale. Item means ranged from an unsatisfactory low .18 (Q195) to 1.44 with items Q21 (1.44) and Q71 (1.16) obtaining extreme means. Standard deviations ranged from .555 (Q195) to .959. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Item-total correlations below .30 were obtained for items Q21 (.213), Q46 (.118), Q71 (.281), Q120 (.166), Q145 (.235), Q171 (.256) and Q195 (.299). The remaining five items revealed item-total correlations greater than .30. The squared multiple correlations ranged from .024 (Q46) to .203. An increase in the Cronbach's alpha from .636 to .638 would be obtained if item Q46 would be deleted. Item Q46 was therefore identified as a poor item.

The results from the Coloured group revealed a similar result as for the Black group by pointing towards a set of rather incoherent items. This was concluded from the modest, and at times negative, inter-item correlations (see appendix 2) and the unsatisfactory low Cronbach alpha of .682 for the subscale. Item means ranged from .25 to 1.53 (Q21). However, the absence of any small standard deviations indicated the possible absence of poor items. Standard deviations ranged from .719 to .977.

Scale mean if items deleted ranged from 5.88 to 7.16 with items Q120 (.29) and Q195 (.25) showing the largest increases given a current scale mean of 7.41. Scale variance if items deleted ranged from 18.374 to 20.668 with items Q21 (20.048) and Q120 (20.66) receiving the largest increase given a current scale variance of 21.87. Item-total correlations below .30 were obtained for items Q21 (.148), Q46 (.238), Q120 (.117), Q145 (.284) and Q171 (.292). The remaining seven items obtained item-total correlations greater than .30. Items Q120 (.027), Q21 (.095) and Q46 (.069) obtained the smallest squared multiple correlations. The squared multiple correlations ranged from .027 to .266. The deletion of both item Q120 and item Q21 would incur an increase in the alpha from .682 to .689 (Δ = 0.007). These two items were identified as poor items.

The results showed some items over the three groups that could be considered as possible poor items. The item statistics results from the Black sample revealed that item Q46 could be flagged as a poor item, whereas the results for the White and Coloured samples revealed that items Q21 and Q120 are poor items.

6.1.1.4.15 Factor Q_3

The results from the *Informal – Self-disciplined* subscale returned an unsatisfactory low Cronbach alpha of .661 in the White sample. This, along with the low inter-item correlations (see Appendix 2) indicated a set of incoherent items. The items do not seem to respond in unity to the systematic differences in the latent *Informal – Self-disciplined* personality variable, although the items were meant to all measure Factor Q_3. Item means ranged from .80 to 1.91 and standard deviations ranged from .383 (Q73) to .953. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Item-total correlations below .30 were obtained for items Q47 (.249), Q72 (.248), Q97 (.173) and Q98 (.269). The remaining items obtained item-total correlations greater than .30. The squared multiple correlations ranged from .044 (Q97) to .236. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. None of the items were flagged as poor items.

The results from the Black sample revealed an extremely low and unsatisfactory Cronbach alpha of .465. This, along with the low inter-item correlations (see Appendix 2) indicated a set of incoherent items contained in this subscale. Item means ranged from .63 (Q98) to 1.94 and standard deviations ranged from .312 (Q48) to .920. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. None of the items obtained item-total correlations greater than .30. Item Q47 revealed the lowest item-total correlation of .085. The squared multiple correlations ranged from .014 (Q47) to .122. The results also revealed that the deletion of item Q47 would incur an increase in the alpha ($\Delta = 0.014$, $\alpha = .479$). The results, furthermore, indicated that the deletion of item Q98 would also incur an increase in the alpha ($\Delta =0.010$, $\alpha = .475$). Hence, these two items were specifically identified as poor items. In reality all the items should be considered to be problematic due to the lack of coherence in the item set.

In keeping with the results from the Black sample, the results from the Coloured group also revealed a low and unsatisfactory Cronbach alpha of .555. This, along with the low inter-item correlations (see Appendix 2) also indicated a set of incoherent items for this subscale. However, the absence of extreme means indicated the absence of poor items. Item means ranged from .91 to 1.94. The standard deviations ranged from .346 (Q73) to .985. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Item-total correlations below .30 were obtained for items Q23 (.252), Q47 (.194), Q48 (.200), Q72 (.129), Q73 (.252), Q97 (.194), Q98 (.251), Q122 (.297), Q172 (.231) and Q197 (.282). Only the remaining two items obtained item-total correlations greater than .30. The squared multiple correlations ranged from .042 (Q72) to .246. An increase in the Cronbach's alpha from .555 to .563 would be obtained if item Q72 would be deleted. Given the evidence presented above item Q72 should be specifically flagged as a poor item. Deletion of Q72, however, does not really salvage the subscale. The whole subscale is problematic due to a lack of coherence in the item set.

The results indicated that the items lacked internal consistency across all three samples although to a somewhat lesser degree so for the White sample. The results of the Black sample specifically revealed items Q72 and Q98 as poor items and the results of the Coloured sample revealed item Q72 as a poor item. The results, however, really indicated that the whole subscale is problematic due to a lack of coherence in the item set. This questions the suitability of these items as indicators for this particular latent trait.

6.1.1.4.16 Factor Q_4

The results from the *Composed – Tense driven* subscale for the White group indicated a definite set of coherent items which respond in unity to the systematic differences in the latent *Composed – Tense driven* personality variable. The results for this subscale revealed a more positive psychometric picture than was the case for some of the previous subscales analyzed. This was evident in the high and satisfactory Cronbach alpha of .800 and the substantial positive inter-item correlations (see Appendix 2). The absence of extreme means and small standard deviations indicated the absence of poor items. Item means ranged from .52 to 1.51 and standard deviation ranged from .837 to .984. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. All twelve items obtained item-total correlations greater than .30 and the squared multiple correlations ranged from .146 to .427. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. None of the items were flagged as poor items.

The results from the Black sample were strikingly different to the results found for the White sample. The results for the Black sample revealed a definite set of incoherent items. This was evident from the low inter-item correlations (see Appendix 2) and the low and unsatisfactory Cronbach alpha of .582. Item means ranged from .38 (Q198) to 1.05 (Q124). The absence of small standard deviations indicated the absence of poor items. Standard deviations ranged from .701 to .985. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Item-total correlations below .30 were obtained for items Q24, Q74, Q99, Q123, Q124, Q148, Q149, Q174, Q198, Q199 with item Q124 (.087) obtaining the smallest correlation. Only the remaining two items obtained item-total correlations greater than .30. The squared multiple correlations ranged from .035 (Q124) to .152. The results revealed that an increase in the Cronbach's alpha from .582 to .598 would be obtained if item Q124 would be deleted. Item Q124 therefore does not respond in unity to systematic differences in the single underlying latent variable although all items were written to reflect factor Q_4 and was therefore flagged as a poor item. The overall internal consistency of this subscale seems to be problematic given the low Cronbach alpha of .582.

The results from the Coloured sample were similar to the results reported for the White sample. This was evident from the higher inter-item correlations (see Appendix 2) and the satisfactory Cronbach alpha of .739 obtained for the subscale. The absence of extreme means and small standard deviations indicated the absence of poor items. Item means ranged from .35 to 1.08 and standard deviations ranged from .732 to .986. No exceptionally small or large increases in scale mean or small increases or decreases in scale variance were evident if any items were to be deleted from the scale. Eleven items obtained item-total correlations greater than .30. Item Q124 (.252) was the only item that obtained an item-total correlation less than .30. The squared multiple correlations ranged from .068 (Q124) to .294. No substantial increase in the subscale Cronbach alpha would be obtained by deleting any items. Given the basket of evidence none of the items were flagged as poor items.

The results indicated that the set of items were shown to be internally consistent across the White and Coloured sample groups. The results from the Black sample group revealed item Q124 to be a possible poor item. The low Cronbach alpha for the Black group indicated low internal consistency for this subscale. However; clear evidence existed to suggest that the set of items was more internally consistent for the White and Coloured sample groups, than for the Black sample group.

6.1.2 Summary of the Item analysis results

Overall the results of the item analyses provided a mixed picture of the reliability of the respective subscales for the respective groups. In general, the results of the item analyses on the 15FQ+ indicated a less favourable psychometric picture for the Black group than for the White and Coloured groups, and a less favourable psychometric picture for the Coloured group than for the White group. The above discussed results indicated only one subscale (Factor M) with a definite set of incoherent items in the White group. A clear lack of coherence in the items of three subscales (Factor G, Factor M and Factor Q_3) was indicated for the Coloured sample. In the Black group, however, seven subscales (Factor A, Factor B, Factor E, Factor M, Factor N, Factor Q_3 and Factor Q_4) with a definite set of incoherent items were identified. Low internal consistencies were more evident in the Black group than in the Coloured group.

Usually the purpose of determining how well the items represent the content of any particular factor is to detect poor items. The objective of detecting poor items would normally be either to rewrite them, and if not possible, to delete them from the subscale. The rewriting and/or deletion of items were not a viable solution for this study. The intention was to retain all items but report on poor items that failed to discriminate between the different levels of latent variables they were designed to reflect which could be a possible reason for poor model fit in the subsequent confirmatory factor analysis. If the deletion of poor items was an option it would probably have resulted in the sequential deletion of the majority of items in 7 of the 16 subscales for the Black sample, and 3 of the 16 subscales for the Coloured sample. While the results of the item analyses do not provide information regarding the measurement equivalence and invariance of the 15FQ+, it does provide valuable information that could be returned to when wanting to identify reasons for poor model fit when conducting the confirmatory factor analyses.

6.2 DIMENSIONALITY ANALYSIS

Uni-dimensionality occurs when the items selected for each subscale, to represent the different latent variables, do in fact measure the intended latent variable (Hair et al., 2006). To expect each item in a subscale to exclusively reflect only the latent personality dimension of interest is unrealistic. At best essential unidimensionality can be achieved in which the latent personality dimension of interest is the only common source of systematic variance in the items. Essential unidimensionality implies that when the latent personality dimension of interest is statistically controlled the inter-item partial correlations approach zero. Each subscale in the 15FQ+ was designed to reflect essentially one-dimensional sets of items which collectively measure the latent variable of interest. These items are meant to operate as stimuli to which test respondents react with behaviour that is primarily an expression of that specific one-dimensional underlying latent variable. Due to the suppressor effect (Gerbing & Tuley, 1991), the items of the 15FQ+, however, also should reflect the remaining latent variables constituting the personality domain. Personality operates and affects behaviour as an integrated whole. The manner in which individuals respond to the items of the 15FQ+ might be predominantly determined by a specific personality dimension but the response is always influenced to some degree by the standing of the individual on the remaining dimensions as well. Each item of the 15FQ+ is assumed to show a pattern of small positive and negative loadings on the remaining latent personality variables, these patterns of positive and negative loadings are assumed to cancel each other out in a suppressor action (Gerbing & Tuley, 1991). The design intention, of the test developers, was to obtain a relatively uncontaminated measure of the specific latent personality dimensions comprising the 16 dimensional 15FQ+ personality variables from the items included in each subscale.

To examine the unidimensionality assumption exploratory factor analyses was performed on each of the subscales of the 15FQ+. Unrestricted principle axis factor analysis was used as extraction technique (Tabachnick & Fidell, 2001) with oblique rotation. The unidimensionality assumption was tested on the respective ethnic groups for each of the 16 personality scales. Principle axis factor analysis was chosen over principle component analysis as the former only analyses common variance (Tabachnick & Fidell, 2001). Principle axis factor analysis allows for the presence of measurement error, while according to Kline (1994), principle components analysis does not separate error and specific variance. Measuring human behaviour without measurement error is unlikely (Steward, 2001). Consequently, principal axis factor analysis was the preferred method to use in this study.

For the analyses the number of factors extracted, the associated factor loadings and the percentage of large residual correlations were used to evaluate the unidimensionality of the subscale. The residual correlations indicate the difference between the observed and reproduced correlations. A difference of zero will likely only be observed in a perfect dataset (Gorsuch, 2003), for this dataset a limited number of large residual correlations will be sufficient. A small percentage of non-redundant residuals with absolute values greater than .05 would suggest that the reproduced inter-item correlation matrix is a likely explanation for the observed inter-item correlation matrix. A large percentage of non-redundant residuals with absolute values greater than .05 would indicate that the factor solution is an unlikely explanation for the observed correlations matrix. The unidimensionality assumption was considered to be corroborated if a single factor could adequately account for the observed inter-item correlation matrix [i.e. small percentage (<50%) large residual correlations (>.50) exist] and the items loaded satisfactorily (i.e., $\lambda i \geq .50$) on the single extracted factor. When unidimensionality was not supported the next step was the investigation of possible meaningful factor fission. This procedure investigated whether the extracted factors constitute meaningful subthemes within the original latent dimension. Although, the 15FQ+ makes provision for the fusion of the 16 primary factors into five global factors; no provision is made for the fission of the primary factors into narrower more specific sub-factors. Given the absence of any splitting of the primary factors into narrower more specific sub-factors in the manner in which the 15FQ+ conceptualises the personality construct, and given the confirmatory nature of this study, the ability of a single factor to account for the observed inter-item correlation matrix was investigated in the event of factor fission irrespective of whether the rotated factor structure allowed for a meaningful interpretation or not. This investigation allowed for determining the magnitude of the factor loadings when a single factor (as per the *a priori* model) was forced and allowed the examination of the magnitude of the residual correlations. The magnitude of the latter could be regarded as reflecting on the credibility of the extracted single factor solution as an explanation for the observed correlation matrix.

The eigenvalue-greater-than-unity rule of thumb was used to determine the number of factors to extract. Factor loadings can be interpreted as follows (i) .30 to .40 are considered to meet the minimal level for interpretation of the structure, (ii) .50 or greater are considered acceptable and (iii) loadings exceeding .70 are considered indicative of a well-defined structure (Hair et al., 2006).

The question should, however, be raised whether the decision-rule defined in the previous paragraph adequately acknowledges the presence of the suppressor effect (Gerbing & Tuley, 1991). It could on the one hand be argued that the suppressor principle should result in the extraction of 16 factors but where all twelve items in the subscale show reasonably high loadings on the first factor. This outcome only seems a reasonable possibility if the individual items are used in the analysis. The exploratory factor analyses were performed on the inter-item correlation matrices. However, in the case of the single- and multi-group confirmatory factor analyses item parcels were utilised (see Paragraph 6.3.1 for an explanation as to why this route was taken). When item parcels are formed one could argue that the suppressor effect will start operating and having the non-focal personality dimensions cancelling each other out. A single factor model could then more likely be expected to fit the data. The original argument, however, on the other hand contends that the suppressor principle should result in the extraction of a single factor and that all twelve items in the subscale should show reasonably high loadings on this factor. Implicit in the original position is the argument that the 12 items in each subscale have sufficiently low positive and negative loadings on the 15 non-focal personality factors to make the difference in the ability of a 16 factor model with a random scatter of small positive and negative loadings on the 15 non-focal personality factors to reproduce the observed inter-item correlation matrix, a 16 factor model with zero loadings on the 15 non-focal personality factors and a single-factor model, negligible.

The following subsections will summarise the results of the dimensionality analyses for each subscale for the different ethnic group samples. Differences between the results for each sample will also be discussed. While this does not provide information regarding the measurement equivalence and invariance of the 15FQ+, it does provide valuable information that could be returned to when wanting to identify reasons for poor model fit.

6.2.1 Integrated discussion of the dimensionality analysis results over the three ethnic group samples

Tables 6.2 to 6.4 provide an overview of the principal axis factor analyses for the three ethnic groups. The Kaiser-Meyer-Olkin (KMO) and Bartlett's test were used to examine the factor analyzability of the observed inter-item correlation matrices. The KMO measures sampling adequacy as an index expressing the ratio of the sum of the squared inter-item correlations and the squared inter-item correlation plus the sum of the squared partial inter-item correlation coefficients (Sricharoena & Buchenrieder, 2005). The KMO measure varies from unity to zero; values closer to unity are regarded as better values. If items reflect a common underlying factor the value will approach unity. Where KMO approaches at least .60 the correlation matrix is considered to be factor analyzable (Moyo, 2009). With regards to the results in Table 6.2 to Table 6.4 the values of the KMO range between .65 and .89. This indicates that that all the correlation matrices were factor analyzable.

The null hypothesis that the inter-item correlation matrix is an identity matrix in the parameter was tested by the Bartlett test of sphericity. An identity matrix is one in which all items only correlate with themselves and not with each other (Moyo, 2009). This can be seen when all the diagonal elements are 1's and all off diagonals are 0's. The results for all 16 subscales across the three ethnic groups revealed that the null hypothesis could be rejected. This further indicated the factor analyzability of the correlation matrices.

The results of the KMO and Bartlett tests suggested that it would be meaningful to conduct factor analysis on the 16 inter-item correlation matrices across the three ethnic groups.

Table 6.2

SUMMARY OF THE RESULTS OF THE PRINCIPAL AXIS FACTOR ANALYSES FOR THE WHITE SAMPLE GROUP

Subscale	Determinant	KMO	Bartlett x^2	% Variance Explained	No. of Factors Extracted
FA	.17	.86	7923.83	22.14	2
FB	.17	.81	7937.66	20.17	3
FC	.14	.87	9074.72	24.16	3
FE	.23	.84	6723.11	19.80	3
FF	.11	.85	10124.14	24.07	2
FG	.13	.89	9387.06	25.01	2
FH	.06	.89	13098.72	30.03	2
FI	.18	.82	7814.01	20.39	3
FL	.17	.82	8027.95	20.35	3
FM	.29	.75	5687.26	15.11	4
FN	.13	.83	9329.87	22.71	3
FO	.18	.88	7833.31	22.53	2
FQ1	.17	.79	8035.18	18.82	3
FQ2	.16	.86	8422.73	22.43	2
FQ3	.29	.80	5546.64	16.75	3
FQ4	.10	.89	10344.69	26.00	2

FA - Factor A; FB - Factor B; FC - Factor C; FE - Factor E; FF - Factor – F; FG - Factor G; FH - Factor H; FI - Factor I; FL - Factor L; FM - Factor M; FN - Factor N; FO - Factor O; FQ1 - Factor Q1; FQ2 - Factor Q2; FQ3 - Factor Q3; FQ4 - Factor Q4

Table 6.3

SUMMARY OF THE RESULTS OF THE PRINCIPAL AXIS FACTOR ANALYSIS FOR THE BLACK SAMPLE GROUP

Subscale	Determinants	KMO	Bartlett x^2	% Variance Explained	No. of Factors Extracted
FA	.53	.76	2806.39	11.82	3
FB	.33	.77	4883.4	14.96	3
FC	.25	.81	6127.204	18.10	3
FE	.57	.73	2534.7	10.50	3
FF	.20	.81	7118.1	18.814	4
FG	.30	.85	5317.32	18.06	2
FH	.20	.85	7354.54	21.236	3
FI	.36	.69	4496.18	12.22	4
FL	.33	.74	4883.29	14.19	3
FM	.57	.65	2506.77	8.26	4
FN	.46	.75	3469.48	12.57	3
FO	.37	.79	4387.34	15.32	4
FQ1	.43	.69	3755.09	11.48	4
FQ2	.40	.77	4084.65	13.99	3
FQ3	.62	.72	2144.13	9.75	4
FQ4	.50	.74	3128.74	11.38	3

FA - Factor A; FB - Factor B; FC - Factor C; FE - Factor E; FF - Factor – F; FG - Factor G; FH - Factor H; FI - Factor I; FL - Factor L; FM - Factor M; FN - Factor N; FO - Factor O; FQ1 - Factor Q1; FQ2 - Factor Q2; FQ3 - Factor Q3; FQ4 - Factor Q4

Table 6.4

SUMMARY OF THE RESULTS OF THE PRINCIPAL AXIS FACTOR ANALYSES FOR THE COLOURED SAMPLE GROUP

Subscale	Determinants	KMO	Bartlett x^2	% Variance Explained	No. of Factors Extracted
FA	.34	.80	1125.42	16.05	4
FB	.23	.79	1518.05	18.15	3
FC	.29	.81	1286.25	17.39	3
FE	.44	.76	862.60	13.16	4
FF	.17	.79	1851.77	19.03	3
FG	.22	.85	1555.05	19.93	3
FH	.10	.88	2390.23	25.77	3
FI	.25	.78	1441.70	16.99	3
FL	.23	.80	1517.95	17.77	2
FM	.47	.65	783.18	9.81	4
FN	.24	.80	1503.16	18.12	3
FO	.30	.83	1272.65	17.63	3
FQ1	.28	.72	1341.92	14.12	3
FQ2	.29	.80	1301.70	17.06	3
FQ3	.42	.69	899.361	12.38	3
FQ4	.20	.83	1678.28	20.16	3

FA - Factor A; FB - Factor B; FC - Factor C; FE - Factor E; FF - Factor – F; FG - Factor G; FH - Factor H; FI - Factor I; FL - Factor L; FM - Factor M; FN - Factor N; FO - Factor O; FQ1 - Factor Q1; FQ2 - Factor Q2; FQ3 - Factor Q3; FQ4 - Factor Q4

6.2.1.1 Factor A

The results for the *Aloof – Empathic* subscale for the White sample revealed that two clear factors emerged. Two factors obtained eigenvalues greater than unity. The rotated factor matrix (pattern matrix[11]; see Appendix 4) revealed that factor 1 had three items (Q52, Q76 and Q101) with loadings greater than .50 and four items (Q51, Q77, Q151 and Q176) with loadings greater than .30. Factor 2 indicated three items with substantial negative loadings. One item (Q2) obtained a loading of less than -.50 and two items (Q27 and Q151) obtained loadings of less than -.30. The negative loading reveals a negative correlation between the factor and the item. Three items (Q2, Q26 and Q126) did not load on any of the two factors. As indicated in the results one item showed itself as a complex item (Q151) because it simultaneously loaded on both factors. No meaningful identity could be determined

[11] The pattern matrix displays the partial regression coefficients when regressing the item on the extracted factors. The partial regression coefficients acknowledge the fact that under oblique rotation the factors are allowed to correlate and therefore share variance.

for the two extracted factors based on common themes shared by the items that loaded on them.

Due to the confirmatory nature of this study a single factor was forced on the scale as per the *a priori* model. It is evident from Table 6.5 that the loadings for the single extracted factor were reasonable. Four items (Q1, Q52, Q77 and Q151) obtained loadings greater than .50 and seven items (Q26, Q27, Q51, Q76, Q101, Q126 and Q176) obtained loadings greater than .30. Only one item (Q2) did not load on the single extracted factor.

The residual correlations were calculated for both the two-factor and one-factor solutions. The two-factor solution showed a small percentage (9%) of non-redundant residuals with absolute values greater than .05. The one-factor solution's percentage (15%) of large non-redundant residuals was larger than for the two-factor solution, signifying that the one-factor solution provided a less credible, but still plausible explanation, for the observed correlation matrix.

The dimensionality analysis results for the Black sample revealed a three-factor structure based on the eigen-value-greater-than-unity rule. The pattern matrix (Appendix 4) revealed that factor 1 had one item (Q151) with a loading greater than .50 and three items (Q1, Q52 and Q77) with loadings greater than .30. There was only one item (Q26) with a loading greater than .30 on factor 2. Factor 3 indicated one item (Q101) with a loading greater than .50 and two items (Q76 and Q176) with loadings greater than .30. Four items (Q2, Q27, Q51 and Q126) did not load on any of the three factors. No meaningful identity could be determined for the three extracted factors based on common themes shared by the items that load on them.

Due to the confirmatory nature of this study a single factor was forced on the scale as per the *a priori* model. Table 6.5 revealed that two items (Q52 and Q151) obtained loadings greater than .50 and five items (Q27, Q76, Q77, Q101 and Q176) loadings greater than .30. Five items (Q1, Q2, Q26, Q51 and Q126) did not load on the single extracted factor.

The residual correlations were calculated for both the factor solutions. The three-factor solution indicated a zero percentage of non-redundant residuals with absolute values greater than .05. The one-factor solution's percentage (12%) of large non-redundant residuals was larger than the three-factor solution, signifying that the one-factor solution provided a less credible, but still acceptable explanation for the observed correlation matrix.

The results of the analysis for the Coloured sample once again revealed factor fission in that a four-factor structure underlied the subscale (based on the eigen-value-greater-than-unity rule). The rotated factor structure revealed that factor 1 had one item (Q151) with a loading greater than .50 and four items (Q1, Q27, Q52 and Q77) with loadings greater than .30. Two items (Q2 and Q51) with loadings greater than .30 loaded on factor 2. Factor 3 indicated two items (Q26 and Q176) with loadings greater than .30 and factor 4 also indicated two items (Q76 and Q101) with loadings greater than .30. One item (Q126) did not load on any of the four factors. Again no meaningful identity could be determined for the four extracted factors based on common themes shared by the items that loaded on them.

Fairly low item loadings were obtained when a single factor was forced. Table 6.5 revealed that three items (Q52, Q77 and Q151) obtained loadings greater than.50 and five items (Q1, Q76, Q51, Q27 and Q101) had loadings greater than.30. Four items (Q2, Q26, Q126 and Q176) did not load significantly on the single extracted factor.

Further to this the residual correlations were calculated for both the four-factor and one-factor solutions. The four-factor solution showed a zero percentage of non-redundant residuals with absolute values greater than .05. The one-factor solution's percentage (13%) of large non-redundant residuals was larger than the four-factor solution, signifying that the one-factor solution provided a less credible but still plausible explanation for the observed correlation matrix.

The dimensionality analyses results for this subscale revealed two factors for the White group, three factors for the Black group and four factors for the Coloured group when the eigen-values-greater-than-unity rule was applied. The overall results, therefore, revealed more than one factor underlying the structure of this subscale in every one of the three groups. This signified the need for more than one factor to satisfactorily explain the observed correlations between the items in the subscale. Strictly speaking the unidimensionality assumption was therefore not corroborated. Item Q2 did not load effectively on the White and Black groups. Item Q126 also revealed an insignificant loading on the factors of the Coloured and Black groups. The item analysis results also indicated item Q2 as a problematic item. When the extraction of a single factor was forced the majority of items in the three groups obtained relatively good loadings. Therefore it could be deduced that the majority of the items represent the underlying latent variable well, with the exception of items Q2 and Q126. The percentage of large residual correlations obtained for the single-factor solution was still sufficiently small to regard the single factor solution as a credible explanation for the observed correlation matrix. Interpreted somewhat more leniently the assumption of essential unidimensionality can therefore be regarded as not altogether without merit.

Table 6.5

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR A) OVER THE THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_FA_Q1	**.50**	15FQ+_FA_Q1	**.30**	15FQ+_FA_Q1	**.40**
15FQ+_FA_Q2	.10	15FQ+_FA_Q2	-.00	15FQ+_FA_Q2	.00
15FQ+_FA_Q26	**.30**	15FQ+_FA_Q26	.16	15FQ+_FA_Q26	.20
15FQ+_FA_Q27	**.30**	15FQ+_FA_Q27	**.30**	15FQ+_FA_Q27	**.30**
15FQ+_FA_Q51	**.50**	15FQ+_FA_Q51	.28	15FQ+_FA_Q51	**.40**
15FQ+_FA_Q52	**.60**	15FQ+_FA_Q52	**.52**	15FQ+_FA_Q52	**.60**
15FQ+_FA_Q76	**.50**	15FQ+_FA_Q76	**.33**	15FQ+_FA_Q76	**.50**
15FQ+_FA_Q77	**.70**	15FQ+_FA_Q77	**.47**	15FQ+_FA_Q77	**.60**
15FQ+_FA_Q101	**.40**	15FQ+_FA_Q101	**.34**	15FQ+_FA_Q101	**.40**
15FQ+_FA_Q126	**.30**	15FQ+_FA_Q126	.17	15FQ+_FA_Q126	.10
15FQ+_FA_Q151	**.70**	15FQ+_FA_Q151	**.52**	15FQ+_FA_Q151	**.60**
15FQ+_FA_Q176	**.40**	15FQ+_FA_Q176	**.35**	15FQ+_FA_Q176	.30

1 factor extracted. 5 iterations required.

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.1.2 Factor B

The results for the *Intellectance* subscale for the White group returned a three-factor structure. Examination of the pattern matrix (see Appendix 4) revealed two items (Q102 and Q152) with loadings greater than .50 and three items (Q127, Q153 and Q178) with loadings greater than .30 (on Factor 1). Substantial negative loadings of less than -.50 for two items (Q53 and Q177) were evident on Factor 2. Factor 3 indicated one item (Q78) with a loading greater than .50 and two items (Q3 and Q28) with loadings greater than .30. Two items (Q103 and Q128) did not load on any of the three extracted factors. The identity of the three extracted factors could not be inferred from the items loading on them.

It was evident from Table 6.6 that upon forcing a single factor, reasonable item loadings emerged. Two items (Q102 and Q153) obtained loadings greater than .50 and ten items (Q3, Q28, Q53, Q78, Q103, Q128, Q127, Q152, Q177, and Q178) obtained loadings greater than .30. All items loaded greater than .30 on the forced single extracted factor.

The residual correlations were calculated for both the three-factor and one-factor solutions. The three-factor solution showed a small percentage (4%) of non-redundant residuals with absolute values greater than .05. The one-factor solution's percentage (45%) of large non-redundant residuals was large, signifying that the one-factor solution was a less credible explanation for the observed correlation matrix.

The dimensionality analysis results for the Black sample also revealed three factors. Three factors had eigen values greater than unity. The rotated pattern matrix (see Appendix 4) indicated that factor 1 had one item (Q153) with a loading greater than .50 and five items (Q3, Q28, Q78, Q128 and Q178) with loadings greater than .30. Factor 2 had two items (Q53 and Q177) with loadings greater than .50 and factor 3 had three items (Q102, Q127 and Q152) with loadings greater than .30. Only one item (Q103) did not load on any of the three extracted factors. No meaningful identity could be determined for the three extracted factors based on common themes shared by the items that loaded on them.

Next, a single factor was extracted. It was evident from Table 6.6 that the loadings for the single extracted factor were fairly low. Only one item (Q153) had a loading greater than .50 and eight items (Q3, Q28, Q78, Q102, Q178, Q127, Q128, and Q177) obtained loadings greater than .30. Three items (Q53, Q103 and Q152) did not load on the single extracted factor.

The results of the calculated residual correlations for the three-factor solution showed a small percentage (3%) of non-redundant residuals with absolute values greater than .05. The one-factor solution's percentage (27%) of large non-redundant residuals was larger than the three-factor solution signifying that the one-factor solution provided a less credible, but still plausible, explanation for the observed correlation matrix.

Similar to the previous two analyses, the results for the *Intellectance* subscale for the Coloured sample also revealed that a three-factor structure best explained the observed correlation matrix. Three factors obtained eigenvalues greater than unity. The rotated pattern matrix (see Appendix 4) revealed that factor 1 indicated three items (Q28, Q78 and Q127) with loadings greater than .50 and one item (Q3) with a loading greater than .30. Factor 2 indicated two items (Q53 and Q177) with negative loadings less than -.50 and one item (Q102) with a negative loading less than -.30. Factor 3 indicated one item (Q178) with a loading greater than .50 and two items (Q128 and Q153) with loadings greater than .30. Two items (Q103 and Q152) did not load on any of the three extracted factors. Upon forcing a single factor, reasonable factor loadings emerged. Table 6.6 revealed one item (Q177) with a loading greater than .50 and ten items (Q3, Q28, Q53, Q78, Q102, Q128, Q127, Q152, Q153, and Q178) with loadings greater than .30. Only one item (Q103) did not load on the forced single extracted factor. Again no meaningful identity could be determined for the three extracted factors based on common themes shared by the items that load on them.

The three-factor solution showed a small percentage (1%) of non-redundant residuals with absolute values greater than .05. The one-factor solution's percentage (28%) of large non-redundant residuals was substantially larger signifying that the one-factor solution was a less credible, but still plausible explanation for the observed correlation matrix.

Overall the dimensionality analyses results indicated three factors with eigenvalue-greater than unity for this subscale across the three samples. This signifies the need for three factors to satisfactorily explain the observed correlations between the items in the subscale. Strictly speaking the unidimensionality assumption was therefore not corroborated. Item Q103 was flagged as a problematic item as it did not load on any of the factors across the three groups. When the extraction of a single factor was forced the majority of items in the three groups obtained relatively good loadings. This phenomenon indicated that the majority of the items represent the underlying latent variable well. Attention should be given to item Q103. The percentage of large residual correlations obtained for the single-factor solution was still sufficiently small (especially for the Black and Coloured samples) to regard the single factor solution as a credible explanation for the observed correlation matrix. When the results are interpreted somewhat more leniently the position that a single common factor underlies the 12 items of the *Intellectance* subscale therefore is not altogether untenable.

Table 6.6

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR B) OVER THE THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_B_Q3	**.40**	15FQ+_B_Q3	**.40**	15FQ+_B_Q3	**.40**
15FQ+_B_Q28	**.40**	15FQ+_B_Q28	**.40**	15FQ+_B_Q28	**.50**
15FQ+_B_Q53	**.40**	15FQ+_B_Q53	.20	15FQ+_B_Q53	**.40**
15FQ+_B_Q78	**.50**	15FQ+_B_Q78	**.50**	15FQ+_B_Q78	**.50**
15FQ+_B_Q102	**.60**	15FQ+_B_Q102	**.40**	15FQ+_B_Q102	**.50**
15FQ+_B_Q103	**.40**	15FQ+_B_Q103	.30	15FQ+_B_Q103	.30
15FQ+_B_Q127	**.50**	15FQ+_B_Q127	**.40**	15FQ+_B_Q127	**.40**
15FQ+_B_Q128	**.40**	15FQ+_B_Q128	**.40**	15FQ+_B_Q128	**.40**
15FQ+_B_Q152	**.50**	15FQ+_B_Q152	.30	15FQ+_B_Q152	**.40**
15FQ+_B_Q153	**.50**	15FQ+_B_Q153	**.50**	15FQ+_B_Q153	**.50**
15FQ+_B_Q177	**.50**	15FQ+_B_Q177	**.30**	15FQ+_B_Q177	**.50**
15FQ+_B_Q178	**.50**	15FQ+_B_Q178	**.40**	15FQ+_B_Q178	**.50**

1 factor extracted. 5 iterations required

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.1.3 Factor C

The results for the White sample revealed that the *Affected by feelings – emotionally stable* subscale split into three factors, based on the eigen-value-greater-than-unity rule. Examination of the rotated pattern matrix (see Appendix 4) revealed that two items (Q104 and Q129) with loadings greater than .50 and two items (Q29 and Q55) with loadings greater than .30 loaded on Factor 1. One item (Q5) with a loading greater than .50 and two items (Q30 and Q54) with loadings greater than .30 was evident for Factor 2. Factor 3 indicated three items (Q80, Q154 and Q179) with negative loadings more than -.50 and two items (Q4 and Q79) with negative loadings more than -.30. All items loaded at least on one of the extracted factors. However, no meaningful identity could be determined for the three extracted factors based on common themes shared by the items that loaded on them.

It was evident from Table 6.7 that when forcing a single factor, all items loaded reasonably on the single extracted factor. Six items (Q4, Q54, Q55, Q80, Q104 and Q179) obtained loadings greater than .50 and six items (Q5, Q29, Q30, Q79, Q129 and Q154) obtained loadings greater than .30. Hence, all items load greater than .30 on the forced single factor.

The results of the residual correlations calculations revealed that the three-factor solution obtained a small percentage (4%) of non-redundant residuals with absolute values greater than .05. For the one-factor solution a larger but still acceptably small percentage (18%) of large non-redundant residuals was evident. Therefore it was deduced that the one-factor solution provided a less credible albeit still acceptable explanation for the observed correlation matrix than the three-factor solution.

The results for the Black group also revealed that three factors should be extracted. Examination of the pattern matrix (see Appendix 4) revealed that for Factor 1 five items (Q4, Q5, Q30, Q79 and Q179) obtained loadings greater than .30. Factor 2 indicated two items (Q104 and Q129) with negative loadings of more than -.50 and two items (Q29 and Q55) with negative loadings of more than -.30. Factor 3 indicated one item (Q154) with a negative loading of more than -.50 and one item (Q80) with a negative loading of more than -.30. Only one item (Q54) did not load on any of the three extracted factors. No meaningful identity could be determined for the three extracted factors based on common themes shared by the items that load on them.

Upon forcing a single factor reasonable factor loadings emerged. Table 6.7 revealed two items (Q104 and Q179) had loadings greater than .50 and eight items (Q4, Q29, Q54, Q55, Q79, Q80, Q129 and Q154) had loadings greater than .30. Two items (Q5 and Q30) did not load on the forced single extracted factor.

The residual correlations were calculated for both solutions. The three-factor solution obtained a small percentage (4%) of non-redundant residuals with absolute values greater than .05. The one-factor solution indicated a larger but still acceptably small percentage (31%) of large non-redundant residuals. Therefore the one-factor solution provided a less credible, but nonetheless still plausible, explanation for the observed correlation matrix.

The results for the *Affected by feelings – emotionally stable* subscale's dimensionality analysis for the Coloured sample indicated three factors with eigenvalues greater than unity. The result suggested factor fission. Factor 1 contained one item (Q179) with a loading greater than .50 and four items (Q4, Q79, Q80 and Q154) with loadings greater than .30. Factor 2 had two items (Q129 and Q104) with negative loadings of more than -.50 and factor 3 indicated three items (Q5, Q30 and Q54) with loadings greater than .30. Two items (Q29 and Q55) did not load on the extracted factors. Again no meaningful identity could be determined for the three extracted factors based on common themes shared by the items that loaded on them.

Table 6.7 revealed that when forcing a single factor, all items loaded in a reasonable manner. One item (Q179) obtained a loading greater than .50 and ten items (Q4, Q5, Q29, Q54, Q55, Q79, Q80, Q104, Q129 and Q154) obtained loadings greater than.30. Only one item (Q30) did not load on the single extracted factor.

Results of the residual correlations for the three-factor solution showed a small percentage (6%) of non-redundant residuals with absolute values greater than .05. The one-factor solution obtained a larger, but still acceptably small percentage (21%) of large non-redundant residuals. Therefore the one-factor solution provided a less credible but still permissible explanation for the observed correlation matrix.

Overall the dimensionality analyses results indicated three factors with eigenvalues greater than unity for this subscale across the three samples. This signified the need for three factors to satisfactorily explain the observed correlations between the items in the subscale. Item Q129 and Item Q104 both had significant negative loadings in the Coloured and Black group. Strictly speaking the unidimensionality assumption was therefore not corroborated.

When the extraction of a single factor was forced the majority of items in the three groups obtained relatively good loadings. This phenomenon indicated that the majority of the items represent the underlying latent variable well. The percentage of large residual correlations obtained for the single-factor solution was still sufficiently small for all three samples to regard the single factor solution as a permissible explanation for the observed correlation matrix. When the results were interpreted somewhat more leniently, the position that a single common factor underlies the 12 items of the *Affected by feelings – emotionally stable* subscale may therefore be regarded as tenable.

Table 6.7

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR C) OVER THE THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_FC_Q4	**.60**	15FQ+_FC_Q4	**.50**	15FQ+_FC_Q4	**.50**
15FQ+_FC_Q5	**.40**	15FQ+_FC_Q5	.20	15FQ+_FC_Q5	**.30**
15FQ+_FC_Q29	**.40**	15FQ+_FC_Q29	**.30**	15FQ+_FC_Q29	**.40**
15FQ+_FC_Q30	**.40**	15FQ+_FC_Q30	.20	15FQ+_FC_Q30	.30
15FQ+_FC_Q54	**.50**	15FQ+_FC_Q54	**.40**	15FQ+_FC_Q54	**.40**
15FQ+_FC_Q55	**.50**	15FQ+_FC_Q55	**.50**	15FQ+_FC_Q55	**.40**
15FQ+_FC_Q79	**.50**	15FQ+_FC_Q79	**.50**	15FQ+_FC_Q79	**.40**
15FQ+_FC_Q80	**.50**	15FQ+_FC_Q80	**.40**	15FQ+_FC_Q80	**.40**
15FQ+_FC_Q104	**.50**	15FQ+_FC_Q104	**.60**	15FQ+_FC_Q104	**.50**
15FQ+_FC_Q129	**.50**	15FQ+_FC_Q129	**.50**	15FQ+_FC_Q129	**.40**
15FQ+_FC_Q154	**.50**	15FQ+_FC_Q154	**.40**	15FQ+_FC_Q154	**.40**
15FQ+_FC_Q179	**.60**	15FQ+_FC_Q179	**.60**	15FQ+_FC_Q179	**.50**

1 factor extracted. 4 iterations required.

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.1.4 Factor E

The results of the dimensionality analysis for the *Accommodating – Dominant* subscale in the White sample resulted in three factors being extracted. An examination of the pattern matrix (see Appendix 4) indicated that two items (Q6 and Q155) with loadings greater than .50 and two items (Q156and Q181) with loadings greater than .30 loaded on Factor 1. One item (Q106) with a loading greater than .50 loaded on factor 2. Factor 3 showed two items (Q130 and Q180) with negative loadings more than -.50 and two items (Q31 and Q81) with negative loadings more than -.30. Three items (Q56, Q105 and Q131) did not load on any of the three factors. No meaningful interpretation of the three extracted factors based on common themes shared by the items that loaded on them was possible.

Table 6.8 contains the results obtained upon forcing a single factor. Two items (Q130 and Q155) obtained loadings greater than .50 and nine items (Q6, Q31, Q56, Q81, Q106, Q131, Q156, Q180 and Q181) obtained loadings greater than .30. Only one item (Q105) did not load on the single extracted factor.

The residual correlations were calculated for both the factor solutions. A small percentage (1%) of non-redundant residuals with absolute values greater than .50

was obtained for the three-factor solution. The one-factor solution's percentage (24%) of non-redundant residuals was substantially larger than for the three-factor solution. The one-factor solution provided, therefore, a less credible albeit still acceptable explanation of the observed correlation matrix.

Similarly, the results for the Black sample also provided evidence to suggest that a three-factor structure underlies the subscale. The pattern matrix (see Appendix 4) revealed that two items (Q6 and Q155) with loadings greater than .50 and two items (Q155 and Q131) with loadings greater than .30 loaded on Factor 1. Factor 2 indicated one item (Q130) with a loading greater than .50 and one item (Q180) with a loading greater than .30. Only one item (Q106) with a loading greater than .30 was evident for Factor 3. Five items (Q31, Q56, Q81, Q105 and Q181) did not load on any of the three factors. No meaningful interpretation of the three extracted factors based on common themes shared by the items that loaded on them was possible.

It was evident from Table 6.8 that upon forcing a single factor extremely low factor loadings emerged. Half of the items in the item pool (Q6, Q81, Q130, Q131, Q155 and Q156) obtained loadings in the range of .30 to .50 whilst the other half of the items failed to obtain substantial loadings larger than .30 on the extracted factor (Q31, Q56, Q105, Q106, Q180 and Q181).

The one-factor solution's percentage (16%) of large non-redundant residuals was larger than the three-factor solution's percentage of large non-redundant residuals (0%), but still sufficiently low. This signified that the one-factor solution provided a less credible but still an acceptable explanation for the observed correlation matrix.

The results for the Coloured sample indicated four factors that should be extracted based on the eigen-values-greater-than-unity rule. The pattern matrix (see Appendix 4) revealed that factor 1 had two items (Q6 and Q155) with loadings greater than .50 and two items (Q131 and Q156) with loadings greater than .30. Factor 2 indicated one item (Q130) with a loading greater than .50 and one item (Q180) with a loading greater than .30. For both factors 3 and 4 only one item loaded onto each factor (for factor 3 item Q105 and factor 4 item Q106.) Four items (Q31, Q56, Q81 and Q181) did not load on any of the four factors. No common themes shared by the items that load on the four extracted factors could be identified.

The results upon forcing a single extracted factor revealed two items (Q130 and Q155) with loadings greater than .50 and six items (Q6, Q31, Q56, Q81, Q131 and Q156) with loadings greater than .30. Four items (Q105, Q106, Q180 and Q181) did not load on the single extracted factor. The results are presented in Table 6.8.

A zero percentage of non-redundant residuals with absolute values greater than .05 were found for the four-factor solution. Although the one-factor solution's percentage (25%) of large non-redundant residuals was larger than that of the four-factor solution, it still was sufficiently small to allow the one–factor solution as a credible explanation of the observed correlation matrix.

Overall the dimensionality analyses results revealed more than one factor with eigenvalue greater than unity for this subscale across the three samples. Strong evidence exist over all three groups indicating that more than one factor underlies the subscale. Item Q56 did not load on any of the factors across the three groups. Item Q105 did not load on any of the factors in the White and Black groups and items Q31, Q81 and Q181 did not load on any of the factors in the Black and Coloured groups. Item Q105 also revealed itself as a problematic item in the item analysis results. Strictly speaking the unidimensionality assumption was therefore not corroborated.

However, when the extraction of a single factor was forced the majority of items in the three groups obtained relatively good loadings. The majority of the items, therefore, represent the underlying latent variable well. The percentage of large residual correlations obtained for the single-factor solution was still sufficiently small for all three samples to regard the single factor solution as a permissible explanation for the observed correlation matrix. When the results are interpreted somewhat more leniently the position that a single common factor underlies the 12 items of the *Accommodating – Dominant* subscale may therefore be regarded as tenable.

Table 6.8

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR E) OVER THE THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_FE_Q6	**.50**	15FQ+_FE_Q6	**.40**	15FQ+_FE_Q6	**.50**
15FQ+_FE_Q31	**.50**	15FQ+_FE_Q31	.30	15FQ+_FE_Q31	**.30**
15FQ+_FE_Q56	**.40**	15FQ+_FE_Q56	.30	15FQ+_FE_Q56	**.40**
15FQ+_FE_Q81	**.50**	15FQ+_FE_Q81	**.30**	15FQ+_FE_Q81	**.30**
15FQ+_FE_Q105	.20	15FQ+_FE_Q105	.10	15FQ+_FE_Q105	.10
15FQ+_FE_Q106	**.40**	15FQ+_FE_Q106	.20	15FQ+_FE_Q106	.20
15FQ+_FE_Q130	**.60**	15FQ+_FE_Q130	**.40**	15FQ+_FE_Q130	**.50**
15FQ+_FE_Q131	**.40**	15FQ+_FE_Q131	**.40**	15FQ+_FE_Q131	**.40**
15FQ+_FE_Q155	**.60**	15FQ+_FE_Q155	**.50**	15FQ+_FE_Q155	**.60**
15FQ+_FE_Q156	**.40**	15FQ+_FE_Q156	**.40**	15FQ+_FE_Q156	**.40**
15FQ+_FE_Q180	**.50**	15FQ+_FE_Q180	.20	15FQ+_FE_Q180	.30
15FQ+_FE_Q181	**.40**	15FQ+_FE_Q181	.30	15FQ+_FE_Q181	.20

1 factor extracted. 5 iterations required.

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.1.5 Factor F

The results of the dimensionality analysis for the *Sober serious – Enthusiastic* subscale in the White sample revealed a two-factor structure. Factor 1 indicated four items (Q7, Q107, Q132 and Q157) with loadings greater than .50 and two items (Q33 and Q58) with loadings greater than .30 in the pattern matrix (see Appendix 4). The rotated factor solution revealed that factor 2 had two items (Q82 and Q182) with loadings more than -.50 and two items (Q8 and Q32) with loadings more than -.3. Two items (Q57 and Q83) did not load on any of the two factors. No meaningful common themes shared by the items that loaded on the two extracted factors could be identified.

A single underlying factor was forced to extract a single factor. The loadings for the single extracted factor were reasonable (see Table 6.9). Six items (Q8, Q57, Q82, Q107, Q132 and Q182) had loadings greater than .50 and five items (Q7, Q32, Q33, Q58, and Q157) had loadings greater than .30. Only one item (Q83) did not load on the forced single extracted factor.

The residual correlation matrix was calculated for both the two-factor and one-factor solution. The two factor solution provided a more credible explanation than the one-factor solution for the observed correlation matrix. The two factor solution showed a satisfactory small percentage (12%) of non-redundant residuals with absolute values greater than .05. The one-factor solution in contrast showed a worrisomely large percentage (45%) of large non-redundant residuals that brings into question the credibility of the one-factor solution as a valid explanation of the observed correlation matrix.

The results for the Black sample showed four factors. Four factors had eigenvalues greater than unity. The investigation of the pattern matrix (see Appendix 4) indicated factor 1 had three items (Q8, Q82 and Q182) with loadings greater than .50 and six items (Q7, Q32, Q57, Q58, Q107 and Q132) with loadings greater than .30. Factor 2 indicated two items (Q132 and Q157) with loadings greater than .30 and two items (Q82 and Q182) with loadings more than -.30. None of the items loaded on factor 3 or factor 4. Three items showed itself as complex items (Q182, Q82 and Q132) with loadings on both factor 1 and factor 2. Two items (Q33 and Q83) did not load on any of the four factors. No meaningful common themes shared by the items that load on the four extracted factors could be identified.

When forcing a single factor, all items loaded reasonably (see Table 6.9). Three items (Q8, Q82 and Q182) had loadings greater than .50 and six items (Q7, Q32, Q57, Q58, Q107 and Q132) had loadings greater than .30. Three items (Q33, Q83 and Q157) did not load on the forced single extracted factor.

The four-factor solution showed a zero percentage of non-redundant residuals with absolute values greater than .05 and the one-factor solution showed a large percentage (45%) of large non-redundant residuals. This signified that the one-factor solution did not provide a credible explanation for the observed correlation matrix.

Based on the eigen-greater-than-unity rule the results for the analysis conducted on the Coloured sample revealed three factors. The factor solution revealed factor fission. Factor 1 indicated one item (Q8) with a loading greater than .50 and three items (Q33, Q57 and Q58) with loadings greater than .30. Factor 2 indicated two items (Q132 and Q157) with loadings greater than .50 and one item (Q7) with a loading greater than .30. Factor 3 indicated three items (Q32, Q82 and Q182) with loadings more than -.50. Two items (Q83 and Q107) did not load on any of the three factors. No meaningful common themes shared by the items that loaded on the three extracted factors could be identified.

As is evident from Table 6.9, reasonable loadings were obtained when a single factor solution was forced on the data Two items (Q8 and Q182) obtained loadings greater than .50 and nine items (Q7, Q32, Q33, Q57, Q58, Q82, Q107, Q132 and Q157) obtained loadings greater than .30. Only one item (Q83) did not load on the forced single extracted factor.

The results for the non-redundant residuals signified that the one-factor solution did not provide a credible explanation for the observed correlation matrix. Although the three-factor solution showed a small percentage (4%) of large non-redundant residuals with absolute values greater than .05 the one-factor solution showed a large percentage (48%) of large non-redundant residuals.

Overall the dimensionality analyses results for this sub-scale was less consistent than some of the results for previous subscales. The results revealed two factors for the White group, four factors for the Black group and three factors for the Coloured group with eigenvalues greater than unity. The results signified the need for more than one factor to satisfactorily explain the observed correlations between the items in the subscale across the three groups. Item Q83 did not load on any of the factors across the three groups. The item analysis results also identified item Q83 as a possible poor item. Strictly speaking the unidimensionality assumption was therefore not corroborated.

When the extraction of a single factor was forced the majority of items in the three groups obtained reasonable factor loadings, indicating that the majority of the items represented the underlying latent variable well. The percentage of large residual correlations obtained for the single-factor solution was sufficiently large for all three samples to seriously question the single factor solution as a permissible explanation for the observed correlation matrix. Even when the results are interpreted somewhat more leniently the position that a single common factor underlies the 12 items of the *Sober serious – Enthusiastic* subscale should therefore be regarded as untenable.

Table 6.9

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR F) OVER THE THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_FF_Q7	**.47**	15FQ+_FF_Q7	**.41**	15FQ+_FF_Q7	**.37**
15FQ+_FF_Q8	**.59**	15FQ+_FF_Q8	**.56**	15FQ+_FF_Q8	**.51**
15FQ+_FF_Q32	**.45**	15FQ+_FF_Q32	**.47**	15FQ+_FF_Q32	**.44**
15FQ+_FF_Q33	**.37**	15FQ+_FF_Q33	.29	15FQ+_FF_Q33	**.33**
15FQ+_FF_Q57	**.50**	15FQ+_FF_Q57	**.39**	15FQ+_FF_Q57	**.44**
15FQ+_FF_Q58	**.50**	15FQ+_FF_Q58	**.32**	15FQ+_FF_Q58	**.44**
15FQ+_FF_Q82	**.50**	15FQ+_FF_Q82	**.58**	15FQ+_FF_Q82	**.48**
15FQ+_FF_Q83	.27	15FQ+_FF_Q83	.27	15FQ+_FF_Q83	.29
15FQ+_FF_Q107	**.55**	15FQ+_FF_Q107	**.39**	15FQ+_FF_Q107	**.46**
15FQ+_FF_Q132	**.52**	15FQ+_FF_Q132	**.38**	15FQ+_FF_Q132	**.39**
15FQ+_FF_Q157	**.42**	15FQ+_FF_Q157	.28	15FQ+_FF_Q157	**.40**
15FQ+_FF_Q182	**.64**	15FQ+_FF_Q182	**.66**	15FQ+_FF_Q182	**.60**

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.1.6 Factor G

The results from the *Expedient – Conscientious* subscale for the White group indicated two clear factors. Two factors had eigenvalues greater than unity. Examination of the pattern matrix (see Appendix 4) revealed that factor 1 indicated one item (Q159) with a loading greater than .50 and nine items (Q9, Q59, Q84, Q108, Q109, Q133, Q158, Q183 and Q184) with loadings greater than .30. One item (Q34) obtained a loading of more than -.50 and three items (Q133, Q134 and Q184) had loadings of more than -.30 on factor 2. The results revealed two complex items (Q184 and Q133) that loaded simultaneously on both factors. No meaningful common themes shared by the items that load on the two extracted factors could be identified.

Given the design intention in the development of the subscale a single factor was forced. Table 6.10 revealed reasonable loadings for the single extracted factor. Four items (Q9, Q34, Q133 and Q184) obtained loadings greater than .50 and eight items (Q59, Q84, Q108, Q109, Q134, Q158, Q159 and Q183) loadings greater than .30. Hence, all items loaded greater than .30 on the forced single factor.

The two-factor solution showed a small percentage (3%) of non-redundant residuals with absolute values greater than .05. The one-factor solution's percentage (18%) of large non-redundant residuals, although larger than that of the two-factor solution, was sufficiently small to regard the one-factor solution as a credible explanation of the observed correlation matrix (albeit less so than the two-factor solution).

A two-factor solution was also evident from the analysis conducted on the Black sample. The rotated factor solution revealed one item (Q184) with a loading greater than .50 and five items (Q9, Q34, Q108, Q133 and Q134) with loadings greater than .30 for factor 1. The investigation also revealed five items (Q59, Q84, Q109, Q133 and Q158) with loadings greater than .30 on factor 2 and two items (Q159 and Q183) did not load on any of the two extracted factors. One item was revealed as a complex item (Q133) because it loaded simultaneously on factor 1 and factor 2. No meaningful common themes shared by the items that loaded on the two extracted factors could, however, be identified

Reasonable factor loadings emerged (see Table 6.10) upon forcing a single factor. Three items (Q9, Q133 and Q184) had loadings greater than .50 and seven items (Q34, Q59, Q84, Q108, Q109, Q158 and Q159) had loadings greater than .30. Two items (Q134 and Q183) did not load on the forced single extracted factor.

The residual correlation matrix was calculated for both the two-factor and one-factor solutions. The one-factor solution's percentage (7%) of large non-redundant residuals was negligibly larger than the two-factor solution's percentage (1%), signifying that both the one- and the two-factor solution provided credible explanations for the observed correlation matrix.

The results for the Coloured sample indicated three factors with eigenvalues greater than unity. This is different from the results found for the White and Black group where only two factors qualified for extraction. The results for the rotated factor solution showed that factor 1 had three items (Q34, Q133 and Q184) with loadings greater than .50 and five items (Q9, Q59, Q108, Q109and Q184) with loadings greater than .30. One item (Q159) revealed a loading greater than .50 and one item (Q183) revealed a loading greater than .30 on factor 2. Factor 3 also revealed one item (Q158) with a loading greater than .30. The investigation revealed one item (Q84) that did not load on any of the three factors. The identity of the three extracted factors could not be inferred from any meaningful common theme shared by the items that loaded on the three factors.

Table 6.10 indicated satisfactory item loadings upon forcing a single factor. Three items (Q9, Q133 and Q184) had loadings greater than .50 and seven items (Q34, Q59, Q108, Q109, Q134, Q158 and Q159) had loadings greater than .30. Two items (Q84 and Q183) did not load on the forced single extracted factor.

A small percentage (3%) of non-redundant residuals with absolute values greater than .05 was obtained for the three-factor solution. The one-factor solution's percentage (21%) of non-redundant residuals, although substantially larger than that of the three-factor solution, was still sufficiently small to be regarded as a credible explanation for the observed correlation matrix.

Overall the dimensionality analyses results revealed two factors for the White group, two factors for the Black group and three factors for the Coloured group with eigenvalues greater than one for the *Expedient – Conscientious* subscale. This signifies the need for more than one factor to satisfactorily explain the observed correlations between the items in the subscale. Strictly speaking the unidimensionality assumption was therefore not corroborated.

The extraction of a single factor was forced, given the confirmatory nature of the study. It was found that the majority of items in the three groups obtained relatively strong loadings when forcing a single factor. Therefore the majority of the items can be said to represent the underlying latent variable well. The percentage of large residual correlations obtained for the single-factor solution was sufficiently small for all three samples to allow the single factor solution to be regarded as a permissible explanation for the observed correlation matrix. When the results are interpreted somewhat more leniently the position that a single common factor underlies the 12 items of the *Expedient – Conscientious* subscale therefore be may be regarded as plausible.

Table 6.10

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR G) OVER THE THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_FG_Q9	**.60**	15FQ+_FG_Q9	**.55**	15FQ+_FG_Q9	**.54**
15FQ+_FG_Q34	**.54**	15FQ+_FG_Q34	**.40**	15FQ+_FG_Q34	**.49**
15FQ+_FG_Q59	**.48**	15FQ+_FG_Q59	**.36**	15FQ+_FG_Q59	**.38**
15FQ+_FG_Q84	**.35**	15FQ+_FG_Q84	**.32**	15FQ+_FG_Q84	.23
15FQ+_FG_Q108	**.44**	15FQ+_FG_Q108	**.30**	15FQ+_FG_Q108	**.31**
15FQ+_FG_Q109	**.48**	15FQ+_FG_Q109	**.40**	15FQ+_FG_Q109	**.48**
15FQ+_FG_Q133	**.67**	15FQ+_FG_Q133	**.61**	15FQ+_FG_Q133	**.66**
15FQ+_FG_Q134	**.35**	15FQ+_FG_Q134	.24	15FQ+_FG_Q134	**.34**
15FQ+_FG_Q158	**.46**	15FQ+_FG_Q158	**.47**	15FQ+_FG_Q158	**.46**
15FQ+_FG_Q159	**.47**	15FQ+_FG_Q159	**.33**	15FQ+_FG_Q159	**.38**
15FQ+_FG_Q183	**.38**	15FQ+_FG_Q183	.29	15FQ+_FG_Q183	.25
15FQ+_FG_Q184	**.66**	15FQ+_FG_Q184	**.61**	15FQ+_FG_Q184	**.61**

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.1.7 Factor H

The results from the dimensionality analyses for the *Retiring – Socially bold* subscale in the White sample revealed a two-factor structure. The rotated factor solution resulted in the observation that factor 1 had five items (Q10, Q36, Q61, Q85 and Q135) with loadings greater than .50 and three items (Q11, Q35 and Q60) with loadings greater than .30. Factor 2 indicated one item (Q185) with a loading greater than .50 and two items (Q86 and Q110) with loadings greater than .30. The results revealed that only one item (Q160) did not load on any of the two factors. The identity of the two extracted factors could not be inferred from any meaningful common theme shared by the items that loaded on the two factors.

Upon forcing a single factor satisfactory factor loadings emerged (see Table 6.11). Eight items (Q10, Q11, Q36, Q61, Q85, Q86, Q135 and Q185) obtained loadings greater than .50 and four items (Q35, Q60, Q110 and Q160) obtained loadings greater than .30. Hence, all items loaded greater than .30 on the forced single factor.

Both the two-factor solution (19%) and one-factor solution (28%) showed a moderate percentage of non-redundant residuals with absolute values greater than .05. Both solutions provided a credible explanation for the observed correlation matrix, although the two-factor solution does provide a marginally better solution.

In the Black sample three clear factors emerged based on the eigen-values-greater than-unity rule. Two items (Q36 and Q85) with loadings greater than .50 and two items (Q10 and Q60) with loadings greater than .30 were revealed in the rotated factor solution for factor 1. Factor 2 revealed one item (Q185) with a loading greater than .50 and two items (Q160 and Q110) with loadings greater than .30. Two items (Q11 and Q35) with loadings of more than -.50 and two items (Q61 and Q135) with loadings of more than -.30 were revealed for factor 3. Only one item (Q86) did not load on any of the three factors. The identity of the three extracted factors could, however, not be inferred from any meaningful common theme shared by the items that loaded on the three factors.

When forcing a single factor, four items (Q11, Q36, Q85 and Q135) had loadings greater than .50 and eight items (Q10, Q35, Q60, Q61, Q86, Q110, Q185 and Q160) had loadings greater than .30. All items loaded greater than .30 on the forced single factor (see Table 6.11).

The one-factor solution percentage (22%) of large non-redundant residuals was larger than the three-factor solution's percentage (3%) revealing that the one-factor solution provided a less credible, but nonetheless still plausible explanation for the observed correlation matrix.

Similar to the results obtained for the Black sample, the results for the Coloured sample also revealed a three-factor structure. The pattern matrix (see Appendix 4) was evaluated. Factor 1 had four items (Q10, Q11, Q61 and Q135) with loadings greater than .50 and one item (Q35) with a loading greater than .30. Factor 2 indicated two items (Q110 and Q185) with loadings greater than .50 and two items (Q86 and Q160) with loadings greater than .30. Three items (Q36, Q60 and Q85) loaded on factor 3 with loadings greater than .50. All the items loaded greater than .30 on at least one of the three extracted factors. The identity of the three extracted factors could nonetheless not be inferred from any meaningful common theme shared by the items that loaded on the three factors.

Upon forcing a single factor, mostly satisfactory factor loadings emerged (see Table 6.11). Seven items (Q10, Q11, Q35, Q36, Q135, Q86 and Q85) obtained loadings greater than .50 whilst four items (Q60, Q61, Q160 and Q185) obtained loadings greater than .30. Only one item (Q110) did not load on the forced single extracted factor.

The three-factor solution revealed a small percentage (6%) of large non-redundant residuals with absolute values greater than .05. The one-factor solution's percentage (25%) of large non-redundant residuals with absolute values greater than .50 was, however, still sufficiently small to allow the one-factor solution to be put forward as a plausible explanation for the observed correlation matrix.

The dimensionality analyses results revealed two factors with eigenvalues greater than unity for the White sample signifying the need for two factors to satisfactorily explain the observed correlations between the items in the subscale. The results of the Black and Coloured groups revealed three factors with eigenvalues greater than one. Strictly speaking the unidimensionality assumption was therefore not corroborated.

The extraction of a single factor was forced and the majority of items in the three groups obtained relatively satisfactory loadings. The overall results provided strong evidence indicating that the majority of the items represent the underlying latent variable well. The percentage of large residual correlations obtained for the single-factor solution was sufficiently small for all three samples to allow the single factor solution to be regarded as a permissible explanation for the observed correlation matrix. When the results are interpreted somewhat more leniently the position that a single common factor underlies the 12 items of the *Retiring – Socially bold* subscale, therefore be may be regarded as plausible.

Table 6.11

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR H) OVER THE THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_FH_Q10	**.61**	15FQ+_FH_Q10	**.49**	15FQ+_FH_Q10	**.55**
15FQ+_FH_Q11	**.57**	15FQ+_FH_Q11	**.53**	15FQ+_FH_Q11	**.63**
15FQ+_FH_Q35	**.50**	15FQ+_FH_Q35	**.49**	15FQ+_FH_Q35	**.50**
15FQ+_FH_Q36	**.66**	15FQ+_FH_Q36	**.58**	15FQ+_FH_Q36	**.60**
15FQ+_FH_Q60	**.50**	15FQ+_FH_Q60	**.41**	15FQ+_FH_Q60	**.41**
15FQ+_FH_Q61	**.50**	15FQ+_FH_Q61	**.31**	15FQ+_FH_Q61	**.44**
15FQ+_FH_Q85	**.65**	15FQ+_FH_Q85	**.55**	15FQ+_FH_Q85	**.57**
15FQ+_FH_Q86	**.51**	15FQ+_FH_Q86	**.43**	15FQ+_FH_Q86	**.53**
15FQ+_FH_Q110	**.38**	15FQ+_FH_Q110	**.37**	15FQ+_FH_Q110	.24
15FQ+_FH_Q135	**.66**	15FQ+_FH_Q135	**.54**	15FQ+_FH_Q135	**.66**
15FQ+_FH_Q160	**.46**	15FQ+_FH_Q160	**.35**	15FQ+_FH_Q160	**.37**
15FQ+_FH_Q185	**.50**	15FQ+_FH_Q185	**.38**	15FQ+_FH_Q185	**.44**

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.1.8 Factor I

The dimensionality results from the *Tough minded – Tender minded* subscale for the White sample revealed that three factors underlie the subscale. The pattern matrix (see Appendix 4) indicated that two items (Q62 and Q87) had loadings greater than .50 and four items (Q12, Q136, Q161 and Q162) had loadings greater than .30 on factor 1. Factor 2 indicated three items (Q37, Q112 and Q137) with loadings greater than .50 and one item (Q186) with a loading greater than .30. Factor 3 indicated loadings with two items (Q162 and Q111) of more than -.30. Only one item (Q187) did not load on any of the three factors. The results revealed one item as a complex item (Q162) loading simultaneously on two factors (factor 1 and factor 3). The identity of the three extracted factors could nonetheless not be inferred from any meaningful common theme shared by the items that loaded on the three factors.

Table 6.12 revealed reasonable item loadings when forcing a single factor. Four items (Q62, Q111, Q137 and Q162) had loadings greater than .50 and seven items (Q12, Q37, Q87, Q112, Q136, Q161 and Q186) had loadings greater than .30. Only one item (Q187) did not load on the forced single factor.

The residual correlation matrix was calculated for both the two-factor and one-factor solutions. The two-factor solution showed a small percentage (7%) and the one-factor solution showed a relatively large percentage (36%) of non-redundant residuals with absolute values greater than .05. The finding for the one-factor solution implies that the crediblity of this solution as an explanation for the observed correlation matrix should be regarded as a bit tenuous but not altogether unreasonable.

Further to the results of the White sample, the results for the Black group revealed that not three, but four factors underlie the *Tough minded – Tender minded* subscale in this group. Factor 1 indicated one item (Q62) with a loading greater than .50 and three items (Q87, Q136 and Q161) with loadings greater than .30. Factor 2 indicated two items (Q37 and Q137) with loadings of more than -.50 and factor 3 indicated two items (Q111 and Q162) with loadings of more than -.50. Factor 4 indicated loadings with one item (Q186) greater than .50 and one item (Q187) greater than .30. Two items (Q112 and Q12) did not load on any of the four factors. The identity of the four extracted factors could not be inferred from any meaningful common theme shared by the items that loaded on the four factors.

Given the design intention in the development of the subscale a single factor was extracted. Table 6.12 generally indicated fairly low loadings for the single extracted factor. Only three items (Q111, Q137 and Q162) had loadings greater than .50 and five items (Q12, Q37, Q62, Q87 and Q136) had loadings greater than .30. Four item (Q112, Q161, Q186 and Q187) did not load on the forced single extracted factor.

The four-factor solution showed a small percentage (4%) of large non-redundant residuals and the one-factor solution showed a large percentage (37%) of non-redundant residuals with absolute values greater than .05. The one-factor solution therefore provided a somewhat borderline, but not altogether unreasonable explanation for the observed correlation matrix.

Similar to the results of the White group, the results for the Coloured sample also indicated that three factors should be extracted. Seven items obtained significant loadings above .30 on factor 1(Q12, Q62, Q87, Q111, Q136, Q161 and Q162). Two of these loadings exceeded the .50 cut-off value (Q62 and Q162). Factor 2 indicated two items (Q37 and Q137) with loadings greater than .50 and one item (Q112) with a loading greater than .30. Two items obtained loadings above .30 (Q186 and Q187) on factor 3. One item Q186 obtained a loading greater than .50. All items loaded greater than .30 on at least one of the three extracted factors. The identity of the three extracted factors could not be inferred from any meaningful common theme shared by the items that loaded on the three factors.

Upon forcing a single factor solution, all item loadings were reasonable (see Table 6.12). One item (Q137) had a loading greater than .50 and nine items (Q12, Q37, Q62, Q87, Q111. Q112, Q136, Q161 and Q162) had loadings greater than .30. Two items (Q186 and Q187) did not load on the forced single factor.

A small percentage (7%) of non-redundant residuals with absolute values greater than .05 was obtained for the three-factor solution. The one-factor solution showed a large percentage (39%) of large non-redundant residuals signifying that the one-factor solution provided a somewhat questionable, although not altogether implausible explanation for the observed correlation matrix.

Overall the dimensionality analyses results for the White and Coloured group indicated three factors with eigenvalues greater than unity. The Black group results revealed four factors with eigenvalues greater than unity. This signified the need for three factors to satisfactorily explain the observed correlations for the White and Coloured groups and four factors to satisfactorily explain the observed correlations between the items in the Black sample for this subscale. When applying a strict criterion the unidimensionality assumption was therefore not corroborated.

When the extraction of a single factor was forced for the White and Coloured samples the majority of items obtained reasonable loadings. Forcing the extraction of a single factor for the Black sample revealed fairly low factor loadings in comparison to the factor loadings of the White and Coloured groups. This phenomenon indicates that the majority of the items represent the underlying latent variable relatively well for the White and Coloured samples, but less well for the Black sample. The percentage of large residual correlations obtained for the single-factor solution was however large enough for all three samples to bring the credibility of the single factor solution as a permissible explanation for the observed correlation matrix into question but not so high to altogether rule it out as implausible. Therefore, even when the results are interpreted somewhat more leniently the position that a single common factor underlies the 12 items of the *Tough minded – Tender minded* subscale should be regarded as somewhat tenuous.

Table 6.12

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR I) OVER THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_FI_Q12	**.42**	15FQ+_FI_Q12	**.37**	15FQ+_FI_Q12	**.48**
15FQ+_FI_Q37	**.45**	15FQ+_FI_Q37	**.35**	15FQ+_FI_Q37	**.36**
15FQ+_FI_Q62	**.54**	15FQ+_FI_Q62	**.36**	15FQ+_FI_Q62	**.45**
15FQ+_FI_Q87	**.50**	15FQ+_FI_Q87	**.34**	15FQ+_FI_Q87	**.49**
15FQ+_FI_Q111	**.51**	15FQ+_FI_Q111	**.43**	15FQ+_FI_Q111	**.46**
15FQ+_FI_Q112	**.45**	15FQ+_FI_Q112	.30	15FQ+_FI_Q112	**.38**
15FQ+_FI_Q136	**.36**	15FQ+_FI_Q136	**.30**	15FQ+_FI_Q136	**.37**
15FQ+_FI_Q137	**.65**	15FQ+_FI_Q137	**.44**	15FQ+_FI_Q137	**.53**
15FQ+_FI_Q161	**.33**	15FQ+_FI_Q161	.27	15FQ+_FI_Q161	**.35**
15FQ+_FI_Q162	**.50**	15FQ+_FI_Q162	**.44**	15FQ+_FI_Q162	**.47**
15FQ+_FI_Q186	**.35**	15FQ+_FI_Q186	.22	15FQ+_FI_Q186	.28
15FQ+_FI_Q187	.18	15FQ+_FI_Q187	.29	15FQ+_FI_Q187	.22

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.1.9 Factor L

The results from the dimensionality analyses for the *Trusting – Suspicious* subscale in the White sample revealed three factors. Inspection of the rotated factor structure revealed that factor 1 had two items (Q14 and Q38) with loadings greater than .50 and three items (Q39, Q64 and Q88) with loadings greater than .30. Two items obtained loadings greater than .50 for factor 2 (Q89 and Q113). Factor 3 indicated one item (Q13) with a loading greater than .50 and three items (Q39, Q138 and Q163) with loadings greater than .30. Two items (Q63 and Q188) did not load on any of the three factors. One item revealed itself as a complex item (Q39) by simultaneously loading on two factors (factor 1 and factor 3). The identity of the three extracted factors could not be inferred from any meaningful common theme shared by the items that loaded on the three factors.

The loadings for the single extracted factor were reasonable (see Table 6.13). Four items (Q14, Q39, Q88 and Q163) had loadings greater than .50 and seven items (Q13, Q38, Q63, Q64, Q89, Q113 and Q138) had loadings greater than .30. One item (Q188) did not load on the single extracted factor.

The three-factor solution showed a small percentage (2%) of non-redundant residuals with absolute values greater than .05. The one-factor solution showed a large percentage (45%) of large non-redundant residuals. The one-factor solution showed a definite larger percentage of non-redundant residuals than the three-factor solution, signifying that the one-factor solution did not provide a credible explanation for the observed correlation matrix.

Similar to the results of the White group, the Black sample also revealed a three-factor structure. Factor 1 indicated one item (Q14) with a loading greater than .50 and one item (Q38) with a loading greater than .30. Factor 2 indicated two items (Q89 and Q113) with loadings more than -.50 and one item (Q88) with a loading more than -.30. Factor 3 indicated one item (Q163) with a loading greater than .50 and two items (Q13 and Q39) with loadings greater than .30. Four items (Q63, Q64, Q138 and Q188) did not load on any of the three factors. Again the identity of the three extracted factors could not be inferred from any meaningful common theme shared by the items that loaded on the three factors.

Upon forcing a single factor, extremely low item loadings were obtained (see Table 6.13). Seven items (Q14, Q38, Q39, Q88, Q89, Q113 and Q163) had loadings greater than .30 and five items (Q13, Q63, Q64, Q188 and Q138) did not load on the single extracted factor.

The residual correlation matrix was calculated for both the three-factor and one-factor solutions. The one-factor solution showed a larger but still sufficiently small percentage (34%) of large non-redundant residuals than the three-factor solution (1%), signifying that the one-factor solution was a less credible but nonetheless still plausible explanation for the observed correlation matrix.

Different to the results of the White and Black groups, the Coloured sample revealed two factors with eigenvalues greater than unity. Investigation of the pattern matrix (see Appendix 4) showed six items with significant loadings greater than .30 on factor 1 (Q13, Q14, Q38, Q39, Q138 and Q163) and three items (Q14, Q39 and Q163) had loadings greater than .50. Two items (Q89 and Q113) with loadings greater than .50 loaded on factor 2 and one item (Q88) with a loading greater than .30. Three items (Q63, Q64 and Q188) did not load on any of the two factors. Again the identity of the two extracted factors could not be inferred from any meaningful common theme shared by the items that loaded on the two factors.

Upon forcing a single factor, mostly low factor loadings emerged (see Table 6.13). Only three items (Q39, Q163 and Q14) had loadings greater than .50 and five items (Q13, Q38, Q88 Q113 and Q138) had loadings greater than .30. Four items (Q63, Q64, Q89 and Q188) did not load on the single extracted factor.

The two-factor solution showed a small percentage (9%) of non-redundant residuals with absolute values greater than .05. The one-factor solution showed a large percentage (40%) of large non-redundant residuals. The one-factor solution therefore did not really provide a credible explanation for the observed correlations matrix given the percentage above.

Overall the dimensionality analyses results indicated three factors with eigenvalues greater than unity for the White and Black groups and two factors with eigenvalues greater than unity for the Coloured group. This indicated that more than a single common underling factor was necessary to satisfactorily explain the observed correlations between the items in the subscale. Items Q63 and Q188 did not load on any of the factors across the three groups. Item Q188 also revealed itself as a problematic item in the item analysis. When applying a strict criterion the unidimensionality assumption was therefore not corroborated.

When the extraction of a single factor was forced the majority of items in the White sample obtained reasonable factor loadings and the majority of items in the Black and Coloured sample obtained low factor loadings. This phenomenon indicates that the majority of the items represent the underlying latent variable well in the White sample, but not the Black and Coloured samples. The percentage of large residual correlations obtained for the single-factor solution was moreover large enough for all three samples to bring the credibility of the single factor solution as a permissible explanation for the observed correlation matrix into question. Therefore, even when the results are interpreted somewhat more leniently the position is not supported that a single common factor underlies the 12 items of the *Trusting – Suspicious* subscale.

Table 6.13

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR L) OVER THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_FL_Q13	**.37**	15FQ+_FL_Q13	.29	15FQ+_FL_Q13	**.36**
15FQ+_FL_Q14	**.57**	15FQ+_FL_Q14	**.47**	15FQ+_FL_Q14	**.59**
15FQ+_FL_Q38	**.50**	15FQ+_FL_Q38	**.35**	15FQ+_FL_Q38	**.49**
15FQ+_FL_Q39	**.58**	15FQ+_FL_Q39	**.49**	15FQ+_FL_Q39	**.59**
15FQ+_FL_Q63	**.32**	15FQ+_FL_Q63	.22	15FQ+_FL_Q63	.28
15FQ+_FL_Q64	**.41**	15FQ+_FL_Q64	.25	15FQ+_FL_Q64	.30
15FQ+_FL_Q88	**.52**	15FQ+_FL_Q88	**.44**	15FQ+_FL_Q88	**.39**
15FQ+_FL_Q89	**.40**	15FQ+_FL_Q89	**.47**	15FQ+_FL_Q89	.30
15FQ+_FL_Q113	**.48**	15FQ+_FL_Q113	**.48**	15FQ+_FL_Q113	**.42**
15FQ+_FL_Q138	**.35**	15FQ+_FL_Q138	.25	15FQ+_FL_Q138	**.43**
15FQ+_FL_Q163	**.54**	15FQ+_FL_Q163	**.47**	15FQ+_FL_Q163	**.53**
15FQ+_FL_Q188	.25	15FQ+_FL_Q188	.12	15FQ+_FL_Q188	.20

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.1.10 Factor M

The results from the dimensionality analysis for the *Concrete – Abstract* subscale in the White sample revealed that four factors were needed to satisfactorily explain the observed correlations between the items in the subscale. Inspection of the rotated factor structure revealed one item (Q140) with a loading greater than .30 and four items (Q40, Q90, Q139 and Q165) with loadings greater than .50 on factor 1. Two items (Q65 and Q114) revealed a loading greater than .50 on factor 2. Factor 3 indicated one item (Q90) with a loading greater than .30 and three items (Q15, Q140 and Q164) with loadings greater than .50. Four items revealed substantial loadings on factor 4. Two items (Q15 and Q190) had loadings greater than .50 and two items (Q115 and Q189) had loadings greater than .30. Three items (Q15, Q90 and Q140) was revealed as complex items by loading simultaneously on two factors. The identity of the four extracted factors could not be inferred from any meaningful common theme shared by the items that loaded on the four factors.

Upon forcing a single factor eleven substantial factor loadings emerged (see Table 6.14). One item (Q139) had a loading greater than .50 and ten items (Q15, Q40, Q65, Q90, Q114, Q115, Q140, Q164, Q165 and Q190) had loadings greater than .30. One item (Q189) did not load on the single extracted factor.

A zero percentage of non-redundant residuals with absolute values greater than .05 were shown for the four-factor solution. The one-factor solution had an extremely large percentage (53%) of non-redundant, therefore, the one-factor solution failed to provide a credible explanation for the observed correlation matrix.

Similar to the results of the White sample, the results for the Black sample indicated four factors with eigenvalues greater than unity. Factor 1 indicated two items (Q65 and Q114) with loadings greater than .50 and one item (Q190) with a loading greater than .30. Factor 2 indicated one (Q139) item with a loading greater than .50 and two items (Q40 and Q165) with loadings greater than .30. Factor 3 indicated one item (Q15) with a loading greater than .50 and one item (Q164) with a loading greater than .30. Factor 4 indicated two items (Q90 and Q140) with loadings greater than .30. Two items (Q189 and Q115) did not load on any of the four factors. No meaningful common themes shared by the items that loaded on the four extracted factors could be identified.

The loadings for the single extracted factor were extremely low (see Table 6.14). Only two items (Q65 and Q190) obtained loadings greater than .50 and one item (Q114) had a loading greater than .30. Nine items (Q15, Q40, Q90, Q115, Q139, Q140, Q164, Q165 and Q189) did not load on the single extracted factor.

The four-factor solution showed a zero percentage of non-redundant residuals with absolute values greater than .05 and the one-factor solution had a larger but still sufficiently small percentage (31%) of large non-redundant. This result signified that the one-factor solution did provide a credible explanation for the observed correlation matrix, albeit less so than the four-factor solution.

Similar to the results of the White and Black groups, the results of the Coloured sample indicated four factors with eigenvalues greater than unity. Inspection of the pattern matrix (see Appendix 4) revealed that factor 1 had two items (Q65 and Q114) with loadings greater than .50. Factor 2 indicated one item (Q139) with a loading greater than .50 and four items (Q40, Q90, Q140 and Q165) with loadings greater than .30. Two items (Q15 and Q164) revealed substantial loadings of more than .30 on factor 3. Item Q164 loaded higher than .50 on factor 3. Factor 4 also indicated two items (Q189 and Q190) with loadings greater than .30. One item (Q115) did not load on any of the four factors. No meaningful common themes shared by the items that loaded on the four extracted factors could be identified.

Extremely low item loadings emerged when a single factor was forced (see Table 6.14). Five items (Q40, Q65, Q114, Q139 and Q165) had loadings greater than .30 and seven items (Q15, Q90, Q115, Q140, Q164, Q189 and Q190) did not load on the single extracted factor.

The four-factor solution showed a small percentage (3%) of non-redundant residuals with absolute values greater than .05 in contrast to the one-factor solution (51%). This result signified that the one-factor solution did not provide a credible explanation for the observed correlation matrix.

Overall the dimensionality analyses results consistently indicated four factors with eigenvalues greater than unity for this subscale across the three samples. Four factors are therefore needed to satisfactorily explain the observed correlations between the items in the subscale. Item Q115 did not load on any of the factors in the Coloured and Black groups. When applying a strict criterion the unidimensionality assumption was therefore not corroborated.

When the extraction of a single factor was forced the majority of items in the three groups obtained relatively low loadings. The results of the item analysis also revealed that the items could be flagged as possible poor items. Therefore it could be concluded that the majority of the items do not represent the underlying latent variable well. The percentage of large residual correlations obtained for the single-factor solution was moreover large enough for all three samples to bring the credibility of the single factor solution as a permissible explanation for the observed correlation matrix into question. Therefore even when the results are interpreted somewhat more leniently the position is not supported that a single common factor underlies the 12 items of the *Concrete – Abstract* subscale.

Table 6.14

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR M) OVER THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_FM_Q15	**.32**	15FQ+_FM_Q15	.01	15FQ+_FM_Q15	.18
15FQ+_FM_Q40	**.43**	15FQ+_FM_Q40	.132	15FQ+_FM_Q40	**.36**
15FQ+_FM_Q65	**.39**	15FQ+_FM_Q65	**.512**	15FQ+_FM_Q65	**.42**
15FQ+_FM_Q90	**.32**	15FQ+_FM_Q90	-.19	15FQ+_FM_Q90	.08
15FQ+_FM_Q114	**.37**	15FQ+_FM_Q114	**.476**	15FQ+_FM_Q114	**.47**
15FQ+_FM_Q115	**.33**	15FQ+_FM_Q115	.271	15FQ+_FM_Q115	.27
15FQ+_FM_Q139	**.56**	15FQ+_FM_Q139	.189	15FQ+_FM_Q139	**.46**
15FQ+_FM_Q140	**.40**	15FQ+_FM_Q140	-.10	15FQ+_FM_Q140	.14
15FQ+_FM_Q164	**.32**	15FQ+_FM_Q164	-.08	15FQ+_FM_Q164	.17
15FQ+_FM_Q165	**.49**	15FQ+_FM_Q165	.256	15FQ+_FM_Q165	**.34**
15FQ+_FM_Q189	.30	15FQ+_FM_Q189	.084	15FQ+_FM_Q189	.27
15FQ+_FM_Q190	**.35**	15FQ+_FM_Q190	**.502**	15FQ+_FM_Q190	.30

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.1.11 Factor N

A three-factor structure was revealed from the dimensionality analysis results of the White group for the *Direct – Restrained* subscale. Inspection of the rotated factor structure revealed a three-factor solution. Two items (Q42 and Q116) had loadings greater than .50 and four items (Q16, Q41, Q91 and Q166) had loadings greater than .30 on factor 1. Factor 2 indicated two items (Q66 and Q191) with loadings of more than -.50 and two items (Q67 and Q192) with loadings of more than -.30. Two items (Q17 and Q141) loaded more than -.50 on factor 3. All items loaded at least on one of the extracted factors. No meaningful common themes shared by the items that load on the three extracted factors could be identified.

Given the design intention with the development of the subscale a single factor was extracted. Table 6.15 revealed that the loadings for the single extracted factor were reasonable. Four items (Q91, Q92, Q116 and Q141) had loadings greater than .50 and eight items (Q16, Q17, Q41, Q42, Q66, Q67, Q166 and Q191) had loadings greater than .30. All items loaded greater than .30 on the forced single factor.

The residual correlation matrix was calculated for both the three-factor and the one-factor solutions. The one-factor solution revealed a larger but still acceptable percentage (36%) of large non-redundant residuals than the three-factor solution

(10%) indicating that the one-factor solution provided a less credible but still plausible explanation for the observed correlation matrix.

The results for the Black sample also revealed a three-factor structure. Six items (Q66, Q67, Q91, Q92, Q141 and Q191) revealed significant loadings greater than .30 on factor 1. Factor 2 indicated one item (Q42) with a loading greater than .50 and two items (Q41 and Q116) with loadings greater than .30. One item (Q166) revealed a substantial loading greater than .30 and one item (Q67) revealed a loading of more than -.30 on factor 3. Two items (Q16 and Q17) did not load on any of the extracted factors. One item (Q67) showed itself as a complex item by loading simultaneously on both factor 1 and factor 2. No meaningful common themes shared by the items that loaded on the three extracted factors could be identified.

Upon forcing a single factor extremely low factor loadings emerged (see Table 6.15). Only two items (Q91 and Q92) had loadings greater than .50 and four items (Q66, Q67, Q141 and Q191) had loadings greater than .30. Six items (Q16, Q17, Q41, Q42, Q116 and Q166) did not load on the forced single extracted factor.

The three-factor solution showed a small percentage (3%) of non-redundant residuals with absolute values greater than .05. The one-factor solution indicated a larger but still acceptably small percentage (21%) of large non-redundant residuals than the three-factor solution, signifying that although the three-factor solution provided a more credible explanation for the observed correlation matrix, the one-factor solution still constituted a plausible explanation.

Similar to the results of the White and Black groups, the results for the Coloured sample also revealed three factors with eigenvalues greater than unity. Examination of the rotated factor structure indicated that two items (Q67 and Q92) revealed substantial loadings greater than .50 on factor 1. Factor 2 indicated two items (Q42 and Q116) with loadings greater than .50 and two items (Q41 and Q91) with loadings greater than .30. Factor 3 indicated two items (Q66 and Q191) with loadings greater than .50 and one item (Q141) with a loading greater than .30. Three items (Q16, Q17 and Q166) did not load on any of the three factors. No meaningful common themes shared by the items that loaded on the three extracted factors could be identified.

Upon forcing a single factor reasonable loadings were revealed (Table 6.15). Three items (Q91, Q92 and Q141) had loadings greater than .50 and eight items (Q16, Q17, Q41, Q42, Q66, Q67, Q116 and Q191) had loadings greater than .30. Only one item (Q166) did not load on the forced single extracted factor.

The one-factor solution indicated a large percentage (30%) of large non-redundant residuals in comparison to the three-factor solution's small percentage (9%) of large non-redundant residuals. The one-factor solution, therefore, provided a less credible but still not altogether improbable explanation for the observed correlation matrix.

Taken together the dimensionality analyses results indicated three factors with eigenvalues greater than unity for this subscale across the three samples. Three factors were therefore needed to satisfactorily explain the observed correlations between the items in the subscale. Items Q16 and Q17 did not load on any of the factors in the Coloured and Black groups. Item Q166 did not load on any of the factors in the Coloured group and also showed itself as a possible problematic item in the item analysis results. When applying a strict criterion the unidimensionality assumption was therefore not corroborated.

With the extraction of a single factor the majority of items in the White and Coloured samples obtained relatively good loadings. However, the majority of the items in the Black sample obtained low loadings when a single factor was extracted. This indicates that the majority of the items represent the underlying latent variable well for the White and Coloured samples but not for the Black sample. The percentage of large residual correlations obtained for the single-factor solution was sufficiently small for all three samples to allow the one-factor solution to be regarded as a permissible explanation for the observed correlation matrix. Therefore, when the results are interpreted somewhat more leniently the position is to some degree supported that a single common factor underlies the 12 items of the *Direct – Restrained* subscale.

Table 6.15

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR N) OVER THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_FN_Q16	**.43**	15FQ+_FN_Q16	.21	15FQ+_FN_Q16	**.37**
15FQ+_FN_Q17	**.40**	15FQ+_FN_Q17	.22	15FQ+_FN_Q17	**.34**
15FQ+_FN_Q41	**.42**	15FQ+_FN_Q41	.25	15FQ+_FN_Q41	**.31**
15FQ+_FN_Q42	**.47**	15FQ+_FN_Q42	.27	15FQ+_FN_Q42	**.39**
15FQ+_FN_Q66	**.44**	15FQ+_FN_Q66	**.42**	15FQ+_FN_Q66	**.44**
15FQ+_FN_Q67	**.40**	15FQ+_FN_Q67	**.41**	15FQ+_FN_Q67	**.35**
15FQ+_FN_Q91	**.60**	15FQ+_FN_Q91	**.50**	15FQ+_FN_Q91	**.53**
15FQ+_FN_Q92	**.58**	15FQ+_FN_Q92	**.53**	15FQ+_FN_Q92	**.62**
15FQ+_FN_Q116	**.51**	15FQ+_FN_Q116	.28	15FQ+_FN_Q116	**.41**
15FQ+_FN_Q141	**.54**	15FQ+_FN_Q141	**.39**	15FQ+_FN_Q141	**.59**
15FQ+_FN_Q166	**.46**	15FQ+_FN_Q166	.16	15FQ+_FN_Q166	.18
15FQ+_FN_Q191	**.42**	15FQ+_FN_Q191	**.39**	15FQ+_FN_Q191	**.39**

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.1.12 Factor O

The results from the dimensionality analysis for the *Self-assured – Apprehensive* subscale in the White group revealed two factors with eigenvalues greater than unity. Factor 1 indicated one item (Q43) with a loading greater than .50 and four items (Q118, Q142, Q168 and Q193) with loadings greater than .30. Factor 2 indicated three items (Q68, Q117 and Q167) with loadings of more than -.50. Four items (Q18, Q93, Q143 and Q192) did not load on any of the two factors. No meaningful common themes shared by the items that loaded on the two extracted factors could be identified.

Table 6.16 revealed that when a single factor was forced, all items loaded in a satisfactory manner. Six items (Q68, Q117, Q142, Q167, Q192 and Q193) had loadings greater than .50 and six items (Q18, Q43, Q93, Q118, Q143 and Q168) had loadings greater than .30. All items loaded greater than .30 on the single extracted factor.

The residual correlation matrix was calculated for both the two-factor and one-factor solutions. The two-factor solution indicated a small percentage (7%) of non-redundant residuals with absolute values greater than .05, while for the one-factor solution sixteen percent (16%) of the non-redundant residuals were large. The difference in percentage is negligible which led to the conclusion that both factor solutions provide a credible explanation for the observed correlation matrix.

In contrast to the results of the White group, the Black group revealed four factors with eigenvalues greater than unity. The obliquely rotated pattern matrix (see Appendix 4) was investigated and factor 1 revealed three items (Q68, Q117 and Q167) with loadings greater than .50 and five items (Q18, Q142, Q192 and Q193) with loadings greater than .30. Factor 2 indicated two items (Q43 and Q168) with loadings greater than .50, one item (Q192) with a loading greater than .30 and one item (Q18) with a loading of more than -.30. Factor 3 indicated one item (Q93) with a loading greater than .50, one item (Q143) with a loading greater than .30 and one item (Q18) with a loading more than -.30. Three items (Q18, Q118 and Q193) revealed significant loadings greater than .30 on factor 4. Item Q118 revealed a loading greater than .50. Four items (Q18, Q143, Q192 and Q193) showed itself as problematic items by loading simultaneously on more than one factor. No meaningful common themes shared by the items that loaded on the four extracted factors could be identified.

Table 6.16 showed that when forcing a single factor the items generally loaded extremely low. Two items (Q68 and Q167) had loadings greater than .50 and four items (Q117, Q142, Q192 and Q193) had loadings greater than .30. Six items (Q18, Q43, Q93, Q118, Q143 and Q168) did not load on the single extracted factor.

The residual correlation matrix was calculated for both the four-factor and one-factor solutions. The four-factor solution indicated a zero percentage of non-redundant residuals with absolute values greater than .05. For the one-factor solution sixteen percent (16%) of the non-redundant residuals were large. Although the percentage of large residuals was larger for the one-factor solution than for the four-factor solution, the one-factor solution could still be regarded as a credible explanation for the observed correlation matrix.

For the Coloured sample three factors with eigenvalues greater than unity emerged. Three items (Q68, Q117 and Q167) revealed substantial loadings greater than .50 and three items (Q142, Q192 and Q193) revealed substantial loadings greater than .30 on factor 1. One item (Q43) had a loading greater than .50 on factor 2 and one item (Q118) had a loading greater than .50 on factor 3. Four items (Q18, Q93, Q143 and Q168) did not load on any of the three factors. No meaningful common themes shared by the items that loaded on the three extracted factors could, however, be identified.

Upon forcing a single extracted factor relative low item loadings emerged (see Table 6.16). Three items (Q68, Q117 and Q167) had loadings greater than .50 and four items (Q43, Q142, Q192 and Q193) had loadings greater than .30. Five items (Q18, Q93, Q118, Q143 and Q168) did not load on the single extracted factor.

The one-factor solution showed eighteen percent (18%) large non-redundant residuals and the three-factor solution showed six percent (6%) large non-redundant residuals. The percentage large residuals obtained for the one-factor solution was still sufficiently small to allow the one-factor solution to be regarded as a credible explanation for the observed correlation matrix.

Overall the results from the dimensionality analyses over the three groups indicated inconsistent results. Two factors for the White group, four factors for the Black group and three factors for the Coloured group revealed eigenvalues greater than unity for this subscale. This signifies the need for more than one factor to satisfactorily explain the observed correlations between the items in the subscale. The results revealed that items Q18 and Q143 could be regarded as possible problematic items. When applying a strict criterion the unidimensionality assumption was therefore not corroborated.

The extraction of a single factor was forced due to the confirmatory nature of the study. The results showed that the majority of items in the White sample had satisfactorily loadings. The items for the Black and Coloured sample revealed relatively low loadings when the extraction of a single factor was forced. This indicated that the majority of the items represent the underlying latent variable well for the White sample, but not for the Black and Coloured samples. The percentage of large residual correlations obtained for the single-factor solution was sufficiently small for all three samples to allow the one-factor solution to be regarded as a permissible explanation for the observed correlation matrix. Therefore, when the results are interpreted somewhat more leniently the position is supported that a single common factor underlies the 12 items of the *Self-assured – Apprehensive* subscale.

Table 6.16

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR O) OVER THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_FO_Q18	**.36**	15FQ+_FO_Q18	.272	15FQ+_FO_Q18	.24
15FQ+_FO_Q43	**.36**	15FQ+_FO_Q43	.254	15FQ+_FO_Q43	**.31**
15FQ+_FO_Q68	**.58**	15FQ+_FO_Q68	**.626**	15FQ+_FO_Q68	**.62**
15FQ+_FO_Q93	**.42**	15FQ+_FO_Q93	-.01	15FQ+_FO_Q93	.28
15FQ+_FO_Q117	**.51**	15FQ+_FO_Q117	**.457**	15FQ+_FO_Q117	**.51**
15FQ+_FO_Q118	**.38**	15FQ+_FO_Q118	.051	15FQ+_FO_Q118	.27
15FQ+_FO_Q142	**.50**	15FQ+_FO_Q142	**.459**	15FQ+_FO_Q142	**.48**
15FQ+_FO_Q143	**.45**	15FQ+_FO_Q143	.268	15FQ+_FO_Q143	.29
15FQ+_FO_Q167	**.63**	15FQ+_FO_Q167	**.625**	15FQ+_FO_Q167	**.59**
15FQ+_FO_Q168	**.31**	15FQ+_FO_Q168	.244	15FQ+_FO_Q168	.27
15FQ+_FO_Q192	**.53**	15FQ+_FO_Q192	**.47**	15FQ+_FO_Q192	**.49**
15FQ+_FO_Q193	**.55**	15FQ+_FO_Q193	**.379**	15FQ+_FO_Q193	**.44**

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.1.13 Factor Q_1

The *Conventional – Radical* subscale's results for the dimensionality analysis for the White sample revealed three factors. Examination of the obliquely rotated factor matrix indicated four items (Q19, Q44, Q94 and Q194) with substantial loadings greater than .30 for factor 1 and item Q44 revealed a loading greater than .50. Factor 2 indicated three items (Q45, Q70 and Q119) with loadings greater than .50 and two items (Q20 and Q95) with loadings greater than .30. Two items (Q69 and Q144) with loadings greater than -.50 was revealed for factor 3. One item (Q169) did not load on any of the three factors. No meaningful common themes shared by the items that loaded on the three extracted factors could, however, be identified.

Upon forcing a single factor, reasonable item loadings were obtained (see Table 6.17). Three items (Q70, Q144 and Q194) had loadings greater than .50 and eight items (Q19, Q20, Q44, Q45, Q69, Q94, Q119 and Q169) had loadings greater than .30. Only one item (Q95) did not load on the single extracted factor.

The three-factor solution showed a small percentage (1%) of non-redundant residuals with absolute values greater than .05. However, the one-factor solution showed a large percentage (53%) of large non-redundant residuals. This signified that the one-factor solution did not provide a credible explanation for the observed correlation matrix.

Different to the results of the White group, the results of the Black group indicated four factors with eigenvalues greater than unity. Factor 1 indicated two items (Q44 and Q69) with loadings greater than .50 and factor 2 indicted three items (Q45, Q70 and Q119) with loadings greater than .30. One item (Q44) with a loading greater than .50 and one item (Q94) with a loading greater than .30 was revealed for factor 3. Factor 4 indicated two items (Q19 and Q194) with loadings more than -.30. Three items (Q20, Q95 and Q169) did not load on any of the four factors. No meaningful common themes shared by the items that loaded on the four extracted factors could, however, be identified.

Upon forcing a single factor two items (Q69 and Q144) obtained loadings greater than .50 and three items (Q19, Q94 and Q194) had loadings greater than .30. Seven items (Q20, Q44, Q45, Q70, Q95, Q119 and Q169) did not load on the single extracted factor. The low factor loadings can be seen in Table 6.17.

A zero percentage of non-redundant residuals with absolute values greater than .05 were revealed for the four-factor solution. The one-factor solution showed a large percentage (46%) of non-redundant residuals. The one-factor solution, therefore, did not provide a credible explanation for the observed correlation matrix.

Similar to the results of the White sample, the results of the Coloured sample revealed three factors with eigenvalues greater than unity. The investigation of the pattern matrix (see Appendix 4) revealed that factor 1 had one item (Q44) with a loading greater than .50 and two items (Q19 and Q94) with loadings greater than .30. Factor 2 indicated two items (Q45 and Q70) with loadings greater than .50 and three items (Q20, Q95 and Q119) with loadings greater than .30. Factor 3 only indicated two items (Q69 and Q144) with loadings more than -.50. Two items (Q169 and Q194) did not load on any of the three factors. No meaningful common themes shared by the items that loaded on the three extracted factors could, however, be identified.

When a single factor was extracted fairly low item loadings emerged (see Table 6.17). Nine items (Q44, Q45, Q69, Q70, Q94, Q95, Q144, Q169 and Q194) had loadings greater than .30 and three items (Q19, Q20 and Q119) did not load on the single extracted factor.

The three-factor solution showed a small percentage (3%) of large non-redundant residuals but the one-factor solution showed a large percentage (56%) of large non-redundant residuals. This signified that the one-factor solution did not provide a credible explanation for the observed correlation matrix.

The dimensionality analyses results indicated that for the White and Coloured groups three factors are needed to satisfactorily explain the observed correlations between the items in the subscale. The results for the Black group indicated four factors with eigenvalues greater than unity for this subscale. Item Q169 did not load on any of the factors across the three groups. This item was not revealed as a problematic item in the item analyses conducted before the dimensionality analyses. When applying a strict criterion the unidimensionality assumption was therefore not corroborated.

When the extraction of a single factor was forced the majority of items in the three groups obtained reasonably to relatively low loadings which revealed that the majority of the items did not represent the underlying latent variable well with emphasis placed on item Q169. The percentage of large residual correlations obtained for the single-factor solution was moreover large enough for all three samples to bring the credibility of the single factor solution as a permissible explanation for the observed correlation matrix into question. Therefore, even when the results are interpreted somewhat more leniently the position is not supported that a single common factor underlies the 12 items of the *Conventional – Radical* subscale.

Table 6.17

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR Q_1) OVER THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_FQ1_Q19	**.37**	15FQ+_FQ1_Q19	**.33**	15FQ+_FQ1_Q19	.26
15FQ+_FQ1_Q20	**.30**	15FQ+_FQ1_Q20	.13	15FQ+_FQ1_Q20	.26
15FQ+_FQ1_Q44	**.43**	15FQ+_FQ1_Q44	.28	15FQ+_FQ1_Q44	**.42**
15FQ+_FQ1_Q45	**.43**	15FQ+_FQ1_Q45	.09	15FQ+_FQ1_Q45	**.34**
15FQ+_FQ1_Q69	**.49**	15FQ+_FQ1_Q69	**.56**	15FQ+_FQ1_Q69	**.41**
15FQ+_FQ1_Q70	**.54**	15FQ+_FQ1_Q70	.29	15FQ+_FQ1_Q70	**.5**
15FQ+_FQ1_Q94	**.38**	15FQ+_FQ1_Q94	**.38**	15FQ+_FQ1_Q94	**.35**
15FQ+_FQ1_Q95	.29	15FQ+_FQ1_Q95	.18	15FQ+_FQ1_Q95	**.36**
15FQ+_FQ1_Q119	**.38**	15FQ+_FQ1_Q119	.07	15FQ+_FQ1_Q119	.29
15FQ+_FQ1_Q144	**.52**	15FQ+_FQ1_Q144	**.58**	15FQ+_FQ1_Q144	**.40**
15FQ+_FQ1_Q169	**.43**	15FQ+_FQ1_Q169	.14	15FQ+_FQ1_Q169	**.36**
15FQ+_FQ1_Q194	**.55**	15FQ+_FQ1_Q194	**.47**	15FQ+_FQ1_Q194	**.48**

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.1.14 Factor Q_2

The results from the dimensionality analysis for the *Group orientated – Self sufficient* subscale in the White group resulted in two factors. Two factors showed eigenvalues greater than unity. Factor 1 indicated four items (Q71, Q146, Q195 and Q196) with loadings greater than .50 and five items (Q46, Q96, Q121, Q145 and Q170) with loadings greater than .30. Two items (Q21 and Q171) revealed substantial loadings greater than .30 on factor 2 with one item (Q171) obtaining a loading greater than .50. Only one item (Q120) did not load on any of the two factors. No meaningful common themes shared by the items that loaded on the two extracted factors could, however, be identified.

Table 6.18 revealed mostly satisfactory loadings upon forcing a single factor. Six items (Q71, Q96, Q121, Q146, Q195 and Q196) had loadings greater than .50 and four items (Q46, Q145, Q170 and Q171) had loadings greater than .30. Two items (Q21 and Q120) did not load on the single extracted factor.

The residual correlation matrix was calculated for both the two-factor and the one-factor solutions. The two-factor solution indicated a relative small percentage (7%) and the one-factor solution indicated a larger but nonetheless still acceptably small percentage (22%) of non-redundant residuals with absolute values greater than .05.

The one-factor solution therefore provided a less credible, but still plausible explanation for the observed correlation matrix.

The results for the Black group revealed a three-factor structure. An examination of the obliquely rotated pattern matrix revealed that factor 1 had one item (Q146) with a loading greater than .50 and three items (Q71, Q121 and Q196) with loadings greater than .30. Two items (Q21 and Q171) revealed significant loadings greater than .30 for factor 2 and item Q171 obtained a loading greater than .50. Factor 3 also indicated two items (Q170 and Q195) with significant loadings greater than .30 with item Q170 obtaining a loading greater than .50. Four items (Q46, Q96, Q120 and Q145) did not load on any of the three factors. No meaningful common themes shared by the items that loaded on the three extracted factors could, however, be identified.

Table 6.18 shows that when the single factor was forced generally low item loadings emerged. Two items (Q146 and Q196) had loadings greater than .50 and six items (Q71, Q96, Q121, Q145, Q170 and Q195) had loadings greater than .30. Four items (Q21, Q46, Q120 and Q121) did not load on the single extracted factor.

A small percentage (1%) of non-redundant residuals with absolute values greater than .05 was revealed for the three-factor solution. The one-factor solution's percentage (21%) of non-redundant residuals was larger than the three-factor solution, signifying that the one-factor solution offered a less credible but still permissible explanation for the observed correlation matrix.

Similar to the results of the Black group, the Coloured group showed three factors with eigenvalues greater than unity. Factor 1 indicated three items (Q71, Q146 and Q196) with loadings greater than .50 and four items (Q96, Q121, Q145 and Q196) with loadings greater than .30. As with the results for the White and the Black groups factor 2 of the Coloured group also indicated two items (Q21 and Q171) with substantial loadings greater than .30 and with item Q171 obtaining a loading greater than .50. Factor 3 indicated one item (Q170) with a loading greater than .50 and two items (Q46 and Q120) did not load on any of the three factors. No meaningful common themes shared by the items that loaded on the three extracted factors could, however, be identified.

Upon forcing a single factor three items (Q96, Q146 and Q196) obtained loadings greater than .50 and six items (Q71, Q121, Q145, Q170, Q171 and Q196) had loadings greater than .30. Three items (Q21, Q46 and Q120) did not load on the single extracted factor. Table 6.18 presents these satisfactory loadings that emerged.

The three-factor solution showed a small percentage (3%) of non-redundant residuals with absolute values greater than .05. The one-factor solution's percentage (22%) of large non-redundant residuals was larger than the three factor solution, but still sufficiently small to be regarded as a credible explanation of the observed correlation matrix.

The dimensionality analyses results for the White group revealed two factors with eigenvalues greater than unity, whilst for the Black and Coloured groups three factors emerged for this subscale. This signified the need for more than one factor to satisfactorily explain the observed correlations between the items in the subscale for all three groups. Item Q120 did not load on any of the factors across the three groups. Item Q120 was also identified as a poor item in the item analyses results especially for the White and Coloured groups. When applying a strict criterion the unidimensionality assumption was therefore not corroborated.

The extraction of a single factor for the White and Coloured samples revealed items with satisfactory loadings. The results of the Black sample revealed extremely low loadings when the extraction of a single factor was forced. This indicated that the majority of the items represented the underlying latent variable well in the White and Coloured samples (with the exception of item Q120), but not for the Black sample . The percentage of large residual correlations obtained for the single-factor solution was sufficiently small for all three samples to allow the one-factor solution to be regarded as a permissible explanation for the observed correlation matrix. Therefore when the results are interpreted somewhat more leniently the position is supported that a single common factor underlies the 12 items of the *Group orientated – Self sufficient* subscale.

Table 6.18

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR Q_2) OVER THE THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_FQ2_Q21	.20	15FQ+_FQ2_Q21	.24	15FQ+_FQ2_Q21	.15
15FQ+_FQ2_Q46	**.33**	15FQ+_FQ2_Q46	.14	15FQ+_FQ2_Q46	.28
15FQ+_FQ2_Q71	**.58**	15FQ+_FQ2_Q71	**.37**	15FQ+_FQ2_Q71	**.47**
15FQ+_FQ2_Q96	**.53**	15FQ+_FQ2_Q96	**.39**	15FQ+_FQ2_Q96	**.51**
15FQ+_FQ2_Q120	.22	15FQ+_FQ2_Q120	.21	15FQ+_FQ2_Q120	.13
15FQ+_FQ2_Q121	**.50**	15FQ+_FQ2_Q121	**.47**	15FQ+_FQ2_Q121	**.44**
15FQ+_FQ2_Q145	**.39**	15FQ+_FQ2_Q145	**.32**	15FQ+_FQ2_Q145	**.36**
15FQ+_FQ2_Q146	**.65**	15FQ+_FQ2_Q146	**.53**	15FQ+_FQ2_Q146	**.56**
15FQ+_FQ2_Q170	**.46**	15FQ+_FQ2_Q170	**.39**	15FQ+_FQ2_Q170	**.38**
15FQ+_FQ2_Q171	**.37**	15FQ+_FQ2_Q171	.29	15FQ+_FQ2_Q171	**.32**
15FQ+_FQ2_Q195	**.54**	15FQ+_FQ2_Q195	**.39**	15FQ+_FQ2_Q195	**.49**
15FQ+_FQ2_Q196	**.64**	15FQ+_FQ2_Q196	**.53**	15FQ+_FQ2_Q196	**.58**

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.1.15 Factor Q_3

The dimensionality analysis results for the *Informal – Self-disciplined* subscale in the White sample showed a three-factor structure. The investigation of the pattern matrix (see Appendix 4) revealed that factor 1 had two items (Q122 and Q197) with loadings greater than .50 and two items (Q48 and Q72) with loadings greater than .30. Two items (Q22 and Q147) with loadings of more than -.50 loaded on factor 2. Factor 3 indicated one item (Q73) with a loading of more than -.50 and one item (Q23) with a loading of more than -.30. Four items (Q47, Q97, Q98 and Q172) did not load on any of the three factors. No meaningful common themes shared by the items that load on the three extracted factors could, however, be identified.

Table 6.19 indicates when a single factor was extracted; the loadings for the factor were fairly low. Two items (Q48 and Q197) had loadings greater than .50 and eight items (Q22, Q23, Q47, Q73, Q98, Q122, Q147 and Q172) had loadings greater than .30. Two items (Q97 and Q72) did not load on the single extracted factor.

A small percentage (1%) of non-redundant residuals with absolute values greater than .05 was revealed for the three-factor solution in comparison to the one-factor solution's percentage (25%) of large non-redundant residuals. This signified that the one-factor solution provided a less credible, but nonetheless still permissible explanation for the observed correlation matrix.

The results for the Black group indicated four factors with eigenvalues greater than unity. Two items (Q23 and Q73) revealed substantial loadings greater than .30 on factor 1. Item Q73 revealed a loading of greater than .50 on factor 1. One item (Q122) with a loading greater than .30 loaded on factor 2. Factor 3 indicated one item (Q147) with a loading of more than -.50 and one item (Q22) with a loading of more than -.30. Two items (Q48 and Q197) with loadings greater than .30 loaded on factor 4. Five items (Q47, Q72, Q97, Q98 and Q172) did not load on any of the four factors. No meaningful common themes shared by the items that loaded on the four extracted factors could, however, be identified.

Upon forcing a single factor fair factor loadings emerged (see table 6.19). Eight items (Q22, Q23, Q48, Q73, Q97, Q122, Q147 and Q197) had loadings greater than .30 and four items (Q47, Q72, Q98 and Q172) did not load on the single extracted factor.

The four-factor solution showed a zero percentage of non-redundant residuals with absolute values greater than .05. Although the one factor solution's percentage (9%) of large non-redundant residuals was larger than that of the four-factor solution, it nonetheless was sufficiently small to conclude with reasonable confidence that the one-factor solution provided a credible explanation for the observed correlation matrix.

The results for the Coloured sample indicated three factors with eigenvalues greater than unity. The obliquely rotated factor structure revealed that factor 1 indicated two items (Q22 and Q147) with loadings greater than .50. Factor 2 and factor 3 also indicated two items respectively with substantial loadings. Item Q197 had a loading greater than .50 and item Q48 had a loading greater than .30 on factor 2. Item Q73 had a loading greater than .50 and item Q122 had a loading greater than .30 on factor 3. Six items (Q23, Q47, Q72, Q97, Q98 and Q172) did not load on any of the three factors. No meaningful common themes shared by the items that loaded on the three extracted factors could, however, be identified.

Upon forcing a single factor, rather low item loadings were obtained (see Table 6.19). Only one item (Q147) had a loading greater than .50 and six items (Q22, Q23, Q73, Q98, Q122 and Q197) had loadings greater than .30. Five items (Q47, Q48, Q72, Q97 and Q172) did not load on the single extracted factor.

The one-factor solution's percentage (31%) of large non-redundant residuals was larger than that of the three-factor solution (7%) but still sufficiently small to conclude with reasonable confidence that the one-factor solution provided a permissable explanation of the observed correlation matrix.

The results from the dimensionality analyses for the White and Coloured groups indicated three factors with eigenvalues greater than unity for this subscale. The results for the Black group revealed four factors were needed to satisfactorily explain the observed correlations between the items in the subscale. Items Q47, Q97, Q98 and Q172 did not load on any of the factors across the three groups. When applying a strict criterion the unidimensionality assumption was therefore not corroborated.

When the extraction of a single factor was forced the majority of items in the three groups obtained fairly low loadings. This phenomenon indicated that the majority of the items did not represent the underlying latent variable well. The percentage of large residual correlations obtained for the single-factor solution was sufficiently small for all three samples to allow the one-factor solution to be regarded as a permissible explanation for the observed correlation matrix. Therefore, when the results are interpreted somewhat more leniently the position is supported that a single common factor underlies the 12 items of the *Informal – Self-disciplined* subscale.

Table 6.19

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR Q_3) OVER THE THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_FQ3_Q22	**.41**	15FQ+_FQ3_Q22	**.35**	15FQ+_FQ3_Q22	**.48**
15FQ+_FQ3_Q23	**.43**	15FQ+_FQ3_Q23	**.32**	15FQ+_FQ3_Q23	**.38**
15FQ+_FQ3_Q47	**.30**	15FQ+_FQ3_Q47	.12	15FQ+_FQ3_Q47	.21
15FQ+_FQ3_Q48	**.50**	15FQ+_FQ3_Q48	**.31**	15FQ+_FQ3_Q48	.24
15FQ+_FQ3_Q72	.30	15FQ+_FQ3_Q72	.23	15FQ+_FQ3_Q72	.15
15FQ+_FQ3_Q73	**.45**	15FQ+_FQ3_Q73	**.39**	15FQ+_FQ3_Q73	**.38**
15FQ+_FQ3_Q97	.22	15FQ+_FQ3_Q97	**.32**	15FQ+_FQ3_Q97	.27
15FQ+_FQ3_Q98	**.32**	15FQ+_FQ3_Q98	.16	15FQ+_FQ3_Q98	**.32**
15FQ+_FQ3_Q122	**.50**	15FQ+_FQ3_Q122	**.37**	15FQ+_FQ3_Q122	**.38**
15FQ+_FQ3_Q147	**.43**	15FQ+_FQ3_Q147	**.43**	15FQ+_FQ3_Q147	**.57**
15FQ+_FQ3_Q172	**.41**	15FQ+_FQ3_Q172	.20	15FQ+_FQ3_Q172	.28
15FQ+_FQ3_Q197	**.53**	15FQ+_FQ3_Q197	**.37**	15FQ+_FQ3_Q197	**.34**

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.1.16 Factor Q_4

The results from the dimensionality analysis for the *Composed – Tense driven* subscale in the White sample showed two factors with eigenvalues greater than unity. Inspection of the pattern matrix (see Appendix 4) revealed that factor 1 indicated four items (Q74, Q99, Q174 and Q198) with loadings greater than .50 and three items (Q49, Q123 and Q173) with loadings greater than .30. Factor 2 indicated one item (Q199) with a loading greater than .50 and two items (Q149 and Q124) with loadings greater than .30. Two items (Q24 and Q148) did not load on any of the two factors. The identity of the two extracted factors could not be inferred from any meaningful common theme shared by the items that loaded on the two factors.

Upon forcing a single factor, mostly satisfactory factor loadings emerged (see Table 6.20). Six items (Q74, Q99, Q49, Q173, Q174 and Q198) had loadings greater than .50 and six items (Q24, Q123, Q124, Q148, Q149, and Q199) had loadings greater than .30. All the items loaded on the single extracted factor.

The two-factor solution showed a small percentage (4%) of non-redundant residuals with absolute values greater than .05. The one-factor solution's percentage (19%) of large non-redundant residuals, although larger than that of the two-factor solution, nonetheless was still sufficiently small to allow the interpretation of the one-factor solution as a credible explanation of the observed correlation matrix.

In contrast to the results of the White group, the results of the Black group revealed three factors with eigenvalues greater than unity. Factor 1 indicated one item (Q199) with a loading greater than .50 and three items (Q24, Q148 and Q173) with loadings greater than .30. Two items (Q174 and Q199) with substantial loadings greater than .30 was revealed for factor 2 with item Q199 obtaining a loading greater than .50. One item (Q198) loaded more than -.30 on factor 3 whilst five items (Q49, Q74, Q123, Q124 and Q149) did not load on any of the three factors. The identity of the three extracted factors could not be inferred from any meaningful common theme shared by the items that loaded on the factors.

Table 6.20 revealed reasonable loadings when a single factor was extracted. Ten items (Q24, Q49, Q74, Q99, Q148, Q149, Q173, Q174, Q198 and Q199) had loadings greater than .30 and two items (Q123 and Q124) did not load on the single extracted factor.

The one-factor solution's percentage (30%) of large non-redundant residuals, although larger than that of the three-factor solution (1%), was nonetheless borderline acceptable to thereby signifying that the one-factor solution could be seen as a reasonably credible explanation for the observed correlation matrix.

Similar to the results of the Black group, the results of the Coloured group indicated three factors with eigenvalues greater than unity. Examination of the obliquely rotated factor structure indicated one item (Q99) with a loading greater than .50 and four items (Q49, Q74, Q174 and Q198) with loadings greater than .30 on factor 1. Factor 2 indicated one item (Q199) with a loading greater than .50 and three items (Q24, Q149 and Q198) with loadings greater than .30. One item (Q173) with a loading of more than -.50 and one item (Q174) with a loading of more than -.30 was revealed for factor 3. Three items (Q123, Q124 and Q148) did not load on any of the three factors. Two items (Q174 and Q198) showed itself as complex items by loading on two factors simultaneously. The identity of the three extracted factors could not be inferred from any meaningful common theme shared by the items that loaded on the factors.

Given the confirmatory nature of the study a single factor was extracted and the item loadings obtained were reasonable (see Table 6.20). Three items (Q74, Q99 and Q173) had loadings greater than .50 and eight items (Q24, Q49, Q123, Q148, Q149, Q174, Q198 and Q199) had loadings greater than .40. Only one item (Q124) did not load on the single extracted factor.

The residual correlation matrix was calculated for both the three-factor and the one-factor solutions. Although the one-factor solution's percentage (24%) of large non-redundant residuals was larger than that of the three-factor solution (3%) the percentage was nonetheless sufficiently small to warrant interpreting the one-factor solution as a credible explanation of the observed correlation matrix.

Overall the dimensionality analyses results indicated three factors with eigenvalues greater than unity for the Black and Coloured samples. The White sample revealed two factors with eigenvalues greater than unity. More than one factor was therefore consistently necessary to satisfactorily explain the observed correlations between the items in the subscale. Item Q148 did not load on any of the factors in the White and Coloured analyses and items Q123 and Q124 did not load on any of the factors in the Black and Coloured analyses. When applying a strict criterion the unidimensionality assumption was therefore not corroborated.

With the extraction of a single factor the majority of items in the three groups obtained relatively good loadings indicating that the majority of the items represent the underlying latent variable well. The percentage of large residual correlations obtained for the single-factor solution was sufficiently small for all three samples to allow the one-factor solution to be regarded as a permissible explanation for the observed correlation matrix. Therefore when the results are interpreted somewhat more leniently the position is supported that a single common factor underlies the 12 items of the *Composed – Tense driven* subscale.

Table 6.20

FACTOR MATRIX WHEN FORCING THE EXTRACTION OF A SINGLE FACTOR (FACTOR Q_4) OVER THE THREE ETHNIC GROUP SAMPLES

White Sample		Black Sample		Coloured Sample	
15FQ+_FQ4_Q24	**.45**	15FQ+_FQ4_Q24	**.35**	15FQ+_FQ4_Q24	**.42**
15FQ+_FQ4_Q49	**.51**	15FQ+_FQ4_Q49	**.40**	15FQ+_FQ4_Q49	**.39**
15FQ+_FQ4_Q74	**.72**	15FQ+_FQ4_Q74	**.34**	15FQ+_FQ4_Q74	**.59**
15FQ+_FQ4_Q99	**.65**	15FQ+_FQ4_Q99	**.32**	15FQ+_FQ4_Q99	**.53**
15FQ+_FQ4_Q123	**.39**	15FQ+_FQ4_Q123	.21	15FQ+_FQ4_Q123	**.36**
15FQ+_FQ4_Q124	**.35**	15FQ+_FQ4_Q124	.10	15FQ+_FQ4_Q124	.29
15FQ+_FQ4_Q148	**.44**	15FQ+_FQ4_Q148	**.32**	15FQ+_FQ4_Q148	**.41**
15FQ+_FQ4_Q149	**.43**	15FQ+_FQ4_Q149	**.34**	15FQ+_FQ4_Q149	**.37**
15FQ+_FQ4_Q173	**.51**	15FQ+_FQ4_Q173	**.40**	15FQ+_FQ4_Q173	**.51**
15FQ+_FQ4_Q174	**.54**	15FQ+_FQ4_Q174	**.34**	15FQ+_FQ4_Q174	**.49**
15FQ+_FQ4_Q198	**.57**	15FQ+_FQ4_Q198	**.38**	15FQ+_FQ4_Q198	**.48**
15FQ+_FQ4_Q199	**.46**	15FQ+_FQ4_Q199	**.42**	15FQ+_FQ4_Q199	**.47**

The items that have been highlighted can be considered satisfactory in terms of the proportion of item variance that can be explained by the single extracted factor.

6.2.2 Summary of dimensionality analysis results

The purpose of the dimensionality analyses was to gain insight into whether the only common source of variance in the different subscales of indicator variables is in fact the latent variable the subscale intended to measure. The exploratory factor analysis is not able to conclusively verify that a single extracted factor is in fact the focal latent personality dimension. The exploratory factor analysis can, however, conclusively verify that more than a single common underlying latent variable is responsible for variance in the subscale items. The dimensionality analysis in addition assisted in gaining an understanding about the psychometric integrity of the items that represents each of the latent personality variables. Unidimensionality occurs when the observed inter-item correlation matrix can be satisfactorily explained (i.e., the percentage large residual correlations is small) by a single common underlying factor and all items display satisfactory loadings (i.e., $\lambda_{i1} \geq .50$) on the single extracted factors (Hair et al., 2006). Therefore the dimensionality analyses could provide valuable information regarding the items as per the *a priori* specified factor structure of the 15FQ+ and reasons for possible poor model fit in the subsequent confirmatory factor analyses.

The results of the dimensionality analyses were not what one would have expected if the design intention of the 15FQ+ across the three groups would have succeeded. A number of observations can be made regarding the dimensionality analyses results across the three groups. Firstly, the analyses indicated more than one factor with eigenvalues greater than unity for all the subscales across the three groups. This indicated the need for more than one factor to satisfactorily explain the observed correlations between the items in the all the subscales for all three groups. In no case could a single underlying factor provide the optimal explanation for the observed correlation matrix. When applying strict criteria set out for unidimensionality the unidimensionality assumption was therefore not corroborated for any of the 16 subscales.

Secondly this finding raised the question whether a single-factor solution could not at least satisfactorily account for the observed correlation matrix, although not optimally. In 11 cases the percentage of large residual correlations obtained for the single-factor solution was sufficiently small for all three samples to allow the one-factor solution to be regarded as a permissible explanation for the observed correlation matrix. Therefore when the results were interpreted somewhat more leniently the position was supported that a single common factor underlies the 12 items of 11 of the 16 subscales over the three ethnic groups.

Thirdly, the investigation of how well the items represent a single underlying factor indicated that the items represent an underlying latent variable reasonably well for most of the subscales in the White group, and for most of the subscales in the Coloured group. However, for the Black group the items did not seem to represent a single underlying factor very well. The extraction of a single factor therefore signified that the majority of items represent the underlying variables in the White and Coloured group with little support indicating the items reflecting one invisible underlying theme for the Black group. Factor E, factor M, factor N, factor O and factor Q_1 of the Black sample and factor M of the Coloured sample obtained extremely low factor loadings upon forcing a single factor. This indicates that the items in these subscales do not represent the underlying latent variable well.

Fourthly the question arises whether the above mentioned results could possibly have been explained in terms of the suppressor principle? The foregoing results could be attributed to the suppressor principle if all twelve items in the subscales showed a reasonably high loading on the first factor. A reasonable high loading would have been greater than .50 which would mean that the first factor is at least responsible for 25% of the variance in each of the items in the subscale. To meet the requirements of the suppressor principle the extraction of a single factor or the extraction of multiple factors with satisfactory loadings on the first factor would have been sufficient. This was however not found for any of the subscales and therefore the suppressor effect could not be regarded as a reason for more than one factor revealing eigenvalues greater than unity.

In general the dimensionality analyses indicated mixed results for and against the design assumption that all items comprising the specific subscale reflect one invisible underlying theme. Generally, the residual correlations calculated from the inter-item correlation matrices and the reproduced matrices indicated that the initial solutions, prior to forcing a single factor, provided a more convincing explanation for the observed inter-item correlation matrices. This is suggestive that these factors could be better explained by further sub facets of the personality construct. The 15FQ+ instrument does not however make provision for the subdivision of factors. Neither could the identity of the extracted factors be inferred from any meaningful common themes shared by the items that loaded on the factors.

Based on the observations made from the dimensionality analyses results it may be expected that the model fit could be jeopardized in the subsequent analysis that was conducted. The results indicated the possibility that the 15FQ+ may not define the personality construct as per the design intention of the instrument. This seemed to be more of a problem for the results from the Black group, than for the other two groups.

6.3 EVALUATION OF THE 15FQ+ SINGLE-GROUP MEASUREMENT MODEL

6.3.1 Variable type

As stated in chapter 5, fitting the single- and multi-group measurement models with individual items as indicator variables is preferred when conducting tests of measurement invariance and equivalence. Marsh et al., (1998) cautioned that solutions in CFA tend to be better when larger numbers of indicator variables are used to represent latent variables. In addition, the use of individual items as indicator variables will prevent poor items from hiding in item parcels. In this study the initial proposal was to conduct the test of measurement invariance and equivalence across all three groups using item level data. The initially proposed CFA utilising item level data was conducted with LISREL 9 which, unfortunately, returned unsuccessful results. Scientific Software International (SSI)[12] was contacted in an attempt to find solutions for the reason why the model did not want to run successfully. They advised that the unsuccessful results were produced due to a lack of the current memory capacity of the computer that was being utilised, and that the measurement model was too complex for the current 64-bit LISREL programme (Personal Communication with Gerhard Mels, 2012). The problem was that the calculation of the inverse of the estimated asymptotic covariance matrices requires extremely large memory capacity (Personal Communication with Gerhard Mels, 2012). Consequently, item parcelling was an unavoidable practical necessity to solve the impasse created by the memory problem in this study. Item parcelling reduced the number of measurement model parameters that have to be estimated, resulting in a less complex model. More importantly it reduces the order of the covariance and asymptotic covariance matrices. It was decided to determine the largest number of observed variables that could be used which would provide successful results with LISREL 9. The multi-group CFA ran successfully on the three single groups with a model where the 16 latent variables were each operationalised by 6 item parcels consisting of two items per parcel (resulting in 96 observed variables).

The creation of parcels was the only feasible solution to performing CFA on the respective samples. A number of different approaches can be taken when generating item parcels. These approaches could include: (i) a qualitative investigation into the content of items and allocating parcels accordingly, (ii) investigating the internal consistency of the scale and allocating items accordingly, (iii) using factor loading information resulting from an exploratory factor analysis, as well as (iv) the use of descriptive statistic information (Nasser, Takahashi & Benson, 1997). These approaches could be considered as logical quantitative approaches to specifying item parcels (Hall, Snell &Foust, 1999). A further approach that could be considered is a random combination of items as per sub-scale (Hall et al., 1999; Kim & Hagtvet, 2003). Some researchers recommend making use of a logical method as opposed to a random item selection (e.g., Bandalos, 2002; Hall et al., 1999; Sass & Smith, 2006). The construction of item parcels based on factor loadings would make sense if the unidimensionality assumption would have been supported and if

[12] Scientific Software International (SSI) developed and markets LISREL

meaningful factor fission would have occurred. This procedure would then result in item parcels that measure their single underlying latent variables approximately equally well. The construction of item parcels based on factor loadings did not make sense in this study since the instrument does not make provision for the subdivision of factors. The 15FQ+ makes provision for the fusion of the 16 primary factors into five global factors but no provision is made for the fission of the primary factors into narrower more specific sub-factors. Parcels according to factor loadings will not reflect the design intentions of the test developers and the use of such parcels would therefore result in a questionable test of the extent to which the original design intentions succeeded. Based on the above, it therefore seemed more appropriate to use a random selection approach in creating the parcels. The items were divided randomly into six parcels with two items in each parcel. Item parcels were randomly created by sorting items in a top-down fashion. The top-down assignment was based on where the items where situated, for example, the first and second, third and fourth, fifth and six etc. This resulted in 96 (16 sub-scales with 6 parcels) item parcels being created to represent the observed variables per latent variable.

The 15FQ+ utilises a three-point Likert-type response scale. This data are referred to as ordinal data. If the individual items were used to represent the latent variables in the measurement model they would have been treated as ordinal variables. Using item parcels rather than item level raw data converted the ordinal data into continuous data. Hence, the composite indicator variables were treated as continuous variables. In addition, because this study has as its objective the investigation of measurement bias in the 15FQ+ the intercepts of the regression of the indicator variables on the latent variables needed to be modelled, therefore the observed variables needed to be treated as continuous variables.

6.3.2 Missing values

The data used for this study was drawn from a large archival database of the 15FQ+ psychometric test scores provided by a test distributor. The information provided included raw item scores for all relevant ethnic groups and self-reported biographical information including gender, age, language, education and ethnic group origin. No missing values on any of the items were evident in the data that was received from the participating company. Hence, no remedy (options described in chapter 5) was necessary to treat missing values in this study.

6.3.3 Evaluation of multivariate normality

When using continuous data in LISREL, maximum likelihood estimation is the default technique to obtain estimates for the freed model parameters. However, this assumes that the indicator variables follow a multivariate normal distribution. Failure to satisfy this assumption results in incorrect standard errors and chi-square estimates (Du Toit & Du Toit, 2001; Mels, 2003). The null hypothesis that this assumption was satisfied was tested in LISREL. It was decided that if the null hypothesis of multivariate normality would be rejected, normalisation would not be attempted. In such a case the robust maximum likelihood estimation technique (RML) would rather be used. Mels (2003) recommends that RML would be the preferred approach when dealing with multivariate non-normal data.

The results of the test of multivariate normality for the different ethnic group samples are depicted in Tables 6.21, 6.22, and 6.23. The results of the tests for univariate normality for the different ethnic group samples can be found in Appendix 3.

Table 6.21

TEST OF MULTIVARIATE NORMALITY FOR THE WHITE GROUP

Skewness			Kurtosis			Skewness and Kurtosis	
Value	Z-Score	P-Value	Value	Z-Score	P-Value	Chi-Square	P-Value
313.47	131.45	.00	9812.84	59.36	.00	20803.54	.00

Table 6.22

TEST OF MULTIVARIATE NORMALITY FOR THE BLACK GROUP

Skewness			Kurtosis			Skewness and Kurtosis	
Value	Z-Score	P-Value	Value	Z-Score	P-Value	Chi-Square	P-Value
427.94	198.89	.00	10905.83	78.58	.00	4573.37	.00

Table 6.23

TEST OF MULTIVARIATE NORMALITY FOR THE COLOURED GROUP

Skewness			Kurtosis			Skewness and Kurtosis	
Value	Z-Score	P-Value	Value	Z-Score	P-Value	Chi-Square	P-Value
1236.64	69.89	.00	10652.31	3.44	.00	5811.40	.00

The null hypothesis of univariate normality was rejected ($p < .05$) for all the indicator variables in the different ethnic groups (with the exception of one variable in the Black group). Furthermore, the null hypothesis of multivariate normality was also rejected for all the ethnic groups (X^2= 20803.54; $p < .05$; X^2= 4573.37; $p < .05$; X^2 = 5811.40; $p < .05$). Hence, the normality assumption made by the maximum likelihood estimation technique was not satisfied. The RML method of estimation was selected as the preferred estimation method for this research. The item parcel data was not normalized.

6.3.4 Assessing the Single Group Measurement Model Fit

The fundamental hypothesis being tested in this study is that the 15FQ+ measures the personality construct as constitutively defined and that the construct is measured in the same manner across different ethnic groups, including Black, Coloured and White South Africans.

A series of single- and multi-group confirmatory factor analyses (CFA's) were required in order to determine the validity of the above mentioned hypothesis. The CFA's evaluates the fit of the implied single- and multi-group measurement model. The measurement model of the 15FQ+ portrays the manner in which the parceled items of the specific subscales should load on their designated latent personality dimensions. The measurement model was fitted by analyzing the observed and asymptotic covariance matrices computed from the parceled 15FQ+ data obtained from the participating company. LISREL 9 was used to test the hypothesis that the measurement model can explain the observed covariance matrix/matrices.

In estimating the hypothesised models' fit the extent to which the model is consistent with the empirical data was tested. In order to investigate the hypothesised model's fit an exact fit null hypothesis and a close fit null hypothesis was tested (Diamantopoulos & Siguaw, 2000). The ideal would be to find exact fit. Exact fit means that the 15FQ+ flawlessly explains the covariances between the indicator variables across the three ethnic groups. More specifically the following exact fit null hypotheses were tested to evaluate the fit of the three single-group measurement models:

H_{01i}: $\Sigma = \Sigma(\Theta)$; i=1, 2, 3

H_{a1i}: $\Sigma \neq \Sigma(\Theta)$; i=1, 2, 3

Where Σ is the observed population covariance matrix and $\Sigma(\Theta)$ is the derived or reproduced covariance matrix obtained from the fitted model (Kelloway, 1998). In its alternative format the exact fit hypothesis could be formulated as (Browne & Cudeck, 1993):

H_{01i}: RMSEA=0; i=1, 2, 3

H_{a1i}: RMSEA>0; i=1, 2, 3

However, the possibility of exact fit is highly unlikely in that models are only approximations of reality and, therefore, rarely exactly fit in the population. The close fit null hypothesis takes the error of approximation into account and is therefore more realistic (Diamantopoulos & Siguaw, 2000). If the error due to approximation in the population is equal to or less than .05 the model can be said to fit closely (Diamantopoulos & Siguaw, 2000).

Therefore, the following close fit null hypothesis was also tested:

H_{02i}: RMSEA ≤ .05; i=1, 2, 3

H_{a2i}: RMSEA > .05; i=1, 2, 3

If H_{01} and/or H_{02} would not be rejected, indicating exact or close model fit, a further series of hypotheses on the slope and intercepts of the regression for the items on the respective latent personality dimensions was tested.

6.3.4.1 Confirmatory Factor analyses results of the White sample

6.3.4.1.1 Overall fit assessment

The chi-square value is the traditional measure for evaluating overall model fit. The chi-square test statistic provides information regarding the differences between the observed and estimated covariance matrices as a function of sample size (Pousette & Hanse, 2002). In this study, the Satorra-Bentler (Satorra & Bentler, 1999) chi-square result was interpreted (a result of the use of RML estimation) as it is better suited to multivariate non-normal data. Upon fitting the data of the White sample to the 15FQ+ measurement model the Goodness of Fit (GOF) statistics indicated in Table 6.24 were obtained.

Table 6.24

GOODNESS-OF-FIT INDICATORS FOR THE WHITE SAMPLE

Degrees of Freedom = 4344

Minimum Fit Function Chi-Square = 25336.767 (P = .0)

Normal Theory Weighted Least Squares Chi-Square = 31427.582 (P = .0)

Satorra-Bentler Scaled Chi-Square = 30137.226 (P = .0)

Chi-Square Corrected for Non-Normality = 54350.340 (P = .0)

Estimated Non-centrality Parameter (NCP) = 25793.226

90 Percent Confidence Interval for NCP = (25245.663; 26347.037)

Minimum Fit Function Value = 5.593

Population Discrepancy Function Value (F0) = 5.694

90 Percent Confidence Interval for F0 = (5.573; 5.816)

Root Mean Square Error of Approximation (RMSEA) = .0362

90 Percent Confidence Interval for RMSEA = (.0358; .0366)

P-Value for Test of Close Fit (RMSEA < .05) = 1.000

Expected Cross-Validation Index (ECVI) = 6.833

90 Percent Confidence Interval for ECVI = (6.691; 6.934)

ECVI for Saturated Model = 2.056

ECVI for Independence Model = 89.814

Chi-Square for Independence Model with 4560 Degrees of Freedom = 406667.283

Independence AIC = 406859.283

Model AIC = 21449.226

Saturated AIC = 9312.000

Independence CAIC = 407571.478

Model BIC = -6432.639

Model CAIC = -10776.639

Saturated CAIC = 43853.458

Normed Fit Index (NFI) = .926

Non-Normed Fit Index (NNFI) = .933

Parsimony Normed Fit Index (PNFI) = .882

Comparative Fit Index (CFI) = .936

Incremental Fit Index (IFI) = .936

Relative Fit Index (RFI) = .922

Critical N (CN) = 686.994

Root Mean Square Residual (RMR) = .0210

Standardized RMR = .0497

Goodness of Fit Index (GFI) = .874

Adjusted Goodness of Fit Index (AGFI) = .865

Parsimony Goodness of Fit Index (PGFI) = .815

The Satorra-Bentler scaled chi-square was significant, returning a value of 30137.226 (p = .0). The null hypothesis of exact model fit (H_{011}: RMSEA=0) was consequently rejected. This indicated that the measurement model did not have the ability to reproduce the observed covariance matrix to a degree of accuracy explainable in terms of sampling error only.

A test of close fit was also performed by LISREL to determine the probability of obtaining a RMSEA value of .0362 in the sample given the assumption that the model fits closely in the population (i.e. that H_{021}: RMSEA=.05 is true in the parameter). The root mean square error of approximation (RMSEA) indexes (under H_{021}) the discrepancy between the observed population covariance matrix and the estimated population covariance matrix implied by the model per degree of freedom. According to Diamantopoulos and Siguaw (2000), it is regarded as one of the most informative fit indices as it takes model complexity into consideration. Values below .05 are generally regarded as indicative of good model fit, values above .05 but less than .08 as indicative of reasonable fit; values greater than or equal to .08 but less than .10 are considered to be indicative of mediocre fit, and values exceeding .10 are generally regarded as indicative of poor fit (Diamantopoulos & Sigauw, 2000). The RMSEA of .0362 indicated that the measurement model showed very good model fit. The 90 percent confidence interval for RMSEA (.0358; .0366) also indicated that the fit of the measurement model could be regarded as good. Confidence intervals assist in assessing the precision of the fit statistics. For example, a small RMSEA value with a large confidence interval indicates that the estimated discrepancy value is quiet imprecise, thereby negating any possibility to determine accurately the degree of fit in the population. On the other hand, small intervals indicate a higher level of precision in reflecting the model fit in the population (Byrne, 2001). The fact that the upper boundary of the confidence interval fell below the critical cut off value of .05 moreover indicated that the null hypothesis of close fit would not be rejected (given a .10 significance level). The test of close fit was performed by testing H_{021}: RMSEA ≤ .05 against H_{a21}: RMSEA > .05. The RMSEA value was lower than the cut-off value of .05 signifying that H_{O21} would unlikely be rejected. The p-value for test of close fit (1.00) portrayed the same picture as the 90 percent confidence interval for RMSEA. confirming that the null hypothesis of close fit was not rejected ($p>.05$) , concluding the position that the measurement model showed close fit in the parameter is permissable.

The expected cross-validation index (ECVI) express the difference between the reproduced sample covariance matrix $\hat{\Sigma}$ derived from fitting the model on the sample at hand, and the expected covariance matrix that would be obtained in an independent sample of the same size from the same population (Diamantapolous & Siguaw, 2000). This means that it therefore focuses on the difference between $\hat{\Sigma}$ and Σ. Diamantapolous and Sigauw (2000) indicate that it's a useful indicator of overall model fit. The model ECVI (6.833) was smaller than the value obtained for the independence model (89.814) but larger than the ECVI value associated with the saturated model (2.056). These findings indicated that this model had a better chance of being replicated in a cross-validation sample than the less complex independence model but the more complex saturated model may be better replicated than this model.

The assessment of parsimonious fit acknowledges that model fit can always be improved by adding more paths and estimating more parameters until perfect fit is achieved in the form of a saturated or just-identified model with no degrees of freedom (Spangenberg & Theron, 2005). In defining and fitting models it would seem essential to find the most parsimonious model that achieves satisfactory fit with as few model parameters as possible (Jöreskog & Sörbom, 1993). The parsimonious normed fit index (PNFI = .882) and the parsimonious goodness-of-fit index (PGFI = .815) approached model fit from this perspective. These fit indices range from 0 to 1, with higher values indicating a more parsimonious fit. The closer the values are to 1.00 the better the fit of the model (Davidson, 2000). The values obtained for PNFI and PGFI in this instance therefore indicated a good model fit.

The values for this model's Aiken information criterion (AIC= 21449.226) suggested that the fitted measurement model provided a more parsimonious fit than the independent model (406859.283) but not the saturated model (9312.00) since smaller values on these indices indicate a more parsimonious model, although there is no agreed upon value (Spangenberg & Theron, 2005). Values for the consistent Aiken information criterion (CAIC = 10776.639) suggested that the fitted measurement model provided a more parsimonious fit than both the independent/null model (407571.478) and the saturated model (43853.458). The above mentioned results indicated that the measurement model did not provide a too simplistic account of the process underlying the 15FQ+ but it failed to model one or more influential paths.

Indices of comparative fit use a baseline and independence or null model to contrast the ability of the model to reproduce the observed covariance matrix. The fit indices presented includes the normed fit index (NFI= .926), the non-normed fit index (NNFI= .933), the comparative fit index (CFI= .936), the incremental fit index (IFI=.936) and the relative fit index (RFI =.922). The closer these values are to unity, the better the fit. However, .90 could be considered indicative of a well-fitting model (Spangenberg & Theron, 2005). All of these indices exceeded the critical value of .90, thus indicating good comparative fit relative to the independence model.

The critical sample size statistic (CN) refers to the size of the sample that would have made the obtained minimum fit function $\chi 2$ statistic just significant at the .05 significance level (Diamantopoulos & Siguaw, 2000). The estimated CN (686.994) revealed a value above the recommended threshold value of 200 suggested by Diamantopoulos and Siguaw (2000). This threshold was regarded as indicative of the model providing an adequate representation of the data (Diamantopoulos & Siguaw, 2000) although this proposed threshold should be used with caution (Hu & Bentler, 1995).

The root mean square residual (RMR) represents the average value of the residual matrix (S-Sˆ) and the standardized RMR (SRMR) represents the fitted residuals divided by their estimated errors. RMR and SRMR values generally range from 0 to 1 with good fitting models obtaining values less than .05 (Diamantopoulus and Siguaw, 2000). A value of 0 therefore indicates a perfect fit. The RMR returned a value of .0210 and SRMR returned a value of .0497, indicating a good fit.

The goodness-of-fit index (GFI) and the adjusted goodness-of-fit index (AGFI) reflect how closely the model comes to perfectly reproducing the sample covariance matrix (Diamantopoulos & Siguaw, 2000). The AGFI (.865) adjusts the GFI (.874) for the degrees of freedom in the model and should range between 0 and 1.0 with values exceeding .90 indicating that the model fits the data well (Jöreskog & Sörbom, 1993; Kelloway, 1998). For the fit of this model, both the GFI and AGFI were slightly below the acceptable cut-off level. However this guideline for the acceptable cut-off value is only based on experience and should therefore be used with caution (Kelloway, 1998).

In conclusion, the abovementioned model fit statistics considered holistically suggested a good to reasonable fitting model. The model did outperform the independence model indicating that the model did not provide a too simplistic description of the process underlying the 15FQ+. The results did however suggest that the model may benefit from the inclusion of a number of additional paths.

6.3.4.1.2 Examination of residuals

Residuals refer to the differences between corresponding cells in the observed and fitted covariance matrices (Diamantopoulos & Siguaw, 2000). Standardised residuals refer to a residual that is divided by its estimated standard error (Jöreskog & Sorbom, 1993). Residuals and especially standardized residuals provide valuable diagnostic information on lack of model fit (Kelloway, 1998). Residuals should be distributed symmetrical around zero where large positive and negative residuals with absolute values greater than zero is indicative of relationships (or the lack thereof) between indicator variables that the model fails to explain (Diamantopoulos & Siguaw, 2000). Large positive residuals indicate underestimation and therefore imply the need to add additional paths (Diamantopoulos & Siguaw, 2000). Large negative residuals indicate overestimation, suggesting the need to reduce some of the paths that are associated with the indicator variables in question (Diamantopoulos & Siguaw, 2000).

The standardised residuals were examined collectively in a stem-and-leaf plot and Q-plot. The stem-and-leaf plot depicted in Figure 6.1 provided graphical information regarding the sample standardised residual distribution. A good model is represented by a stem-and-leaf plot in which the residuals are distributed approximately symmetrical around zero. An excess of residuals on the positive or negative side would have indicated that the covariance terms are systematically over or underestimated. In this case the distribution of standardised residuals appeared approximately symmetrical around zero, suggesting good model fit.

```
- 3|6
 - 3|210
 - 2|5
 - 2|
 - 1|866
 - 1|3222111111111111100000000000000000000
 - 0|9999999999999999999999999999999999999999999888888888888888888888888888888+98
 - 0|4444444444444444444444444444444444444444444444444444444444444444444444444+94
   0|1111111111111111111111111111111111111111111111111111111111111111111111111+96
   0|5555555555555555555555555555555555555555555555555555555555555555555555555+98
   1|00000000000000000000001111111111112222233333444
   1|5566788
   2|001
   2|
   3|
   3|
   4|1
```

Figure 6.1

STEM-AND-LEAF PLOT OF THE STANDARDIZED RESIDUALS FOR THE WHITE SAMPLE 15FQ+ MEASUREMENT MODEL

The Q-plot of the 15FQ+ measurement model as fitted to the data of the White group is depicted in Figure 6.2. The Q-plot provided an additional graphical display of residuals by plotting the standardised residuals (horizontal axis) against the quantiles of the normal distribution (Diamantopoulos & Siguaw, 2000). When interpreting the Q-plot the extent to which the data points fall on the 45-degree reference line should be noted. Good model fit would be indicated if the points fall on the 45-degree reference line (Jöreskog & Sorbom, 1993). Model fit would be less satisfactory when the data points swivel away from the 45-degree reference line. To some degree problematic model fit was indicated by the Q-plot of the White sample 15FQ+ measurement model due to the deviation from the 45-degree reference line in the upper and lower regions of the X-axis.

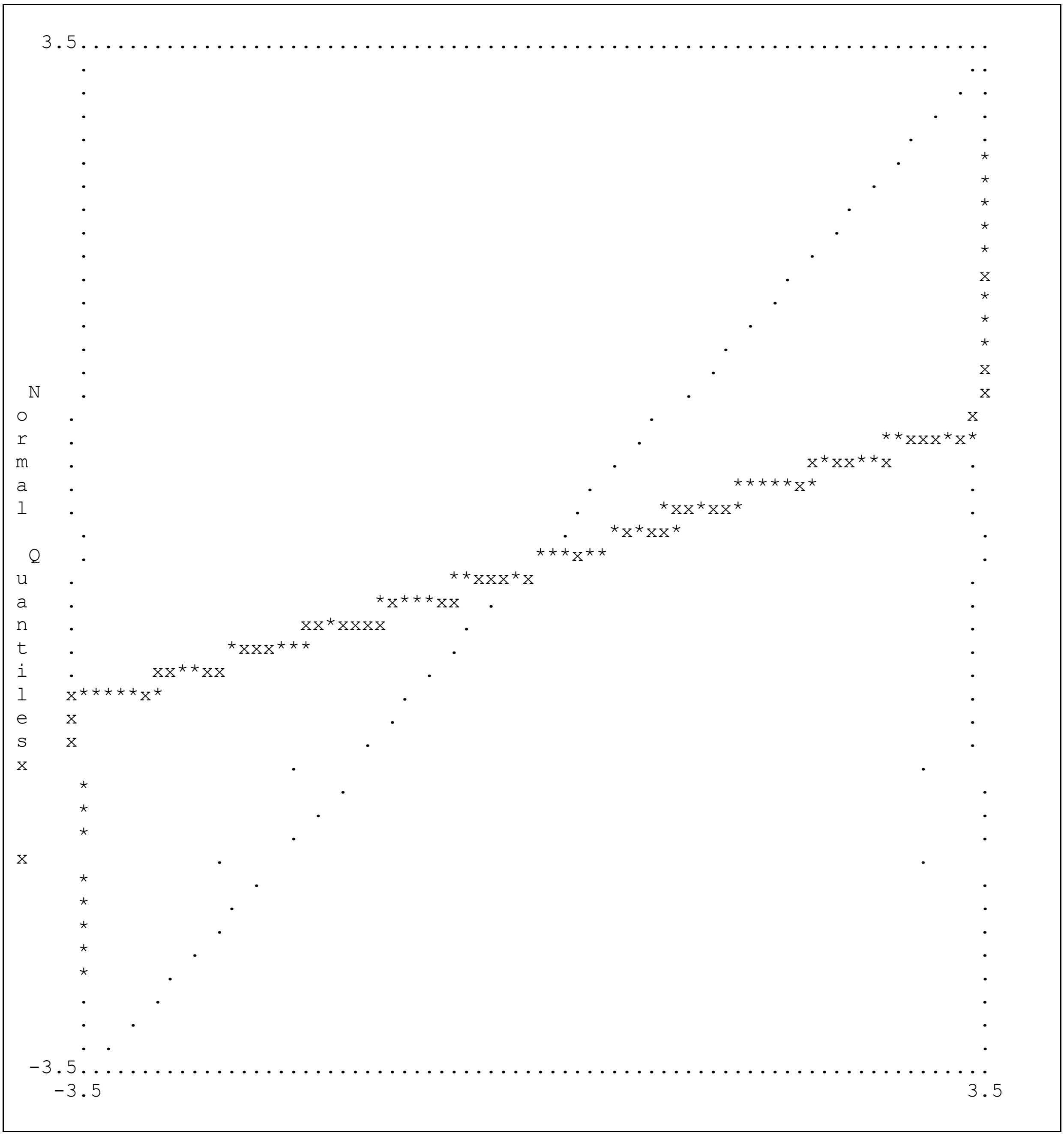

Figure 6.2

Q-PLOT OF THE STANDARDIZED RESIDUALS FOR THE WHITE SAMPLE 15FQ+ MEASUREMENT MODEL

6.3.4.1.3 Model modification indices

Examining the modification indices returned by LISREL for the currently fixed parameters of the model provided an additional way of evaluating the fit of the single-group measurement model by determining if adding one or more paths would significantly improve the fit of the model. Modification indices (MI) indicate the extent to which the $\chi 2$ fit statistic would decrease if a currently fixed parameter in the model was freed and the model re-estimated (Jöreskog & Sorbom, 1993). Modification indices with large values (> 6.64) identify currently fixed parameters that would improve the fit of the model significantly ($p < .01$) if set free (Diamantopoulos & Siguaw, 2000; Jöreskog & Sörbom, 1993). Paths were not freed in this study as the purpose was purely to evaluate the fit of the a priori model indicated by the test authors. A small percentage of large and statistically significant modification indices constitute a positive comment on the fit of the current model. Modification indices calculated for the Λ_X and Θ_δ matrices were examined which gave additional evidence on the fit of the model.

Examination of the modification indices calculated for the factor loading matrix (Λ_X) indicated a number of paths (60%) that if freed, would significantly improve model fit. This indicated that the claim made that the model is constructed of subscales in which certain items were allocated to primarily represent a specific personality dimension should to some degree be questioned. The above mentioned results could have been explained through the suppressor principle if all twelve items in the subscales in the exploratory factor analysis had showed a reasonably high loading on the first factor. A reasonable high loading would have been greater than .50 which would mean that the first factor is at least responsible for 25% of the variance in each of the items in the subscale. This was however not found, therefore, the results cannot be explained through the suppressor principle. The suppressor principle acknowledges the fact that the 15FQ+ is based on the design principle that the items of each subscale primarily reflect a specific personality dimension but are scattered throughout the remainder of the personality domain, albeit to a lesser degree. Therefore each of the 15FQ+ items indicates a pattern of positive and negative loadings on the remaining factors. These patterns of positive and negative loading cancel each other out in a suppressor action (Gerbing & Tuley, 1991).

As far as the theta-delta (Θ_δ) modification indices are concerned a number of paths (24%) would significantly improve the fit of the 15FQ+ measurement model if the current assumption of uncorrelated measurement error terms were to be relaxed. The small percentage of significant ($p < .01$) modification index values in the error variance-covariance matrix (Θ_δ) commented favourably on the fit of the 15FQ+ measurement model. As previously indicated, no changes were made to the model.

6.3.4.1.4 *Assessment of the estimated model parameters*

The good to reasonable model fit warranted the interpretation of the freed measurement model parameter estimates. Due to the acceptable fit the parameter estimates were regarded as valid (i.e., permissible) estimates because the estimates allowed a close reproduction of the observed covariance matrix. The completely standardised factor loading matrix (Λ_x) depicted in Table 6.25 indicate the regression of the item parcels X_j on the latent personality dimension ξ_j and was used to evaluate the significance and the magnitude of the first-order factor loadings as specified by the a priori model. An evaluation of the results shown in Table 6.25 indicated that all the freed factor loadings were significant ($p < .05$). The fit of the model would therefore deteriorate significantly if any of the existing paths in the measurement model would be reduced through fixing the corresponding parameters in Λ_x to zero and thus effectively eliminating the subset of items in question from the sub-scale in which they were currently included. None of the existing paths in the model were therefore redundant. Although the item parcels significantly reflected the latent personality dimension they were designed to represent, the factor loading matrix did indicate, in some instances, low factor loadings. The low factor loadings suggested that the items comprising each item parcel generally did not represent the latent personality dimension they were designed to reflect very well. Sixteen of the 96 factor loadings fell below the critical cutoff value of .50. Given the broad nature of the personality dimension and the fact that responses to the test items are, to a certain extent, also determined by the whole personality, the finding of somewhat lower factor loadings were to be expected.

Table 6.25

COMPLETELY STANDARDIZED FACTOR LOADING MATRIX FOR THE WHITE SAMPLE

	FA	FB	FC	FE	FF	FG	FH	FI	FL	FM	FN	FO	FQ1	FQ2	FQ3	FQ4
PFA1	.333	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFA2	.461	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFA3	.681	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFA4	.675	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFA5	.487	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFA6	.658	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB1	- -	.494	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB2	- -	.568	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB3	- -	.592	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB4	- -	.601	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB5	- -	.623	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB6	- -	.602	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC1	- -	- -	.644	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC2	- -	- -	.503	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC3	- -	- -	.642	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC4	- -	- -	.655	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC5	- -	- -	.515	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC6	- -	- -	.675	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE1	- -	- -	- -	.605	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE2	- -	- -	- -	.585	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE3	- -	- -	- -	.381	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE4	- -	- -	- -	.643	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE5	- -	- -	- -	.635	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE6	- -	- -	- -	.547	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFF1	- -	- -	- -	- -	.676	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFF2	- -	- -	- -	- -	.542	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

PFF3	- -	- -	- -	- -	.628	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFF4	- -	- -	- -	- -	.502	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFF5	- -	- -	- -	- -	.706	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFF6	- -	- -	- -	- -	.664	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFG1	- -	- -	- -	- -	- -	.685	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFG2	- -	- -	- -	- -	- -	.529	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFG3	- -	- -	- -	- -	- -	.578	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFG4	- -	- -	- -	- -	- -	.657	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFG5	- -	- -	- -	- -	- -	.573	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFG6	- -	- -	- -	- -	- -	.694	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFH1	- -	- -	- -	- -	- -	- -	.705	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFH2	- -	- -	- -	- -	- -	- -	.709	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFH3	- -	- -	- -	- -	- -	- -	.667	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFH4	- -	- -	- -	- -	- -	- -	.735	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFH5	- -	- -	- -	- -	- -	- -	.650	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFH6	- -	- -	- -	- -	- -	- -	.631	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFI1	- -	- -	- -	- -	- -	- -	- -	.586	- -	- -	- -	- -	- -	- -	- -	- -
PFI2	- -	- -	- -	- -	- -	- -	- -	.584	- -	- -	- -	- -	- -	- -	- -	- -
PFI3	- -	- -	- -	- -	- -	- -	- -	.637	- -	- -	- -	- -	- -	- -	- -	- -
PFI4	- -	- -	- -	- -	- -	- -	- -	.664	- -	- -	- -	- -	- -	- -	- -	- -
PFI5	- -	- -	- -	- -	- -	- -	- -	.538	- -	- -	- -	- -	- -	- -	- -	- -
PFI6	- -	- -	- -	- -	- -	- -	- -	.367	- -	- -	- -	- -	- -	- -	- -	- -
PFL1	- -	- -	- -	- -	- -	- -	- -	- -	.644	- -	- -	- -	- -	- -	- -	- -
PFL2	- -	- -	- -	- -	- -	- -	- -	- -	.664	- -	- -	- -	- -	- -	- -	- -
PFL3	- -	- -	- -	- -	- -	- -	- -	- -	.434	- -	- -	- -	- -	- -	- -	- -
PFL4	- -	- -	- -	- -	- -	- -	- -	- -	.509	- -	- -	- -	- -	- -	- -	- -
PFL5	- -	- -	- -	- -	- -	- -	- -	- -	.549	- -	- -	- -	- -	- -	- -	- -
PFL6	- -	- -	- -	- -	- -	- -	- -	- -	.608	- -	- -	- -	- -	- -	- -	- -
PFM1	- -	- -	- -	- -	- -	- -	- -	- -	- -	.530	- -	- -	- -	- -	- -	- -
PFM2	- -	- -	- -	- -	- -	- -	- -	- -	- -	.517	- -	- -	- -	- -	- -	- -

PFM3	--	--	--	--	--	--	--	--	--	.469	--	--	--	--	--	--
PFM4	--	--	--	--	--	--	--	--	--	.593	--	--	--	--	--	--
PFM5	--	--	--	--	--	--	--	--	--	.554	--	--	--	--	--	--
PFM6	--	--	--	--	--	--	--	--	--	.411	--	--	--	--	--	--
PFN1	--	--	--	--	--	--	--	--	--	--	.526	--	--	--	--	--
PFN2	--	--	--	--	--	--	--	--	--	--	.541	--	--	--	--	--
PFN3	--	--	--	--	--	--	--	--	--	--	.532	--	--	--	--	--
PFN4	--	--	--	--	--	--	--	--	--	--	.699	--	--	--	--	--
PFN5	--	--	--	--	--	--	--	--	--	--	.656	--	--	--	--	--
PFN6	--	--	--	--	--	--	--	--	--	--	.588	--	--	--	--	--
PFO1	--	--	--	--	--	--	--	--	--	--	--	.475	--	--	--	--
PFO2	--	--	--	--	--	--	--	--	--	--	--	.644	--	--	--	--
PFO3	--	--	--	--	--	--	--	--	--	--	--	.610	--	--	--	--
PFO4	--	--	--	--	--	--	--	--	--	--	--	.642	--	--	--	--
PFO5	--	--	--	--	--	--	--	--	--	--	--	.582	--	--	--	--
PFO6	--	--	--	--	--	--	--	--	--	--	--	.656	--	--	--	--
PFQ11	--	--	--	--	--	--	--	--	--	--	--	--	.514	--	--	--
PFQ12	--	--	--	--	--	--	--	--	--	--	--	--	.570	--	--	--
PFQ13	--	--	--	--	--	--	--	--	--	--	--	--	.661	--	--	--
PFQ14	--	--	--	--	--	--	--	--	--	--	--	--	.457	--	--	--
PFQ15	--	--	--	--	--	--	--	--	--	--	--	--	.661	--	--	--
PFQ16	--	--	--	--	--	--	--	--	--	--	--	--	.605	--	--	--
PFQ21	--	--	--	--	--	--	--	--	--	--	--	--	--	.334	--	--
PFQ22	--	--	--	--	--	--	--	--	--	--	--	--	--	.724	--	--
PFQ23	--	--	--	--	--	--	--	--	--	--	--	--	--	.521	--	--
PFQ24	--	--	--	--	--	--	--	--	--	--	--	--	--	.667	--	--
PFQ25	--	--	--	--	--	--	--	--	--	--	--	--	--	.496	--	--
PFQ26	--	--	--	--	--	--	--	--	--	--	--	--	--	.696	--	--
PFQ31	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.525	--
PFQ32	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.495	--

PFQ33	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.460	--
PFQ34	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.425	--
PFQ35	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.592	--
PFQ36	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.591	--
PFQ41	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.660
PFQ42	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.708
PFQ43	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.491
PFQ44	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.609
PFQ45	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.625
PFQ46	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.696

The total variance in the i^{th} item parcel (X_i) can be decomposed into variance due to variance in the latent variable the item parcel was designed to reflect (ξ_i), variance due to variance in other systematic latent effects the item parcel was not designed to reflect, as well as random measurement error. The latter two sources of variance in the item parcel were acknowledged in the model specification through the measurement term (δ_i). The completely standardised measurement error variances for the item parcels are shown in Table 6.26.

Table 6.26

COMPLETELY STANDARDISED MEASUREMENT ERROR VARIANCE FOR THE WHITE SAMPLE

FA1	FA2	FA3	FA4	FA5	FA6	FB1	FB2	FB3	FB4	FB5	FB6	FC1	FC2
0.89	0.79	0.54	0.54	0.76	0.57	0.76	0.68	0.65	0.64	0.61	0.64	0.59	0.75

FC3	FC4	FC5	FC6	FE1	FE2	FE3	FE4	FE5	FE6	FF1	FF2	FF3	FF4
0.59	0.57	0.73	0.54	0.63	0.66	0.86	0.59	0.59	0.7	0.54	0.71	0.61	0.75

FF5	FF6	FG1	FG2	FG3	FG4	FG5	FG6	FH1	FH2	FH3	FH4	FH5	FH6
0.5	0.56	0.53	0.72	0.67	0.57	0.67	0.52	0.5	0.49	0.56	0.46	0.58	0.6

FI1	FI2	FI3	FI4	FI5	FI6	FL1	FL2	FL3	FL4	FL5	FL6	FM1	FM2
0.66	0.66	0.59	0.56	0.71	0.87	0.59	0.56	0.81	0.74	0.69	0.63	0.72	0.73

FM3	FM4	FM5	FM6	FN1	FN2	FN3	FN4	FN5	FN6	FO1	FO2	FO3	FO4
0.78	0.65	0.69	0.83	0.72	0.71	0.72	0.51	0.57	0.66	0.78	0.59	0.63	0.59

FO5	FO6	FQ11	FQ12	FQ13	FQ14	FQ15	FQ16	FQ21	FQ22	FQ23	FQ24	FQ25	FQ26
0.66	0.57	0.74	0.68	0.56	0.79	0.56	0.63	0.89	0.47	0.73	0.56	0.75	0.52

FQ31	FQ32	FQ33	FQ34	FQ35	FQ36	FQ41	FQ42	FQ43	FQ44	FQ45	FQ46
0.72	0.76	0.79	0.82	0.65	0.65	0.56	0.49	0.76	0.63	0.61	0.52

The measurement error terms (δ) thus did not differentiate between systematic and random sources of error or non-relevant variance. The values in Table 6.26 indicate that the proportion of the variance in the observed variables was not exclusively explained by the latent variables they were meant to reflect but also by random error and systematic latent variables. These results supported the results of Table 6.25 in that the items of the 15FQ+ were shown to be relatively noisy measures of the latent personality dimensions they were designed to reflect.

The phi-matrix of correlations between the 16 latent personality dimensions is provided in Table 6.27. The off-diagonal elements of the Φ matrix are the inter-personality dimension correlations disattenuated for random and systematic measurement error. A smaller portion of the correlations were significant ($p < .05$) with a larger portion of the correlations being not significant. The correlations between the latent personality dimensions varied from low to moderate. The results provided support for the convergent validity of the 16 first-order personality dimensions assumed by the 15FQ+.

Table 6.27

COMPLETELY STANDARDISED PHI MATRIX FOR THE WHITE SAMPLE

	FA	FB	FC	FE	FF	FG	FH	FI	FL	FM	FN	FO	FQ1	FQ2	FQ3	FQ4
FA	1															
FB	**.165**	1														
FC	**.165**	**.399**	1													
FE	**.126**	**.477**	**.342**	1												
FF	**.489**	**.199**	**.213**	**.27**	1											
FG	**.139**	**.20**	**.252**	**.199**	-.07	1										
FH	**.375**	**.445**	**.44**	**.661**	**.62**	**.074**	1									
FI	**.433**	**.105**	.007	-.05	**.075**	.026	**.135**	1								
FL	-.25	-.28	-.48	-.14	-.2	.01	-.25	-.22	1							
FM	**.156**	**.199**	-.22	**.104**	**.283**	-.36	**.248**	**.305**	-.03	1						
FN	**.301**	**.084**	**.261**	-.26	-.09	**.376**	-.14	**.074**	-.12	-.31	1					
FO	-.03	-.36	-.75	-.38	-.24	-.06	-.49	**.074**	**.375**	**.134**	.03	1				
FQ1	-.03	**.152**	-.12	**.199**	**.194**	-.4	**.268**	**.138**	.012	.679	-.48	-.09	1			
FQ2	-.45	-.17	-.37	-.32	-.7	-.02	-.55	-.06	**.402**	-.02	-.11	**.289**	.003	1		
FQ3	**.176**	-.04	.035	.011	.021	**.464**	-.01	-.19	**.266**	-.34	**.426**	**.113**	-.57	-.05	1	
FQ4	-.23	-.21	-.69	.042	-.13	-.17	-.21	-.07	**.355**	**.176**	-.44	**.515**	**.17**	**.28**	-.08	1

The items that have been highlighted indicates the non-significant correlations (p>.05).

6.3.4.1.5 Summary of model fit assessment for the White sample

Overall, the model statistics indicated good fit for the White sample. However, the results also suggested that the model did to a certain degree fail to capture the complexity of the dynamics underlying the 15FQ+. The examination of the Q-plot of standardised residuals for the White group indicated that the model would benefit from adding additional pathways. Modification indices calculated for the factor loading matrix also indicated a number of paths that could be added to improve the fit of the model. The completely standardised measurement error variance indicated the items of the 15FQ+ to be relatively noisy measures of the latent personality dimensions they were designed to reflect. However, this finding needs to be interpreted in terms of the effect of the suppressor effect built into the instrument. All these findings seemed to suggest that the behavioural responses to the items allocated to a specific personality sub-scale, although primarily determined by the latent personality dimension they were tasked to reflect, nonetheless depend on the whole of the personality domain.

The results suggested that the model did adequately account for the covariance observed between the item parcels even though the results raised some questions.

6.3.4.2 Confirmatory Factor analyses results of the Black sample

6.3.4.2.1 Overall fit Assessment

Upon fitting the the 15FQ+ measurement model to the data of the Black sample the spectrum of GOF statistics indicated in Table 6.28 were obtained.

Table 6.28

GOODNESS-OF-FIT INDICATORS FOR THE BLACK SAMPLE

Degrees of Freedom = 4344
Minimum Fit Function Chi-Square = 23774.084 (P = .0)
Normal Theory Weighted Least Squares Chi-Square = 31267.766 (P = .0)
Satorra-Bentler Scaled Chi-Square = 29276.819 (P = .0)
Chi-Square Corrected for Non-Normality = 1252515.005 (P = .0)
Estimated Non-centrality Parameter (NCP) = 24932.819
90 Percent Confidence Interval for NCP = (24393.809; 25478.105)
Minimum Fit Function Value = 5.357
Population Discrepancy Function Value (F0) = 5.618
90 Percent Confidence Interval for F0 = (5.497; 5.741)

Root Mean Square Error of Approximation (RMSEA) = .0360

90 Percent Confidence Interval for RMSEA = (.0356; .0364)

P-Value for Test of Close Fit (RMSEA < .05) = 1.000

Expected Cross-Validation Index (ECVI) = 6.781

90 Percent Confidence Interval for ECVI = (6.638; 6.882)

ECVI for Saturated Model = 2.098

ECVI for Independence Model = 47.137

Chi-Square for Independence Model with 4560 Degrees of Freedom = 209001.726

Independence AIC = 209193.726

Model AIC = 20588.819

Saturated AIC = 9312.000

Independence CAIC = 209903.951

Model BIC = -7203.916

Model CAIC = -11547.916

Saturated CAIC = 43757.947

Normed Fit Index (NFI) = .860

Non-Normed Fit Index (NNFI) = .872

Parsimony Normed Fit Index (PNFI) = .819

Comparative Fit Index (CFI) = .878

Incremental Fit Index (IFI) = .878

Relative Fit Index (RFI) = .853

Critical N (CN) = 692.813

Root Mean Square Residual (RMR) = .0165

Standardized RMR = .0469

Goodness of Fit Index (GFI) = .872

Adjusted Goodness of Fit Index (AGFI) = .863

Parsimony Goodness of Fit Index (PGFI) = .814

The Satorra-Bentler scaled chi-square was significant, returning a value of 29276.819 ($p = .0$). The null hypothesis of exact model fit (H_{012}: RMSEA=0) was consequently rejected. This indicated that the measurement model did not have the ability to reproduce the observed covariance matrix to a degree of accuracy explainable in terms of sampling error only.

A test of close fit was performed by LISREL to determine the probability of obtaining a RMSEA value of .0360 in the sample given the assumption that the model fits closely in the population. The RMSEA of .0360 indicated that the measurement model showed very good model fit in the sample. The 90 percent confidence interval for RMSEA (.0356; .0364) further indicated that the fit of the measurement model could be regarded as good. The fact that the upper bound of the confidence interval fell below the critical cut off value of .05 moreover indicated that the null hypothesis of close fit would not be rejected (given a .10 significance level). The close fit test was performed by testing H_{022}: RMSEA≤ .05 against H_{a22}: RMSEA > .05. The p-value for test of close fit portrayed the same picture as the 90 percent confidence interval for RMSEA. The probability of obtaining the sample RMSEA value under H_{022} was sufficiently large (P(RMSEA=.0360|RMSEA=.05) = 1.00) so that the null hypothesis of close fit needed not to be rejected leading to the conclusion that it is permissible to retain the position that the measurement model showed close fit in the parameter.

The model ECVI (6.781) was smaller than the value obtained for the independence model (47.137) but larger than the value associated with the saturated model (2.098). These findings indicated that this model had a better chance of being replicated in a cross-validation sample than the less complex independence model, but the more complex saturated model may be better replicated than this model.

The parsimonious normed fit index (PNFI = .819) and the parsimonious goodness-of-fit index (PGFI = .814) indicated good model fit. The values for this model's Aiken information criterion (AIC= 20588.819) suggested that the fitted measurement model provided a more parsimonious fit than the independent model (209903.951) but not the saturated model (9312.00) since smaller values on these indices indicate a more parsimonious model (Spangenberg & Theron, 2005). Values for the consistent Aiken information criterion (CAIC = 11547.916) suggested that the fitted measurement model provided a more parsimonious fit than both the independent/null model (209903.951) and the saturated model (43757.947). Similar to the results obtained for the White group, these results indicated that the measurement model did not provide a too simplistic account of the process underlying the 15FQ+, but that it nevertheless failed to model one or more influential paths.

The comparative fit indices, namely the normed fit index (NFI= .860), the non-normed fit index (NNFI= .872), the comparative fit index (CFI= .878), the incremental fit index (IFI= .878) and the relative fit index (RFI = .853) were high enough to indicate good comparative fit relative to the independence model, although it fell slightly below the proposed critical value of .9.

Additionally, the estimated critical sample value (CN) of 692.813 fell above the recommended threshold value of 200 suggested by Diamantopoulos and Siguaw (2000), indicating that the model provided an adequate representation of the data. In addition, the RMR returned a value of .0164 and the SRMR returned a value of .0469 indicating good model fit. However, moderate model fit was suggested by both the GFI (.872) and AGFI (.863) as they fell slightly below the acceptable cut-off level of .9.

The results from the abovementioned model fit statistics viewed holistically suggested a good to reasonable fitting model. The overall fit statistics found for the Black sample echo some of the same results as found for the White sample. The model did outperform the independence model indicating that the model did not provide a too simplistic description of the process underlying the 15FQ+. The results did however suggest that the model may benefit from the inclusion of a number of additional paths.

6.3.4.2.2 Examination of residuals

In the case of the Black sample the distribution of standardised residuals appeared negatively skewed in the stem-and-leaf plot (Figure 6.3). The prevalence of large negative and the small number of large positive residuals suggested that the observed covariance terms in the observed covariance matrix were typically overestimated by the derived model parameter estimates. Deleting paths to the model may rectify the problem. The plotted residuals once again indicated a deviation from the 45° reference line in the Q-plot (Figure 6.4) indicating to some degree problematic model fit.

```
- 1|5
 - 1|2211100000
 - 0|9999999999999888888888888888888888777777777777777777777777777777777777777+97
 - 0|4444444444444444444444444444444444444444444444444444444444444444444444444+95
   0|1111111111111111111111111111111111111111111111111111111111111111111111111+98
   0|5555555555555555555555555555555555555555555555555555555555555555555555555+93
   1|000000000111111112223333333344
   1|577
   2|
   2|
   3|
   3|
   4|
   4|
   5|4
```

Figure 6.3

STEM-AND-LEAF PLOT STANDARDISED RESIDUALS FOR THE BLACK SAMPLE

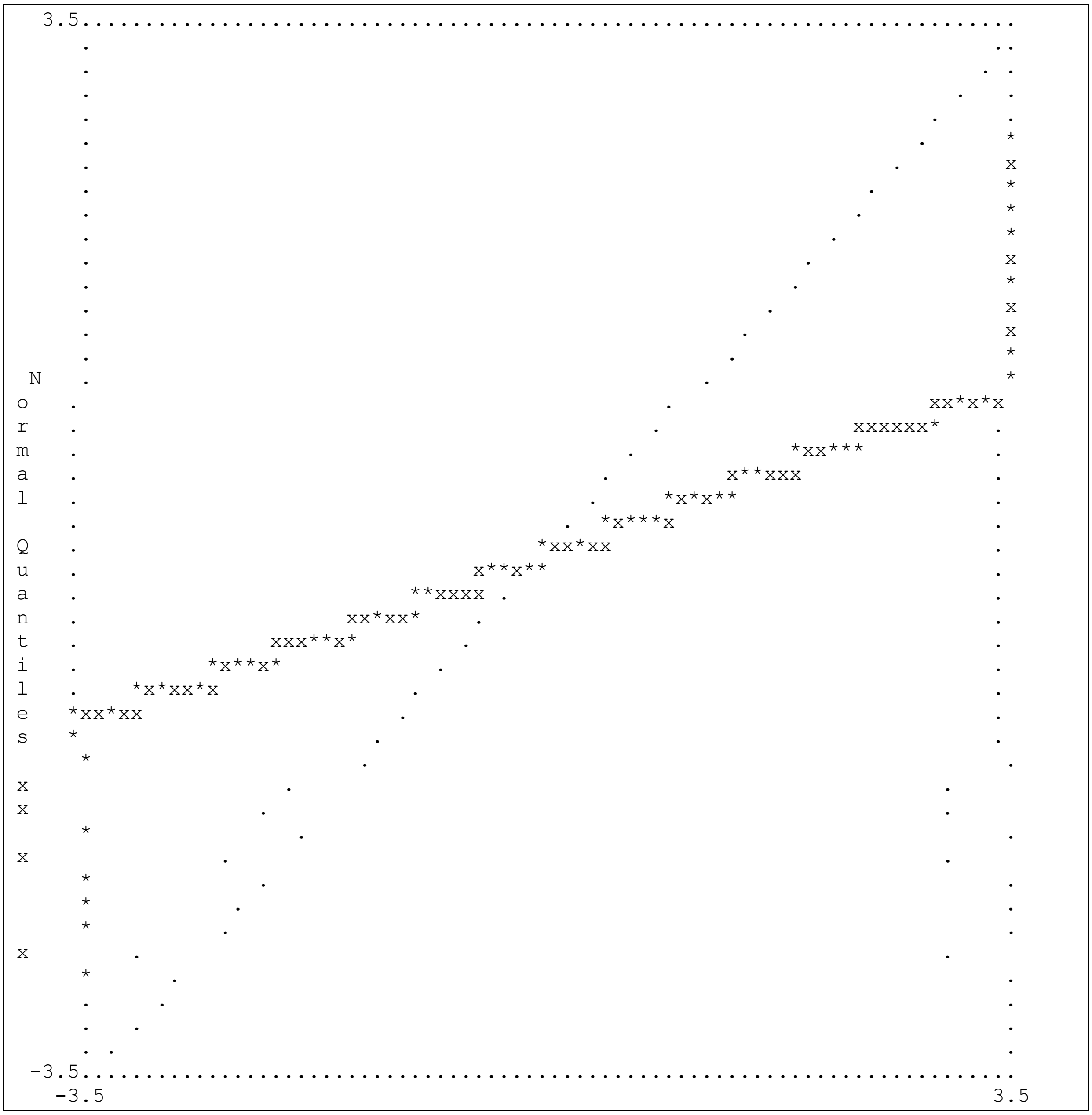

Figure 6.4

Q-PLOT OF STANDARDISED RESIDUALS FOR THE BLACK SAMPLE

6.3.4.2.3 Model modification indices

Examining the results of the Λ_x matrix indicated a number of paths (64%) that if set free would significantly improve model fit. The claim that the model is constructed of subscales, in which certain items are allocated to primarily represent a specific personality dimension, should therefore to some degree be questioned. Although this trend could in principle be explained through the suppressor principle the results obtained in the exploratory factor analysis suggest that this was unlikely the case here.

As far as the theta-delta (Θ_δ) modification indices were concerned a number of paths (28%) would significantly improve the fit of the 15FQ+ measurement model if the current assumption of uncorrelated measurement error terms were to be relaxed. As previously indicated, no changes were made to the model.

6.3.4.2.4 Assessment of the estimated model parameters

The good to reasonable model fit warranted the interpretation of the freed measurement model parameter estimates. Due to the acceptable fit the parameter estimates were regarded as valid (i.e., permissible) estimates because the estimates allowed a close reproduction of the observed covariance matrix. Table 6.29 shows that all the freed factor loadings were significant ($p < .05$) but the general pattern of low factor loadings suggested that the items comprising each item parcel generally did not represent the latent personality dimension they were designed to reflect very well. Given the broad nature of the personality dimension and the fact that responses to the test items are determined by the whole personality the finding of some lower factor loadings were to be expected.

The measurement error variance for the item parcels are shown in Table 6.30. The values in Table 6.30 supported the conclusion made from the results in Table 6.29. The item parcels of the 15FQ+ are relatively noisy measures of the latent personality dimensions they were designed to reflect.

The phi-matrix of correlations between the 16 latent personality dimensions is provided in Table 6.31. A smaller portion of the correlations were significant ($p < .05$) with a larger portion of the correlations being not significant. The correlations between the latent personality dimensions varied from low to moderate. The results provided support for the convergent validity of the 16 first-order personality dimensions assumed by the 15FQ+.

Table 6.29

COMPLETELY STANDARDISED FACTOR LOADING MATRIX FOR THE BLACK SAMPLE

	FA	FB	FC	FE	FF	FG	FH	FI	FL	FM	FN	FO	FQ1	FQ2	FQ3	FQ4
PFA1	.057	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFA2	.312	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFA3	.517	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFA4	.483	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFA5	.390	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFA6	.565	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB1	- -	.488	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB2	- -	.492	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB3	- -	.512	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB4	- -	.468	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB5	- -	.516	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB6	- -	.518	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC1	- -	- -	.494	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC2	- -	- -	.393	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC3	- -	- -	.542	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC4	- -	- -	.576	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC5	- -	- -	.492	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC6	- -	- -	.633	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE1	- -	- -	- -	.463	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE2	- -	- -	- -	.421	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE3	- -	- -	- -	.231	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE4	- -	- -	- -	.546	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE5	- -	- -	- -	.490	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE6	- -	- -	- -	.302	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFF1	- -	- -	- -	- -	.613	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

PFF2	--	--	--	--	.524	--	--	--	--	--	--	--	--	--	--	--
PFF3	--	--	--	--	.469	--	--	--	--	--	--	--	--	--	--	--
PFF4	--	--	--	--	.546	--	--	--	--	--	--	--	--	--	--	--
PFF5	--	--	--	--	.550	--	--	--	--	--	--	--	--	--	--	--
PFF6	--	--	--	--	.648	--	--	--	--	--	--	--	--	--	--	--
PFG1	--	--	--	--	--	.586	--	--	--	--	--	--	--	--	--	--
PFG2	--	--	--	--	--	.434	--	--	--	--	--	--	--	--	--	--
PFG3	--	--	--	--	--	.474	--	--	--	--	--	--	--	--	--	--
PFG4	--	--	--	--	--	.571	--	--	--	--	--	--	--	--	--	--
PFG5	--	--	--	--	--	.514	--	--	--	--	--	--	--	--	--	--
PFG6	--	--	--	--	--	.620	--	--	--	--	--	--	--	--	--	--
PFH1	--	--	--	--	--	--	.642	--	--	--	--	--	--	--	--	--
PFH2	--	--	--	--	--	--	.661	--	--	--	--	--	--	--	--	--
PFH3	--	--	--	--	--	--	.459	--	--	--	--	--	--	--	--	--
PFH4	--	--	--	--	--	--	.639	--	--	--	--	--	--	--	--	--
PFH5	--	--	--	--	--	--	.599	--	--	--	--	--	--	--	--	--
PFH6	--	--	--	--	--	--	.472	--	--	--	--	--	--	--	--	--
PFI1	--	--	--	--	--	--	--	.485	--	--	--	--	--	--	--	--
PFI2	--	--	--	--	--	--	--	.416	--	--	--	--	--	--	--	--
PFI3	--	--	--	--	--	--	--	.456	--	--	--	--	--	--	--	--
PFI4	--	--	--	--	--	--	--	.553	--	--	--	--	--	--	--	--
PFI5	--	--	--	--	--	--	--	.460	--	--	--	--	--	--	--	--
PFI6	--	--	--	--	--	--	--	.317	--	--	--	--	--	--	--	--
PFL1	--	--	--	--	--	--	--	--	.536	--	--	--	--	--	--	--
PFL2	--	--	--	--	--	--	--	--	.558	--	--	--	--	--	--	--
PFL3	--	--	--	--	--	--	--	--	.276	--	--	--	--	--	--	--
PFL4	--	--	--	--	--	--	--	--	.470	--	--	--	--	--	--	--
PFL5	--	--	--	--	--	--	--	--	.478	--	--	--	--	--	--	--
PFL6	--	--	--	--	--	--	--	--	.530	--	--	--	--	--	--	--
PFM1	--	--	--	--	--	--	--	--	--	.456	--	--	--	--	--	--

PFM2	- -	- -	- -	- -	- -	- -	- -	- -	- -	.119	- -	- -	- -	- -	- -	- -
PFM3	- -	- -	- -	- -	- -	- -	- -	- -	- -	.119	- -	- -	- -	- -	- -	- -
PFM4	- -	- -	- -	- -	- -	- -	- -	- -	- -	.456	- -	- -	- -	- -	- -	- -
PFM5	- -	- -	- -	- -	- -	- -	- -	- -	- -	.403	- -	- -	- -	- -	- -	- -
PFM6	- -	- -	- -	- -	- -	- -	- -	- -	- -	.191	- -	- -	- -	- -	- -	- -
PFN1	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.257	- -	- -	- -	- -	- -
PFN2	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.399	- -	- -	- -	- -	- -
PFN3	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.511	- -	- -	- -	- -	- -
PFN4	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.554	- -	- -	- -	- -	- -
PFN5	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.463	- -	- -	- -	- -	- -
PFN6	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.335	- -	- -	- -	- -	- -
PFO1	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.405	- -	- -	- -	- -
PFO2	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.444	- -	- -	- -	- -
PFO3	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.390	- -	- -	- -	- -
PFO4	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.561	- -	- -	- -	- -
PFO5	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.508	- -	- -	- -	- -
PFO6	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.527	- -	- -	- -	- -
PFQ11	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.371	- -	- -	- -
PFQ12	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.292	- -	- -	- -
PFQ13	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.591	- -	- -	- -
PFQ14	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.422	- -	- -	- -
PFQ15	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.501	- -	- -	- -
PFQ16	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.362	- -	- -	- -
PFQ21	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.256	- -	- -
PFQ22	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.558	- -	- -
PFQ23	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.482	- -	- -
PFQ24	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.574	- -	- -
PFQ25	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.372	- -	- -
PFQ26	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.538	- -	- -
PFQ31	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.381	- -

PFQ32	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.208	--
PFQ33	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.367	--
PFQ34	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.344	--
PFQ35	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.473	--
PFQ36	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.389	--
PFQ41	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.523
PFQ42	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.357
PFQ43	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.172
PFQ44	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.497
PFQ45	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.383
PFQ46	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.600

Table 6.30

COMPLETELY STANDARDISED MEASUREMENT ERROR VARIANCE FOR THE BLACK SAMPLE

FA1	FA2	FA3	FA4	FA5	FA6	FB1	FB2	FB3	FB4	FB5	FB6	FC1	FC2
0.99	0.9	0.73	0.77	0.85	0.68	0.76	0.76	0.74	0.78	0.73	0.73	0.76	0.85

FC3	FC4	FC5	FC6	FE1	FE2	FE3	FE4	FE5	FE6	FF1	FF2	FF3	FF4
0.71	0.668	0.758	0.6	0.786	0.823	0.947	0.702	0.76	0.909	0.625	0.725	0.78	0.702

FF5	FF6	FG1	FG2	FG3	FG4	FG5	FG6	FH1	FH2	FH3	FH4	FH5	FH6
0.697	0.58	0.66	0.81	0.78	0.67	0.74	0.62	0.59	0.56	0.79	0.59	0.64	0.78

FI1	FI2	FI3	FI4	FI5	FI6	FL1	FL2	FL3	FL4	FL5	FL6	FM1	FM2
0.77	0.83	0.79	0.69	0.79	0.89	0.71	0.69	0.92	0.78	0.77	0.72	0.79	0.99

FM3	FM4	FM5	FM6	FN1	FN2	FN3	FN4	FN5	FN6	FO1	FO2	FO3	FO4
0.99	0.79	0.84	0.96	0.93	0.84	0.74	0.69	0.79	0.88	0.84	0.8	0.85	0.69

FO5	FO6	FQ11	FQ12	FQ13	FQ14	FQ15	FQ16	FQ21	FQ22	FQ23	FQ24	FQ25	FQ26
0.74	0.72	0.86	0.92	0.65	0.82	0.75	0.87	0.93	0.69	0.77	0.67	0.86	0.71

FQ31	FQ32	FQ33	FQ34	FQ35	FQ36	FQ41	FQ42	FQ43	FQ44	FQ45	FQ46
0.86	0.96	0.87	0.88	0.78	0.85	0.73	0.87	0.97	0.75	0.85	0.64

Table 6.31

COMPLETELY STANDARDISED PHI MATRIX FOR THE BLACK SAMPLE

	FA	FB	FC	FE	FF	FG	FH	FI	FL	FM	FN	FO	FQ1	FQ2	FQ3	FQ4
FA	1															
FB	**.446**	1														
FC	**.298**	**.562**	1													
FE	**.28**	**.554**	**.406**	1												
FF	**.386**	**.368**	**.194**	**.276**	1											
FG	**.257**	**.23**	**.309**	**.217**	-.125	1										
FH	**.429**	**.549**	**.538**	**.675**	**.528**	**.181**	1									
FI	**.535**	**.171**	**.053**	**.071**	.024	**.10**	**.182**	1								
FL	-.276	-.408	-.389	-.16	-.239	**.109**	-.258	-.145	1							
FM	-.011	**.094**	-.329	**.106**	**.272**	-.493	**.103**	**.119**	-.185	1						
FN	**.29**	**.091**	**.20**	-.159	-.157	**.531**	-.059	**.122**	**.148**	-.559	1					
FO	-.112	-.413	-.711	-.398	-.265	-.012	-.494	.029	**.406**	**.151**	**.15**	1				
FQ1	-.056	**.12**	-.022	**.185**	**.226**	-.483	**.16**	-.047	-.229	**.702**	-.586	-.227	1			
FQ2	-.37	-.281	-.355	-.345	-.573	-.052	-.548	-.061	**.331**	.046	-.075	**.307**	-.025	1		
FQ3	**.33**	**.157**	**.133**	**.101**	-.084	**.65**	.008	**.073**	**.26**	-.536	**.623**	**.209**	-.578	-.055	1	
FQ4	-.326	-.37	-.781	-.122	-.157	-.302	-.39	-.065	**.329**	**.39**	-.337	**.615**	**.136**	**.338**	-.133	1

The items that have been highlighted indicates the non-significant correlations (p>.05).

6.3.4.2.5 Summary of model fit assessment for the Black sample

The overall results from the model fit statistics for the Black sample revealed reasonable fit. It was evident from the results that the model to some degree failed to fit well due to the model failing to capture the complexity of the dynamics underlying the 15FQ+. The examination of the measurement model residuals and the modification indices calculated for the factor loading matrix indicated that the model would benefit from adding additional pathways. The completely standardised factor loading matrix and the completely standardised measurement error variance indicated the items of the 15FQ+ to be relatively noisy measures of the latent personality dimensions they were designed to reflect. Holistically these findings seemed to suggest that the behavioural responses to the items allocated to a specific personality sub-scale, although primarily determined by the latent personality dimension they were tasked to reflect, nonetheless depend on the whole of the personality domain.

The results did however suggest that the model adequately accounts for the covariance observed between the item parcels even though some questions had been raised.

6.3.4.3 Confirmatory Factor analyses results of the Coloured Sample

6.3.4.3.1 Overall fit Assessment

The Coloured sample was also subjected to a confirmatory factor analysis. Upon fitting the data of the Coloured sample to the 15FQ+ measurement model the spectrum of GOF statistics indicated in Table 6.32 were obtained.

Table 6.32

GOODNESS-OF-FIT INDICATORS FOR THE COLOURED SAMPLE

Degrees of Freedom = 4344
Minimum Fit Function Chi-Square = 9691.573 (P = .0)
Normal Theory Weighted Least Squares Chi-Square = 1130.516 (P = .0)
Satorra-Bentler Scaled Chi-Square = 10758.440 (P = .0)
Estimated Non-centrality Parameter (NCP) = 6414.440
90 Percent Confidence Interval for NCP = (6113.147; 6723.111)
Minimum Fit Function Value = 9.257
Population Discrepancy Function Value (F0) = 6.126
90 Percent Confidence Interval for F0 = (5.839; 6.421)

Root Mean Square Error of Approximation (RMSEA) = .0376
90 Percent Confidence Interval for RMSEA = (.0367; .0384)
P-Value for Test of Close Fit (RMSEA < .05) = 1.000
Expected Cross-Validation Index (ECVI) = 11.055
90 Percent Confidence Interval for ECVI = (1.675; 11.258)
ECVI for Saturated Model = 8.894
ECVI for Independence Model = 63.323
Chi-Square for Independence Model with 4560 Degrees of Freedom = 66107.687
Independence AIC = 66299.687
Model AIC = 207.440
Saturated AIC = 9312.000
Independence CAIC = 66871.332
Model BIC = -19448.364
Model CAIC = -23792.364
Saturated CAIC = 37036.799
Normed Fit Index (NFI) = .837
Non-Normed Fit Index (NNFI) = .891
Parsimony Normed Fit Index (PNFI) = .798
Comparative Fit Index (CFI) = .896
Incremental Fit Index (IFI) = .896
Relative Fit Index (RFI) = .829
Critical N (CN) = 445.143
Root Mean Square Residual (RMR) = .0207
Standardized RMR = .0543
Goodness of Fit Index (GFI) = .816
Adjusted Goodness of Fit Index (AGFI) = .803
Parsimony Goodness of Fit Index (PGFI) = .762

The Satorra-Bentler scaled chi-square was significant, returning a value of 10758.440 (p = .0). The null hypothesis of exact model fit (H_{013}: RMSEA=0) was consequently rejected. It was evident that the measurement model did not have the ability to reproduce the observed covariance matrix to a degree of accuracy explainable in terms of sampling error only.

A test of close fit was also performed by LISREL to determine the probability of obtaining a RMSEA value of .0376 in the sample, given the assumption that the model fits closely in the population. The RMSEA of .0376 and the 90 percent confidence interval for RMSEA (.0367; .0384) revealed a good fitting measurement model. The upper bound of the confidence interval revealed a value below the critical cut off value of .05, indicating that the null hypothesis of close fit would not be rejected (under a .10 significance level). The test of close fit was performed by testing H_{023}: RMSEA ≤ .05 against H_{a23}: RMSEA > . 05. H_{O23} was not rejected given the fact that the probability of observing the sample RMSEA value under H_{023} was sufficiently large (1.00) portraying the same picture as the 90 percent confidence interval for RMSEA. Overall these results concluded that the null hypothesis of close fit could not be rejected, revealing a close fitting model in the parameter.

The model ECVI (11.05) revealed a smaller value than the independence model (63.323) but larger than the ECVI value associated with the saturated model (8.894). This suggested that the model had a better chance of being replicated in a cross-validation sample than the less complex independence model but the more complex saturated model had a better chance of being replicated than this model.

The parsimonious normed fit index (PNFI = .798) and the parsimonious goodness-of-fit index (PGFI = .762) revealed a reasonable fitting model. The Aiken information criterion (AIC= 2070.440) for this model suggested that the fitted measurement model provided a more parsimonious fit than the independent model (66299.687) and the saturated model (9312.00). Smaller values on these indices generally indicate a more parsimonious model (Spangenberg & Theron, 2005). The consistent Aiken information criterion values (CAIC = 23792.364) also revealed a more parsimonious fit of the fitted measurement model than both the independent/null model (66871.332) and the saturated model (37036.799). It was therefore evident that the measurement model did not provide a too simplistic account of the process underlying the 15FQ+ and also provided a model that takes the complexity of the personality domain into account.

The normed fit index (NFI= .837), the non-normed fit index (NNFI= .891), the comparative fit index (CFI= .896), the incremental fit index (IFI=.896) and the relative fit index (RFI =.829) all fell slightly below the proposed critical value of .90. However, they were closer to unity than the independence model indicating comparative fit.

The estimated critical sample value (CN) of 445.143 fell above the recommended threshold value of 200 (Diamantopoulos & Siguaw, 2000). This revealed that the model provided an adequate representation of the data (Diamantopoulos & Siguaw, 2000). However, according to Hu and Bentler (1995) the proposed threshold should be used with caution. The RMR value of .0207 and the SRMR value of .0543 revealed a moderate fit. The SRMR did fall slightly above the cut-off value of .05.

The GFI (.816) and AGFI (.803) also fell slightly below the acceptable cut-off level of .90. These results therefore were interpreted to reveal moderate model fit.

The results from the overall fit assessment suggested a reasonable fitting model. The model did outperform the independence model, revealing that the model did not provide a too simplistic description of the process underlying the 15FQ+ and at times also outperformed the saturated model, providing evidence that the model seems to account for the complexity of the personality construct.

6.3.4.3.2 Examination of residuals

The stem-and-leaf plot (Figure 6.5) showed a distribution centred around the median of zero, suggesting good model fit. In the Q-plot (Figure 6.6), however, there were deviations from the 45° reference line suggesting only reasonable model fit.

```
- 9|2
 - 8|2
 - 7|6653
 - 6|97664443320
 - 5|987665553332111100
 - 4|988887777777776666665544444444444443333333322222222211111111111000000000
 - 3|99999999999888888888888777777777777777666666666665555555555555555555555544+99
 - 2|999999999999999999999999999999888888888888888888888888888888888888887777+95
 - 1|999999999999999999999999999999999999999999999999999999999888888888888888+94
 - 0|999999999999999999999999999999999999999999999999999999999999999999999999+92
   0|111111111111111111111111111111111111111111111111111111111111111111111111+95
   1|000000000000000000000000000000000000000000000000000000000000000000000000+92
   2|000000000000000000000000000000000000000000111111111111111111111111111111+96
   3|000000000000000000000000001111111111111111111111111222222222222222222222+06
   4|000000000000111111111111111112222333333334444445556666666677777788888899+06
   5|000114555666777899
   6|344455999
   7|299
   8|357
   9|4
  10|1
  11|3
```

Figure 6.5

STEM-AND-LEAF PLOT OF STANDARDISED RESIDUALS FOR THE COLOURED SAMPLE

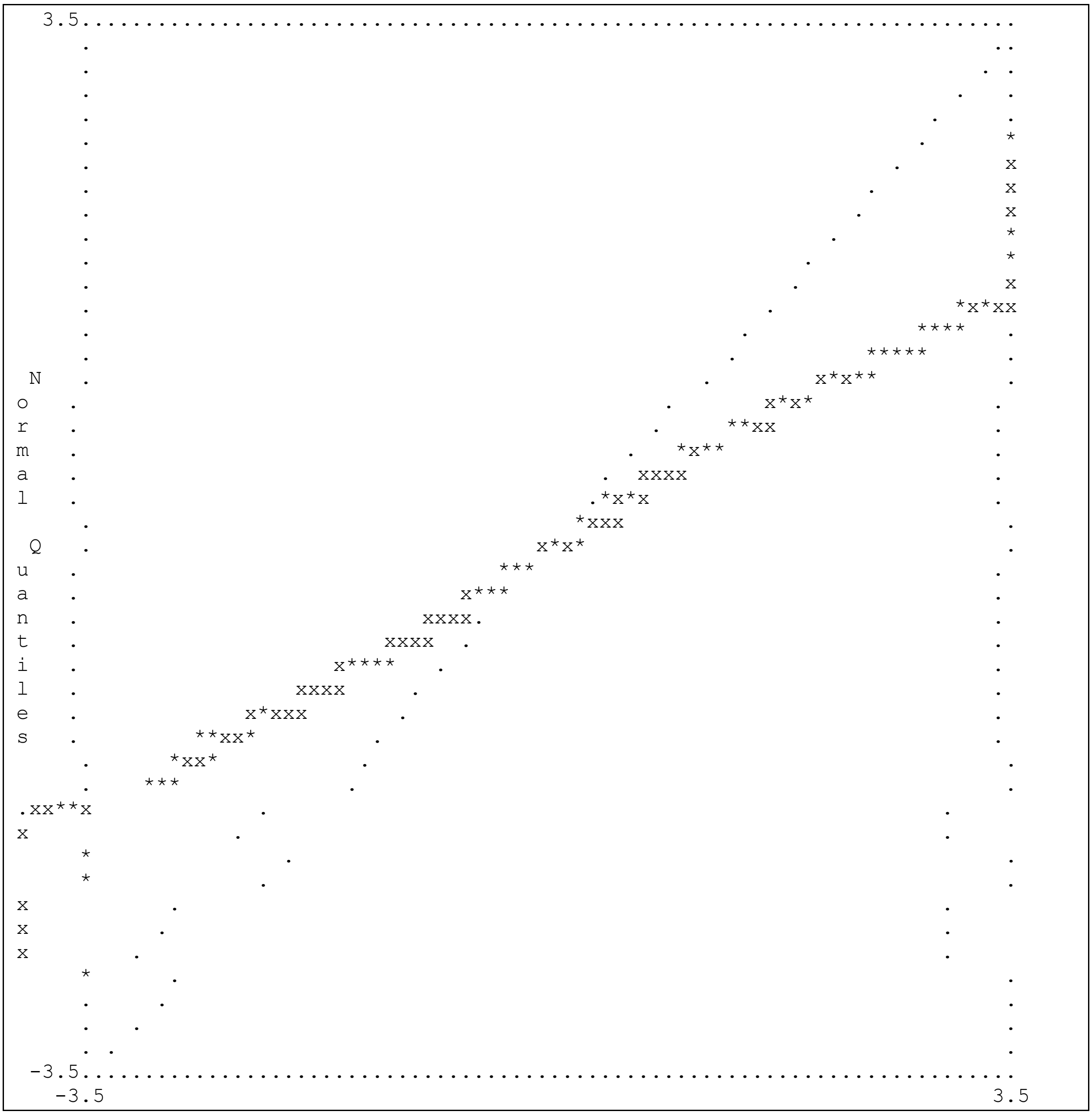

Figure 6.6

Q-PLOT OF STANDARDISED RESIDUALS FOR THE COLOURED SAMPLE

6.3.3.3.3 Model modification indices

The Λ_X modification index matrix revealed that 36% of the paths would significantly improve model fit when freed. This puts the claim made that the model is constructed in such a way that the items are allocated to primarily represent a specific personality dimension, to some degree into question. It is very difficult to isolate behaviour in which only a single personality dimension would express itself. As explained before behaviour tends to reflect the whole personality. Therefore it is reasonable to expect that the items of a specific subscale would load reasonably high on the specific underlying personality dimension, but would also be scattered through the whole personality domain (Gerbing & Tuley, 1991). Support for the suppressor effect was, however, not obtained during the exploratory factor analysis.

6.3.4.3.4 Assessment of the estimated model parameters

Table 6.33 revealed that all the freed factor loadings were significant ($p<.05$). This means that the item parcels significantly reflect the latent personality dimensions they were designed to represent. The factor loading matrix did, however, also contain low factor loadings, suggesting that the items comprising each item parcel generally did not represent the latent personality dimension they were designed to reflect, very well.

Table 6.34 reflects the measurement error variance for the item parcels revealing that the parcels were relatively noisy measures of the latent personality dimensions they were designed to reflect.

Table 6.35 reflects the phi-matrix of correlations between the 16 latent personality dimensions. Only a small portion of the correlations were statistically significant ($p < .05$). The correlations between the latent personality dimensions varied from low to moderate. The results provided support for the convergent validity of the 16 first-order personality dimensions assumed by the 15FQ+.

Table 6.33

COMPLETELY STANDARDISED FACTOR LOADING MATRIX FOR THE COLOURED SAMPLE

	FA	FB	FC	FE	FF	FG	FH	FI	FL	FM	FN	FO	FQ1	FQ2	FQ3	FQ4
PFA1	.134	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFA2	.336	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFA3	.628	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFA4	.605	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFA5	.385	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFA6	.556	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB1	- -	.540	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB2	- -	.561	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB3	- -	.526	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB4	- -	.520	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB5	- -	.521	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFB6	- -	.629	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC1	- -	- -	.517	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC2	- -	- -	.395	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC3	- -	- -	.514	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC4	- -	- -	.573	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC5	- -	- -	.448	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFC6	- -	- -	.618	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE1	- -	- -	- -	.503	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE2	- -	- -	- -	.486	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE3	- -	- -	- -	.229	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE4	- -	- -	- -	.622	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE5	- -	- -	- -	.521	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFE6	- -	- -	- -	.361	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFF1	- -	- -	- -	- -	.567	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

PFF2	- -	- -	- -	- -	.521	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFF3	- -	- -	- -	- -	.582	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFF4	- -	- -	- -	- -	.468	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFF5	- -	- -	- -	- -	.588	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFF6	- -	- -	- -	- -	.661	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFG1	- -	- -	- -	- -	- -	.620	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFG2	- -	- -	- -	- -	- -	.391	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFG3	- -	- -	- -	- -	- -	.511	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFG4	- -	- -	- -	- -	- -	.640	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFG5	- -	- -	- -	- -	- -	.565	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFG6	- -	- -	- -	- -	- -	.595	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFH1	- -	- -	- -	- -	- -	- -	.687	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFH2	- -	- -	- -	- -	- -	- -	.641	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFH3	- -	- -	- -	- -	- -	- -	.566	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFH4	- -	- -	- -	- -	- -	- -	.705	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFH5	- -	- -	- -	- -	- -	- -	.609	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFH6	- -	- -	- -	- -	- -	- -	.547	- -	- -	- -	- -	- -	- -	- -	- -	- -
PFI1	- -	- -	- -	- -	- -	- -	- -	.560	- -	- -	- -	- -	- -	- -	- -	- -
PFI2	- -	- -	- -	- -	- -	- -	- -	.544	- -	- -	- -	- -	- -	- -	- -	- -
PFI3	- -	- -	- -	- -	- -	- -	- -	.561	- -	- -	- -	- -	- -	- -	- -	- -
PFI4	- -	- -	- -	- -	- -	- -	- -	.618	- -	- -	- -	- -	- -	- -	- -	- -
PFI5	- -	- -	- -	- -	- -	- -	- -	.520	- -	- -	- -	- -	- -	- -	- -	- -
PFI6	- -	- -	- -	- -	- -	- -	- -	.306	- -	- -	- -	- -	- -	- -	- -	- -
PFL1	- -	- -	- -	- -	- -	- -	- -	- -	.647	- -	- -	- -	- -	- -	- -	- -
PFL2	- -	- -	- -	- -	- -	- -	- -	- -	.639	- -	- -	- -	- -	- -	- -	- -
PFL3	- -	- -	- -	- -	- -	- -	- -	- -	.344	- -	- -	- -	- -	- -	- -	- -
PFL4	- -	- -	- -	- -	- -	- -	- -	- -	.382	- -	- -	- -	- -	- -	- -	- -
PFL5	- -	- -	- -	- -	- -	- -	- -	- -	.566	- -	- -	- -	- -	- -	- -	- -
PFL6	- -	- -	- -	- -	- -	- -	- -	- -	.584	- -	- -	- -	- -	- -	- -	- -
PFM1	- -	- -	- -	- -	- -	- -	- -	- -	- -	.408	- -	- -	- -	- -	- -	- -

PFM2	--	--	--	--	--	--	--	--	--	.368	--	--	--	--	--	--
PFM3	--	--	--	--	--	--	--	--	--	.364	--	--	--	--	--	--
PFM4	--	--	--	--	--	--	--	--	--	.508	--	--	--	--	--	--
PFM5	--	--	--	--	--	--	--	--	--	.473	--	--	--	--	--	--
PFM6	--	--	--	--	--	--	--	--	--	.249	--	--	--	--	--	--
PFN1	--	--	--	--	--	--	--	--	--	--	.410	--	--	--	--	--
PFN2	--	--	--	--	--	--	--	--	--	--	.470	--	--	--	--	--
PFN3	--	--	--	--	--	--	--	--	--	--	.502	--	--	--	--	--
PFN4	--	--	--	--	--	--	--	--	--	--	.687	--	--	--	--	--
PFN5	--	--	--	--	--	--	--	--	--	--	.628	--	--	--	--	--
PFN6	--	--	--	--	--	--	--	--	--	--	.394	--	--	--	--	--
PFO1	--	--	--	--	--	--	--	--	--	--	--	.386	--	--	--	--
PFO2	--	--	--	--	--	--	--	--	--	--	--	.603	--	--	--	--
PFO3	--	--	--	--	--	--	--	--	--	--	--	.533	--	--	--	--
PFO4	--	--	--	--	--	--	--	--	--	--	--	.569	--	--	--	--
PFO5	--	--	--	--	--	--	--	--	--	--	--	.523	--	--	--	--
PFO6	--	--	--	--	--	--	--	--	--	--	--	.572	--	--	--	--
PFQ11	--	--	--	--	--	--	--	--	--	--	--	--	.392	--	--	--
PFQ12	--	--	--	--	--	--	--	--	--	--	--	--	.500	--	--	--
PFQ13	--	--	--	--	--	--	--	--	--	--	--	--	.621	--	--	--
PFQ14	--	--	--	--	--	--	--	--	--	--	--	--	.472	--	--	--
PFQ15	--	--	--	--	--	--	--	--	--	--	--	--	.532	--	--	--
PFQ16	--	--	--	--	--	--	--	--	--	--	--	--	.518	--	--	--
PFQ21	--	--	--	--	--	--	--	--	--	--	--	--	--	.240	--	--
PFQ22	--	--	--	--	--	--	--	--	--	--	--	--	--	.686	--	--
PFQ23	--	--	--	--	--	--	--	--	--	--	--	--	--	.429	--	--
PFQ24	--	--	--	--	--	--	--	--	--	--	--	--	--	.623	--	--
PFQ25	--	--	--	--	--	--	--	--	--	--	--	--	--	.384	--	--
PFQ26	--	--	--	--	--	--	--	--	--	--	--	--	--	.622	--	--
PFQ31	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.478	--

PFQ32	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.411	- -
PFQ33	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.261	- -
PFQ34	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.453	- -
PFQ35	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.510	- -
PFQ36	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.421	- -
PFQ41	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.587
PFQ42	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.557
PFQ43	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.425
PFQ44	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.571
PFQ45	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.529
PFQ46	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.680

Table 6.34

COMPLETELY STANDARDISED MEASUREMENT ERROR VARIANCE OF THE COLOURED SAMPLE

FA1	FA2	FA3	FA4	FA5	FA6	FB1	FB2	FB3	FB4	FB5	FB6	FC1	FC2
0.98	0.89	0.61	0.64	0.85	0.69	0.71	0.69	0.72	0.73	0.73	0.61	0.73	0.84

FC3	FC4	FC5	FC6	FE1	FE2	FE3	FE4	FE5	FE6	FF1	FF2	FF3	FF4
0.74	0.67	0.79	0.62	0.75	0.76	0.95	0.61	0.73	0.87	0.68	0.73	0.66	0.78

FF5	FF6	FG1	FG2	FG3	FG4	FG5	FG6	FH1	FH2	FH3	FH4	FH5	FH6
0.65	0.56	0.62	0.85	0.74	0.59	0.68	0.65	0.53	0.59	0.68	0.5	0.63	0.7

FI1	FI2	FI3	FI4	FI5	FI6	FL1	FL2	FL3	FL4	FL5	FL6	FM1	FM2
0.69	0.7	0.69	0.62	0.73	0.91	0.58	0.59	0.88	0.85	0.68	0.66	0.83	0.87

FM3	FM4	FM5	FM6	FN1	FN2	FN3	FN4	FN5	FN6	FO1	FO2	FO3	FO4
0.87	0.74	0.78	0.94	0.83	0.78	0.75	0.53	0.61	0.85	0.85	0.64	0.72	0.68

FO5	FO6	FQ11	FQ12	FQ13	FQ14	FQ15	FQ16	FQ21	FQ22	FQ23	FQ24	FQ25	FQ26
0.73	0.67	0.85	0.75	0.62	0.78	0.72	0.73	0.94	0.53	0.82	0.61	0.85	0.61

FQ31	FQ32	FQ33	FQ34	FQ35	FQ36	FQ41	FQ42	FQ43	FQ44	FQ45	FQ46
0.77	0.83	0.93	0.79	0.74	0.82	0.66	0.69	0.82	0.67	0.72	0.54

Table 6.35

COMPLETELY STANDARDISED PHI MATRIX FOR THE COLOURED SAMPLE

	FA	FB	FC	FE	FF	FG	FH	FI	FL	FM	FN	FO	FQ1	FQ2	FQ3	FQ4
FA	1															
FB	**.299**	1														
FC	**.213**	**.493**	1													
FE	**.129**	**.484**	**.406**	1												
FF	**.414**	**.316**	**.206**	**.211**	1											
FG	**.149**	**.30**	**.324**	**.263**	-.047	1										
FH	**.381**	**.463**	**.502**	**.696**	**.523**	**.127**	1									
FI	**.507**	**.194**	**.12**	**.104**	**.07**	.036	**.168**	1								
FL	-.157	-.317	-.428	-.067	-.16	-.005	-.17	-.23	1							
FM	**.175**	**.153**	-.20	**.138**	**.514**	-.321	**.367**	**.282**	-.079	1						
FN	**.198**	**.138**	**.265**	-.23	-.169	**.459**	-.105	.003	-.049	-.422	1					
FO	-.048	-.438	-.783	-.424	-.195	-.142	-.493	-.067	**.435**	**.093**	-.02	1				
FQ1	-.064	**.054**	-.145	**.163**	**.224**	-.333	**.268**	**.088**	.03	**.69**	-.461	-.071	1			
FQ2	-.305	-.158	-.34	-.243	-.588	-.016	-.529	-.08	**.32**	-.098	-.053	**.289**	-.016	1		
FQ3	**.266**	**.069**	.045	-.052	-.113	**.441**	-.024	-.038	**.325**	-.356	**.529**	**.152**	-.536	.044	1	
FQ4	-.163	-.233	-.756	-.042	-.016	-.294	-.257	0.00	**.263**	**.285**	-.474	**.554**	**.281**	**.261**	-.142	1

The items that have been highlighted indicates the non-significant correlations (p>.05).

6.3.4.3.5 Summary of model fit assessment for the Coloured Sample

The results from the model statistics for the Coloured sample indicated reasonable fit. The model did sometimes fail to capture the complexity of the dynamics underlying the 15FQ+ leading to the model failing to fit very well. The measurement model residuals and the modification indices calculated for the factor loading matrix indicated that the model would benefit from adding additional pathways. Furthermore, the completely standardised factor loading matrix and the completely standardised measurement error variances indicated the items of the 15FQ+ to be relatively noisy measures of the latent personality dimensions they were designed to reflect. It is evident from the result that the behavioural responses to the items of a specific personality sub-scale of the 15FQ+, although primarily determined by the latent personality dimension they were tasked to reflect, to varying degrees also reflects the remaining latent personality dimensions. The results suggested that the model did adequately account for the covariance observed between the item parcels even though the results raised some questions.

6.3.5 Assessing the Multi Group Measurement Model

Prior to evaluating the measurement equivalence and invariance of the 15FQ+ it was necessary to establish whether the single-group 15FQ+ measurement model fits the data of all three groups independently. Rejection of the null hypothesis of close fit (H_{02i}; i=1, 2, 3) for any one or more of the three samples would have indicated that the measurement model does not adequately fit the data of one or all three samples, and any examination of measurement invariance and measurement equivalence would then have been unnecessary. However, as indicated in the previous section, satisfactory model fit was obtained for all three sample groups, justifying the further measurement equivalence and invariance analyses.

This study used a series of steps set out by Dunbar and Theron (2010) to answer a sequence of questions or research problems that examine the extent to which the 15FQ+ measurement model may be considered measurement equivalent and invariant or not, and to determine on which measurement model parameters group differences exist.

6.3.5.1 The test of configural invariance

The test of configural invariance establishes if the multi-group measurement model in which the structure of the model is constrained to be the same across groups but with no freed parameters constrained to be equal across groups display reasonable fit when fitted to the samples simultaneously in a multi-group analysis. As such, the test of configural invariance tested the null hypothesis of whether the structure of the model would be invariant across groups. This test was operationalised by fitting a model in which the structure of the measurement model was constrained to be equal but all the model parameters were freely estimated across the White (n=4532), Black (n=4440) and Coloured (n=1049) samples. Failure to reject the null hypothesis of close fit would indicate that the structure of the measurement model is invariant across the three groups. The spectrum of GOF statistics for the 15FQ+ configural invariance multi-group measurement model is presented in Table 6.36[13].

Table 6.36

GLOBAL GOODNESS-OF-FIT INDICATORS FOR THE CONFIGURAL INVARIANCE MULTI-GROUP ANALYSIS

Degrees of Freedom = 13032
Minimum Fit Function Chi-Square = 58802.424 (P = .0)
Normal Theory Weighted Least Squares Chi-Square = 73995.863 (P = .0)
Satorra-Bentler Scaled Chi-Square = 70222.430 (P = .0)
Estimated Non-centrality Parameter (NCP) = 5719.430
90 Percent Confidence Interval for NCP = (56361.030 ; 58024.346)
Minimum Fit Function Value = 5.871
Population Discrepancy Function Value (F0) = 5.710
90 Percent Confidence Interval for F0 = (5.628 ; 5.794)
Root Mean Square Error of Approximation (RMSEA) = .0363
90 Percent Confidence Interval for RMSEA = (.0360 ; .0365)
P-Value for Test of Close Fit (RMSEA < .05) = 1.000
Expected Cross-Validation Index (ECVI) = 7.256
90 Percent Confidence Interval for ECVI = (7.145 ; 7.311)
ECVI for Saturated Model = .930
ECVI for Independence Model = 68.095
Chi-Square for Independence Model with 13680 Degrees of Freedom = 681776.696
Independence AIC = 682352.696
Model AIC = 44158.430

[13] The 64 bit version of LISREL 9 ran 24 hours per day for 7 days before the multi-group model converged.

Saturated AIC = 27936.000

Independence CAIC = 684717.792

Model BIC = -49826.259

Model CAIC = -62858.259

Saturated CAIC = 142643.154

Normed Fit Index (NFI) = .897

Non-Normed Fit Index (NNFI) = .910

Parsimony Normed Fit Index (PNFI) = .855

Comparative Fit Index (CFI) = .914

Incremental Fit Index (IFI) = .914

Relative Fit Index (RFI) = .892

Critical N (CN) = 1913.584

Contribution to Chi-Square = 25336.767

Percentage Contribution to Chi-Square = 43.088

Root Mean Square Residual (RMR) = .0210

Standardized RMR = .0497

Goodness of Fit Index (GFI) = .874

Configural invariance was tested by testing H_{03}: RMSEA ≤ .05. The root mean square error of approximation (RMSEA) obtained a value of .0363. This RMSEA value indicated very good model fit. The 90 percent confidence interval for RMSEA (.0360; .0365) also indicated that the fit of the measurement model could be regarded as good. The upper bound of the confidence interval was below the critical cut off value of .05 indicating that it is unlikely that the null hypothesis of close fit would be rejected (p<.05). The test performed for close fit includes testing H_{03}: RMSEA ≤ .05 against H_{a3}: RMSEA > .05. The probability of observing the sample RMSEA value assuming H_{03} to be true in the parameter signified that H_{O3} need not be rejected. The p-value for test of close fit was 1.00. These fit indicators revealed that the configural invariance multi-group measurement model showed good fit.

The results indicated that the multi-group measurement model in which the structure of the model is constrained to be the same across ethnic groups, but with no freed parameters constrained to be equal across groups, displayed close fit when fitted to the samples simultaneously in a multi-group analysis.The fact that the close fit null hypothesis (H_{03}) was not rejected warranted the conclusion that the 15FQ+ showed configural invariance indicating that the 15FQ+ measured the same construct across the three groups. Hence, a lack of construct bias can be assumed. If there was a lack of configural invariance other tests of measurement invariance and equivalence would have been unnecessary because it would have indicated that the measuring instrument reflected different constructs across the three groups. Finding support for configural invariance signified that the different groups used the same conceptual frame of reference when they responded to the items; the 15FQ+ therefore reflected the same underlying construct across the three groups. Finding support for configural invariance was a prerequisite for evaluating further aspects of measurement invariance and measurement equivalence. The configural invariance multi-group measurement model was used as the baseline model against which further nested models were evaluated (for the equivalence calculations).

6.3.5.2 The test of weak invariance

Given that acceptable model fit on all three samples independently, and configural invariance was supported, the next question then needed to be addressed was whether a lack of invariance exist in the factor loadings of the item parcels on the latent variables across samples. Consequently, weak invariance was tested next. Weak invariance investigates whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are estimated freely across the samples, but for the slope of the regression of the indicator variables on the latent variables which are constrained to be equal, demonstrated acceptable fit when fitted to the samples simultaneously in a multi-group analysis. As such, the test of weak invariance tests the null hypothesis that factor loadings for like items were invariant across the three groups. The multi-group 15FQ+ measurement model, in which the structure of the model and the slopes of the regression of the indicator variables on the latent variables were constrained to be equal, but all other parameters was estimated freely across the ethnic group samples, was fitted to the White (n=4532), Black (n=4440) and Coloured (n=1049) samples. Failure to reject the null hypothesis of close fit would indicate that the factor loadings are invariant across the three groups and that possible invariance can be attributed to other parameter estimates in the measurement model. The GOF statistics for the weak invariance multi-group measurement model is presented in Table 6.37.

Table 6.37

GLOBAL GOODNESS-OF-FIT INDICATORS FOR THE WEAK INVARIANCE MULTI-GROUP ANALYSIS

Degrees of Freedom = 13192
Minimum Fit Function Chi-Square = 6007.756 (P = .0)
Normal Theory Weighted Least Squares Chi-Square = 76328.796 (P = .0)
Satorra-Bentler Scaled Chi-Square = 72437.034 (P = .0)
Estimated Non-centrality Parameter (NCP) = 59245.034
90 Percent Confidence Interval for NCP = (58401.755 ; 60092.739)
Minimum Fit Function Value = 6.054
Population Discrepancy Function Value (F0) = 5.970
90 Percent Confidence Interval for F0 = (5.885 ; 6.056)
Root Mean Square Error of Approximation (RMSEA) = .0368
90 Percent Confidence Interval for RMSEA = (.0366 ; .0371)
P-Value for Test of Close Fit (RMSEA < .05) = 1.000
Expected Cross-Validation Index (ECVI) = 7.514
90 Percent Confidence Interval for ECVI = (7.400 ; 7.571)
ECVI for Saturated Model = .938
ECVI for Independence Model = 67.894
Chi-Square for Independence Model with 13680 Degrees of Freedom = 673517.669
Independence AIC = 674093.669
Model AIC = 46053.034
Saturated AIC = 27936.000
Independence CAIC = 676456.108
Model BIC = -48963.804
Model CAIC = -62155.804
Saturated CAIC = 142514.287
Normed Fit Index (NFI) = .892
Non-Normed Fit Index (NNFI) = .907
Parsimony Normed Fit Index (PNFI) = .861
Comparative Fit Index (CFI) = .910
Incremental Fit Index (IFI) = .910
Relative Fit Index (RFI) = .888
Critical N (CN) = 186.312
Contribution to Chi-Square = 2530.334
Percentage Contribution to Chi-Square = 42.118
Root Mean Square Residual (RMR) = .0214
Standardized RMR = .0509
Goodness of Fit Index (GFI) = .872

Weak invariance was tested by testing H_{04}: RMSEA ≤ .05. The root mean square error of approximation (RMSEA) obtained a value of .036. The RMSEA therefore indicated that the measurement model showed very good model fit. The 90 percent confidence interval for RMSEA (.0366; .0371) indicated that the fit of the measurement model could be regarded as good. The upper bound of the confidence interval was below the critical cut off value of .05 indicating that the null hypothesis of close fit would not be rejected on a 10% significance level. The test of close fit was performed by testing H_{04}: RMSEA ≤ .05 against H_{a4}: RMSEA > .05. The probability of obtaining the same RMSEA value under H_{04} was sufficiently large (1.00) not to reject H_{04}.

In terms of the comparative fit indices, the normed fit index (NFI= .892), the non-normed fit index (NNFI= .907), the comparative fit index (CFI= .910), the incremental fit index (IFI=.910) and the relative fit index (RFI =.888) had the position that the weak invariance multi-group measurement model shows close fit in the parameter is therefore permissible.

The results revealed support for weak invariance. Weak invariance implies the position that the slopes of the regression of the items on the latent variables they represent are the same across the samples. The position that the slope of the regression of item parcels on the latent personality dimensions of the 15FQ+ is the same way across samples is therefore tenable. A lack of weak invariance would have implied that the slope of the regression of at least some of the items of the 15FQ+ on the latent variable they represent, differ across samples. However, finding support for weak invariance indicated that the item content is being perceived and interpreted the same across the three ethnic groups (Byrne & Watkins, 2003). The finding suggests that the rate at which the behavioural response to items change as the testee’s standing on the latent personality dimension changes, is the same across the three samples. In addtion, the results of the single-group confirmatory factor analyses suggested that the items generally are rather insensitive in that the rate at which the behavioural response to items change as the testee’s standing on the latent personality dimension changes, generally tends to be rather low. The rate to some degree differ across items, but not substantially so.

6.3.5.3 The test of metric equivalence

The test of metric equivalence determines whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are estimated freely across the samples but, for the slopes of the regression of the indicator variables on the latent variables, fits the multi-group data (practically significantly) poorer than a multi-group measurement model in which the structure of the model is constrained to be the same across groups but all parameters are estimated freely. Lack of metric equivalence is evident if the fit of the model with more constraints imposed fits practically significantly poorer than the model in which the parameters were allowed to differ across the groups. A lack of metric equivalence will indicate that the parameters in fact do differ across groups (Dunbar & Theron, 2010).

Metric equivalence is investigated by examining the statistical significance in the difference in fit through the chi-square difference test, as well as by examining the practical significance by calculating the differences between the two models in the CFI index, the Gamma Hat fit index and the McDonald non-centrality index. A chi-square difference test is used to determine the statistical significance of the difference between the Satorra-Bentler chi-square values for the multi-group model with the structure and factor loadings constraint across the groups (weak invariance) and for the multi-group model with only the structure constraint across the groups (configural invariance), taking into account the loss of degrees of freedom. The difference in chi-square values will be significant if the probability of obtaining the sample chi-square difference under the null hypothesis of no difference in the parameter is smaller than or equal to .05 indicating the rejection of the null hypothesis. The rejection of the null hypothesis would lead to the conclusion that although the weak invariance position is tenable, the position that the model may be considered to differ across the three groups in the manner in which the item parcels load on the latent variables represents a more tenable position. A non-significant chi-square value would indicate that the null hypothesis could not be rejected indicating that the factor loadings are the same across the three groups (Dunbar & Theron, 2010). The results of the chi-square difference test are presented in Table 6.38.

Table 6.38

CHI-SQUARE DIFFERENCE TEST OF METRIC EQUIVALENCE

HYPOTHESIS	SATORRA-BENTLER CHI SQUARE	NORMAL THEORY CHI-SQUARE	DF	Cd	SCALED DIFFERENCE IN S-B CHI-SQUARE	PROB S-B CHI-SQUARE DIFF	PROB SCALED S-B CHI-SQUARE DIFF
H_a:CONFIGURAL INVARIANCE MODEL	70222.43	73995.863	13032				
H_{08}:WEAK INVARIANCE MODEL	72437.034	76328.796	13192				
DIFF(H_{04}-H_a): METRIC EQUIVALENCE	2214.604		160	1.052969	2215.577	0	**0**

The difference in the chi-square values was statistically significant (p<.05) indicating the rejection of the null hypothesis (H_{08}). The rejection of the metric equivalence null hypothesis means the position that the multi-group measurement model differs across the three groups in the manner in which the item parcels load on the latent variables is a more tenable position than the weak invariance position. This implies lack of equivalence of factor loadings across the three samples (i.e. lack of metric equivalence).

Table 6.39

THE CFI, GAMMA HAT AND MCDONALD DIFFERENCE STATISTICS FOR METRIC EQUIVALENCE

MODEL	N-GROUPS	F0	# X	P	CFI	Γ1	Mc
H_a: CONFIGURAL INVARIANCE MODEL	3	5.71	96	288	0.914	0.96186	0.057556
H_{04}: WEAK INVARIANCE MODEL	3	5.97	96	288	0.91	0.960192	0.05054
DIFFERENCE (H_{04}-H_a): METRIC EQUIVALENCE					**-0.004**	**-0.00167**	**-0.007**

Table 6.49 show the calculations of the difference in the CFI, Gamma Hat and Mcdonald centrality index values for the metric equivalence analysis. A change less than -.01 in the CFI fit index, a change greater than -.001 in the Gamma Hat fit index (Γ_1) and a change less than -.02 in the McDonald Non-centrality index (Mc) (Cheung

& Rensvold, 2002) was revealed between the weak invariance multi-group measurement model and the configural invariance multi-group measurement model. As indicated in Table 6.49, the change in CFI and Mc was less than the critical thresholds; however for the Gamma Hat fit index the changes was slightly greater than the critical threshold of -.001. In terms of the decision-rule specified in chapter 4, metric equivalence could therefore not be concluded. A lack of metric equivalence implies that a multi-group measurement model in which the structure of the model is constrained to be the same across the three groups and in which all parameters are estimated freely but for the slopes of the regression of the indicator variables on the latent variables, fits practically significantly poorer than a multi-group measurement model in which the structure of the model is constrained to be the same across the three groups but all parameters are estimated freely. The slope of the regression of at least some of the item parcels of the 15FQ+ on the latent variables they represent differ across the three samples, indicating that the item content is not being perceived and interpreted the same across the three groups (Byrne & Watkins, 2003).

6.3.5.4 The test of strong invariance

The next step entailed to investigate whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are estimated freely across the samples, but for the factor loadings and the vector of regression intercepts, demonstrates acceptable fit when fitted to the samples simultaneously in a multi-group analysis. The 15FQ+ measurement model, in which the structure of the model, the factor loadings, and the vector of the regression intercepts were constrained to be the same across ethnic groups, was fitted to the White (n=4532), Black (n=4440) and Coloured (n=1049) samples in a multi-group analysis.

The test of strong invariance determines whether the regression slopes and intercepts are the same across groups. The test of strong invariance was considered permissible because of the earlier finding of weak invariance. A lack of strong invariance would imply that the regression intercepts of at least some of the items on the latent variable they represent differ across samples (assuming weak invariance). Finding support for strong invariance would support the position that the items operate in approximately the same way across samples in the way they reflect the underlying latent variables they were meant to reflect (Dunbar & Theron, 2010). Failure to reject the null hypothesis will indicate support for strong invariance. The null hypothesis indicates that the regression slopes and intercepts for like items are invariant across the three groups. Therefore failure to reject the null hypothesis will indicate that the factor loadings and the vector of regression intercepts are invariant across the three groups. The spectrum of GOF statistics for the strong invariance multi-group measurement model is presented in Table 6.40.

Table 6.40

GLOBAL GOODNESS-OF-FIT INDICATORS FOR THE STRONG INVARIANCE MULTI-GROUP ANALYSIS

Contribution to Chi-Square = 1060.554
Percentage Contribution to Chi-Square = 14.302
Root Mean Square Residual (RMR) = .0215
Standardized RMR = .0559
Goodness of Fit Index (GFI) = .807
Contribution to Chi-Square = 3135.387
Percentage Contribution to Chi-Square = 42.298
Root Mean Square Residual (RMR) = .0193
Standardized RMR = .0539
Goodness of Fit Index (GFI) = .829
Degrees of Freedom = 13384
Minimum Fit Function Chi-Square = 74117.258 (P = .0)
Normal Theory Weighted Least Squares Chi-Square = 102879.409 (P = .0)
Satorra-Bentler Scaled Chi-Square = 100032.478 (P = .0)
Estimated Non-centrality Parameter (NCP) = 86648.478
90 Percent Confidence Interval for NCP = (85642.870 ; 87657.021)
Minimum Fit Function Value = 7.469
Population Discrepancy Function Value (F0) = 8.732
90 Percent Confidence Interval for F0 = (8.631 ; 8.834)
Root Mean Square Error of Approximation (RMSEA) = .0442
90 Percent Confidence Interval for RMSEA = (.0440 ; .0445)
P-Value for Test of Close Fit (RMSEA < .05) = 1.000
Expected Cross-Validation Index (ECVI) = 1.257
90 Percent Confidence Interval for ECVI = (1.126 ; 1.329)
ECVI for Saturated Model = .938
ECVI for Independence Model = 67.894
Chi-Square for Independence Model with 13680 Degrees of Freedom = 673517.669
Independence AIC = 674093.669

Model AIC = 73264.478

Saturated AIC = 27936.000

Independence CAIC = 676456.108

Model BIC = -23135.262

Model CAIC = -36519.262

Saturated CAIC = 142514.287

Normed Fit Index (NFI) = .851

Non-Normed Fit Index (NNFI) = .866

Parsimony Normed Fit Index (PNFI) = .833

Comparative Fit Index (CFI) = .869

Incremental Fit Index (IFI) = .869

Relative Fit Index (RFI) = .848

Critical N (CN) = 1366.711

Contribution to Chi-Square = 32166.316

Percentage Contribution to Chi-Square = 43.399

Root Mean Square Residual (RMR) = .0239

Standardized RMR = .0551

Goodness of Fit Index (GFI) = .844

Strong invariance was tested by testing H_{05}: RMSEA ≤ .05 against H_{a5}: RMSEA > .05. The results revealed a sample RMSEA value of .0442, thus indicating that the measurement model obtained good fit in the sample.The 90 percent confidence interval for RMSEA (.0440; .0445) also indicated that the fit of the measurement model could be regarded as good. The upper bound of the confidence interval were below the critical cut off value of .05 indicating that the null hypothesis of close fit would not be rejected under a 10% significance level. The probability of observing the sample RMSEA value assuming H_{05} to be true in the parameter was sufficiently large to allow H_{05} not to be rejected.

The results revealed support for strong invariance. This finding implies that it is an acceptable position to hold that the intercepts of the items on the latent variable they represent are the same across ethnic group samples. A lack of strong invariance would have implied that the intercepts of the regression of at least some of the item parcels of the 15FQ+ on the latent variables they represent differ across samples. However, finding support for strong invariance suggested that the item content is being perceived and interpreted the same across the three groups (Byrne & Watkins, 2003). The finding of strong invariance implied lack of uniform bias. The finding of strict invariance in addition means that a conclusion of a lack of measurement bias is permissible under the more lenient interpretation of measurement bias. The more lenient interpretation of measurement bias argues that items measure can be considered biased if:

$$E[X_i \geq x_c|\xi=\xi_c \ \& \ G=G_1] \neq E[X_i \geq x_c|\xi=\xi_c \ \& \ G=G_2] \neq E[X_i \geq x_c|\xi=\xi_c \ \& \ G=G_3]$$

Since the expected item score [X_i] given a specific standing on the latent personality dimension [$\xi=\xi_c$] only depends on the slope and intercept of the regression of X_i on ξ an item measure can in terms of this definition be considered unbiased if the slope and intercept of the regression of X_i on ξ are the same across the three groups. Stronger evidence of lack of uniform bias would however have been provided if it could be shown that the 15FQ+ multi-group measurement model displays scalar equivalence.

6.3.5.5 The test of scalar equivalence

The test of scalar equivalence determines whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are estimated freely across the samples, but for the slope and the intercepts of the regression of the indicator variables on the latent variables, fits the multi-group data practically significantly poorer than a multi-group measurement model in which the structure of the model is constrained to be the same across groups, but all parameters are estimated freely. If the strong invariance model with more constraints imposed on its parameters fits practically significantly poorer than the configural invariance model in which the parameters were allowed to differ across the groups, a lack of scalar equivalence will be evident.

In this study the test for scalar equivalence is redundant since a lack of metric equivalence has already been shown. The lack of metric equivalence suggests that for one or more of the item parcels the slope of the regression of the indicator variable on the latent personality dimension it is tasked to reflect, differs across two or all three of the samples. The strong invariance multi-group model adds additional constraints to the weak invariance model. If the weak invariance model fitted statistically and practically significantly poorer than the configural invariance multi-group model, logically the strong invariance multi-group model should also fit significantly poorer than the configural invariance multi-group model. The lack of metric equivalence implies non-uniform item bias. The lack of metric and scalar equivalence suggests measurement bias in the 15FQ+ under the more lenient interpretation of measurement bias.

Tests of (revised) scalar equivalence would be warranted only if at least partial metric equivalence can be shown. This requires refitting the weak invariance multi-group model but now with the slope of the regression of the item parcel on the latent personality dimension that differs most across two of the three groups freely estimated in those two groups. The differences in the factor loadings will have to be calculated in the completely standardised common-metric solution obtained for the configural invariance model. Given that there are k=3 groups there are three λ_{ijk}-λ_{ijq} difference terms to be calculated for k=1, 2 and k=2, 3. These three lists of differences then need to be combined into a single list and rank-ordered from the largest difference to the smallest difference. In this list the item and the groups being compared need to be indicated next to each λ_{ijk}-λ_{ijq} difference term.

Once the multi-group measurement model is identified that displays partial metric equivalence, the strong invariance model will be refitted with those specific slope parameters freely estimated. The fit of this revised strong invariance multi-group model[14] will then be compared to that of the configural invariance model and the difference in fit evaluated in terms of practical and statistical significance. This procedure could have resulted in a finding of (revised) full scalar equivalence. This would have meant that once selected differences in slope parameters are controlled for no differences in intercept parameters exist. This procedure, however, also could have resulted in a finding of (revised) partial scalar equivalence. This would have meant that even when selected differences in slope parameters are controlled for differences in intercept parameters also exist.

This procedure was, however, not implemented in this study purely due to the logistical challenge caused by the time it takes LISREL to fit a single multi-group model. In the test for partial metric equivalence it is not inconceivable that 15 or more slope terms (out of a total of 3*[96-16]=240) will have to be freed. This would

[14] This points to the need of an elaborated taxonomy that clearly can get quite complex given the number of possible permutations that could be found.

imply 15 weeks or more of continuous analysis to establish whether partial metric equivalence is a realistic possibility. The same procedure would then have propagated into examining partial scalar equivalence, partial conditional probability equivalence and partial full equivalence. With a model of this magnitude this would have amounted to a staggering number of computational hours. This is more than can be realistically expected of a master's research study.

6.3.5.6 The test of strict invariance

The next step was to investigate strict invariance. Strict invariance determines whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are estimated freely across the samples, but for the factor loadings, the vector of regression intercepts and the measurement error variances of the indicator variables, demonstrates acceptable fit when fitted to the samples simultaneously in a multi-group analysis. The test of strict invariance was considered permissible because of the earlier finding of strong invariance.

It is evident that the test of strict invariance determines whether the regression slope, and the intercept and error variances of indicator variables are the same across groups. Therefore a lack of strict invariance would imply that the regression slope, intercept and error variance of indicator variables of at least some of the items on the latent variable they represent differ across samples. Strict invariance indicates that the respondents from the different ethnic groups responded to the instrument in such a manner that no significant variance exists across samples in terms of error terms associated with the indicator variables (Dunbar & Theron, 2010). The GOF statistics for the strict invariance analysis is presented in Table 6.41.

Table 6.41

GLOBAL GOODNESS-OF-FIT INDICATORS FOR THE STRICT INVARIANCE MULTI-GROUP ANALYSIS

Degrees of Freedom = 13576

Minimum Fit Function Chi-Square = 78088.759 (P = .0)

Normal Theory Weighted Least Squares Chi-Square = 107205.334 (P = .0)

Satorra-Bentler Scaled Chi-Square = 104862.754 (P = .0)

Estimated Non-centrality Parameter (NCP) = 91286.754

90 Percent Confidence Interval for NCP = (90255.754; 9232.451)

Minimum Fit Function Value = 7.869

Population Discrepancy Function Value (F0) = 9.200

90 Percent Confidence Interval for F0 = (9.096; 9.304)

Root Mean Square Error of Approximation (RMSEA) = .0451

90 Percent Confidence Interval for RMSEA = (.0448; .0453)

P-Value for Test of Close Fit (RMSEA < .05) = 1.000

Expected Cross-Validation Index (ECVI) = 1.705

90 Percent Confidence Interval for ECVI = (1.572; 1.780)

ECVI for Saturated Model = .938

ECVI for Independence Model = 67.894

Chi-Square for Independence Model with 13680 Degrees of Freedom = 673517.669

Independence AIC = 674093.669

Model AIC = 7771.754

Saturated AIC = 27936.000

Independence CAIC = 676456.108

Model BIC = -20071.887

Model CAIC = -33647.887

Saturated CAIC = 142514.287

Normed Fit Index (NFI) = .844

Non-Normed Fit Index (NNFI) = .861

Parsimony Normed Fit Index (PNFI) = .838

Comparative Fit Index (CFI) = .862

Incremental Fit Index (IFI) = .862

Relative Fit Index (RFI) = .843

Critical N (CN) = 1322.228

Group Goodness of Fit Statistics

Contribution to Chi-Square = 33965.783

Percentage Contribution to Chi-Square = 43.496

Root Mean Square Residual (RMR) = .0243

Standardized RMR = .0561

Goodness of Fit Index (GFI) = .837

Strict invariance was tested by testing H_{06}: RMSEA ≤ .05 against H_{a6}: RMSEA > .05. The root mean square error of approximation (RMSEA) obtained a value of .0451 indicating good model fit. Good model fit was also revealed in the 90 percent confidence interval for RMSEA (.0448; .0453). The upper bound of the confidence interval was below the critical cut-off value of .05 indicating that the null hypothesis of close fit would not be rejected under a 10% significance level. The p-value for test of close fit revealed that the probability of observing the sample RMSEA value of .0451 if H_{06} is assumed to be true in the parameter is 1.00 leading to the conclusion that the null hypothesis of close fit would not be rejected. These results support a conclusion that close fit was attained in the parameter.

Strict invariance was supported through the results obtained from the analysis. Support is thus provided for the position that the respondents from the different ethnic groups respond to the 15FQ+ in such a manner that no significant variance exists across samples in terms of error terms associated with the indicator variables. A lack of strict invariance would have implied that some of the measurement error variances of the indicator variables of the item parcels of the 15FQ+ on the latent variables they represent differ across samples. The finding of strict invariance means that a conclusion of a lack of measurement bias is permissible under the stringent interpretation of measurement bias. The more stringent interpretation of measurement bias argues that items measure can be considered biased if:

$$P[X_i \geq x_c | \xi = \xi_c \ \& \ G = G_1] \neq P[X_i \geq x_c | \xi = \xi_c \ \& \ G = G_2] \neq P[X_i \geq x_c | \xi = \xi_c \ \& \ G = G_3]$$

Since the probability of obtaining an item score $[X_i]$ given a specific standing on the latent personality dimension $[\xi=\xi_c]$ depends on the slope and intercept of the regression of X_i on ξ as well as the error variance an item measure can in terms of this definition be considered unbiased if the slope, intercept and the error variance of the regression of X_i on ξ are the same across the three groups. Stronger evidence of lack of measurement bias would however have been provided if it could be shown that the 15FQ+ multi-group measurement model displays scalar equivalence.

6.3.5.7 The test of conditional probability equivalence

The test of conditional probability equivalence determines whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are estimated freely across the samples, but for the factor loadings, regression intercepts and measurement error variances of the indicator variables, fits multi-group data practically significantly poorer than a multi-group measurement model in which the structure of the model is constrained to be the same across groups, but all parameters are estimated freely. There will be a lack of conditional probability equivalence if the fit of the model with more constraints imposed fits practically significantly poorer than the model in which the parameters were allowed to differ across the groups. A lack of conditional probability equivalence will indicate that the parameters in fact do differ across groups (Dunbar & Theron, 2010).

In this study the test for conditional probability equivalence is redundant since a lack of metric equivalence has already been shown. The lack of metric equivalence suggests that for one or more of the item parcels the slope of the regression of the indicator variable on the latent personality dimension it is tasked to reflect differs across two or all three of the samples. The strict invariance multi-group model adds additional constraints to the weak and strong invariance models. If the weak invariance model fitted statistically and practically significantly poorer than the configural invariance multi-group model logically the strict invariance multi-group model should also fit significantly poorer than the configural invariance multi-group model. A comparison of the fit of the revised strong invariance multi-group measurement model might in addition have shown lack of scalar invariance. This would strengthened the redundancy of the test for conditional probability equivalence. Lack of conditional probability equivalence therefore suggests measurement bias in the 15FQ+ under the more stringent definition of measurement bias.

Tests of conditional probability equivalence would be warranted only if at least partial metric equivalence and either full (revised[15]) scalar equivalence or partial (revised) scalar equivalence can be shown. This would have required refitting the strong invariance multi-group model but now with the slope of the regression of the item parcels on the latent personality dimensions that differ practically significantly across at least two of the three groups freely estimated in those groups (i.e. a revised strong invariance models that acknowledges the slope differences uncovered by the partial metric equivalence analysis). If this revised strong invariance multi-group model fits closely and if this model does not fit practically significantly poorer than the configural invariance model full (revised) scalar equivalence has been demonstrated. If the revised strong invariance multi-group model does fit practically significantly poorer than the configural invariance model partial scalar equivalence should be sought by systematically identifying the intercept parameters that showed the largest

[15] The term “revised” acknowledges that not all of the slope parameters are constrained to be equal across groups.

difference in the completely standardised solution of the configural invariance model. The procedure will be analogous to the procedure described earlier for the identification of the slope parameter estimates that differs most across groups. These tau parameters will then be sequentially allowed to differ across specific groups and the fit of this further revised strong invariance model will then be compared to the fit of the configural invariance model until a practically insignificant difference in fit is achieved.

Once the multi-group measurement model is identified that displays partial scalar equivalence, the revised strict invariance model will be refitted with the specific slope and intercept parameters freely estimated that were shown to be different across specific groups in the partial metric and partial scalar (if relevant) equivalence analyses. The fit of this revised strict invariance multi-group model will then be compared to that of the configural invariance model and the difference in fit evaluated in terms of practical and statistical significance.

If this revised strict invariance multi-group model fits closely and if this model does not fit practically significantly poorer than the configural invariance model full (revised) conditional probability equivalence has been demonstrated. If the revised strict invariance multi-group model does fit practically significantly poorer than the configural invariance model partial conditional probability equivalence should be sought by systematically identifying the error variance parameters that showed the largest difference in the completely standardised solution of the configural invariance model. The procedure will be analogous to the procedures described earlier for the identification of the slope and intercept parameter estimates that differs most across groups. These theta-delta parameters will then be sequentially allowed to differ across specific groups and the fit of this further revised strict invariance model will then be compared to the fit of the configural invariance model until a practically insignificant difference in fit is achieved.

This procedure was, however, not implemented in this study purely due to the logistical challenge caused by the time it takes LISREL to fit a single multi-group model.

6.3.5.8 The test of complete invariance

The next step included establishing whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are constrained to be the same across the samples demonstrates acceptable fit when fitted to the samples simultaneously in a multi-group analysis. The test of complete invariance was considered permissible because of the earlier finding of strict invariance.

According to Vandenberg and Lance (2000, p.39) the test of complete invariance determines whether the samples use "equivalent ranges of the construct continuum to respond to the indicators reflecting the construct". If the null hypothesis of close fit cannot be rejected complete measurement invariance across samples is indicated. The 15FQ+ measurement model, in which the structure of the model, the factor loadings, the vector of the regression intercepts, the measurement error variances of the indicator variables, and all the latent variable variances and covariances were constrained to be the same across the three ethnic groups, was fitted to the White (n=4532), Black (n=4440) and Coloured (n=1049) samples. The GOF statistics for this analysis is presented in Table 6.42.

Table 6.42

GLOBAL GOODNESS-OF-FIT INDICATORS FOR THE COMPLETE INVARIANCE MULTI-GROUP ANALYSIS

Contribution to Chi-Square = 11159.991
Percentage Contribution to Chi-Square = 13.393
Root Mean Square Residual (RMR) = .0231
Standardized RMR = .0589
Goodness of Fit Index (GFI) = .798
Contribution to Chi-Square = 3682.459
Percentage Contribution to Chi-Square = 44.188
Root Mean Square Residual (RMR) = .0245
Standardized RMR = .0629
Goodness of Fit Index (GFI) = .812
Degrees of Freedom = 13848
Minimum Fit Function Chi-Square = 83326.868 (P = .0)
Normal Theory Weighted Least Squares Chi-Square = 113513.415 (P = .0)
Satorra-Bentler Scaled Chi-Square = 111565.861 (P = .0)
Estimated Non-centrality Parameter (NCP) = 97717.861

90 Percent Confidence Interval for NCP = (96652.567; 98785.471)
Minimum Fit Function Value = 8.397
Population Discrepancy Function Value (F0) = 9.848
90 Percent Confidence Interval for F0 = (9.740; 9.955)
Root Mean Square Error of Approximation (RMSEA) = .0462
90 Percent Confidence Interval for RMSEA = (.0459; .0464)
P-Value for Test of Close Fit (RMSEA < .05) = 1.000
Expected Cross-Validation Index (ECVI) = 11.325
90 Percent Confidence Interval for ECVI = (11.189; 11.404)
ECVI for Saturated Model = .938
ECVI for Independence Model = 67.894
Chi-Square for Independence Model with 13680 Degrees of Freedom = 673517.669
Independence AIC = 674093.669
Model AIC = 83869.861
Saturated AIC = 27936.000
Independence CAIC = 676456.108
Model BIC = -15871.890
Model CAIC = -29719.890
Saturated CAIC = 142514.287
Normed Fit Index (NFI) = .834
Non-Normed Fit Index (NNFI) = .854
Parsimony Normed Fit Index (PNFI) = .845
Comparative Fit Index (CFI) = .852
Incremental Fit Index (IFI) = .852
Relative Fit Index (RFI) = .836
Critical N (CN) = 1267.379
Contribution to Chi-Square = 35346.418
Percentage Contribution to Chi-Square = 42.419
Root Mean Square Residual (RMR) = .0281
Standardized RMR = .0724
Goodness of Fit Index (GFI) = .826

Complete invariance was tested by testing H_{07}: RMSEA ≤ .05 against H_{a7}: RMSEA > .05. The root mean square error of approximation (RMSEA) obtained a value of .0462 indicating good model fit. The 90 percent confidence interval for RMSEA of (.0459; .0464) indicated that the fit of the measurement model could be regarded as good. The upper bound of the confidence interval was below the critical cut off value of .05 indicating that the null hypothesis of close fit would not be rejected under a

10% significance level. The probability of observing the sample RMSEA value under H_{07} (1.00) was larger than .05 signifying that H_{O7} was not rejected.

Upon fitting the complete invariance measurement model, is was established that the multi-group measurement model in which the structure of the model, the factor loadings, the vector of the regression intercepts, the measurement error variances of the indicator variables, and all the latent variable variances and covariances were constrained to be the same across the three ethnic groups, demonstrated acceptable fit when fitted to the ethnic group samples simultaneously in a multi-group analysis. Support for complete invariance was obtained. This finding implies that the position that the latent variable variances and covariances are the same across ethnic group samples is permissible.

6.3.5.9 The test of full equivalence

The test of full equivalence determines whether the multi-group measurement model in which the structure of the model is constrained to be the same across groups and in which all parameters are constrained to be equal across the samples fits the multi-group data practically significantly poorer than a multi-group measurement model in which the structure of the model is constrained to be the same across groups but all parameters are estimated freely. There will be a lack of full equivalence if the fit of the model with more constraints imposed fits practically significantly poorer than the model in which the parameters were allowed to differ across the groups. A lack of full equivalence will indicate that the parameters in fact do differ across groups (Dunbar & Theron, 2010).

In this study the test for full equivalence is redundant since a lack of metric equivalence has already been shown. The lack of metric equivalence suggests that for one or more of the item parcels the slope of the regression of the indicator variable on the latent personality dimension it is tasked to reflect differs across two or all three of the samples. The complete invariance multi-group model adds additional constraints to the weak strong and strict invariance models. If the weak invariance model fitted statistically and practically significantly poorer than the configural invariance multi-group model logically the full invariance multi-group model should also fit significantly poorer than the configural invariance multi-group model.

Tests of complete equivalence would be warranted only if at least partial metric equivalence, full or partial scalar equivalence and full or partial conditional probability equivalence can be shown.

Once the multi-group measurement model is identified that displays (revised) full or (revised) partial conditional probability equivalence, the revised complete invariance model will be refitted with the specific slope, intercept and error variance parameters freely estimated that were shown to be different across specific groups in the partial metric, partial scalar (if relevant) and partial conditional probability (if relevant) equivalence analyses. The fit of this revised complete invariance multi-group model will then be compared to that of the configural invariance model and the difference in fit evaluated in terms of practical and statistical significance.

If this revised complete invariance multi-group model fits closely and if this model does not fit practically significantly poorer than the configural invariance model full (revised) full equivalence has been demonstrated. If the revised complete invariance multi-group model does fit practically significantly poorer than the configural invariance model partial full equivalence should be sought by systematically identifying the latent variable covariance and latent variable variance parameters that showed the largest difference in the completely standardised solution of the configural invariance model. The procedure will be analogous to the procedures described earlier for the identification of the slope, intercept and error variance parameter estimates that differs most across groups. These phi parameters will then be sequentially allowed to differ across specific groups and the fit of this further revised complete invariance model will then be compared to the fit of the configural invariance model until a practically insignificant difference in fit is achieved.

6.3.5.10 Summary of multi-group model fit assessment

The foregoing analyses indicated that the 15FQ+ displays complete measurement invariance across the White, Black and Coloured samples in that the close fit null hypothesis was not rejected for the multi-group measurement model in which the structure and all the measurement model parameters were constrained to be equal across the three samples. The finding of complete invariance means that it is a permissible/tenable position to hold that the 15FQ+ measures the same construct across the three cultural / ethnic samples. The finding of complete invariance in addition means that it is a permissible/tenable position to hold that the slope, intercept, measurement error variances, latent variable covariances and latent variable variances do not differ across the three cultural / ethnic groups. This position may be regarded as permissible/tenable in that the complete invariance measurement model did adequately account for the covariance observed between the item parcels over the White, Black and Coloured samples.

The finding of complete invariance necessarily also implies findings of configural, weak, strong and strict invariance. The results suggested that a multi-group measurement model with, (a) the structure of the model constrained to be equal across groups but with no freed parameters constrained to be equal across groups and with, (b) equality constraints imposed on the factor loadings, the vector of regression intercepts and the measurement error variances of the indicator variables and with, (c) all its parameters constrained to be equal across groups, fits the data obtained from the three samples.

The presence of measurement equivalence was tested by determining whether a specific multi-group measurement invariance model with some of its parameters constrained to be equal across groups fitted substantially (i.e., practically significantly) poorer than a multi-group model with fewer of its parameters constrained to be equal across groups. The results for the metric equivalence model revealed that the configural invariance model with fewer constraints fitted better than the weak invariance model with constraints on the factor loadings. Metric equivalence was investigated through the scaled Satorra-Bentler chi-square difference test, as well as calculating the differences in the CFI index, Gamma Hat fit index and the Mcdonald non-centrality index between the two specified multi-group models. The results of the chi-square difference test revealed that statistically significant differences existed in one or more factor loading parameters estimates across two or more of the three samples. Partial metric equivalence was, however, not investigated due to the massive logistical burden it would place on the study.

The question whether practically significant differences also existed in the regression intercepts, measurement error variances of the indicator variables, the latent variable variances and latent variable covariances were therefore not investigated. Logically a lack of metric equivalence necessarily also means a lack of full scalar equivalence, full conditional probability equivalence and full full equivalence. It was, however, possible that once differences in specific slope parameters across groups are controlled for that no differences in intercept, error variance or phi parameters would be found across groups. Likewise it was, however, possible that once differences in specific slope parameters across groups are controlled for that differences in intercepts still do exist that account for practically significance differences in fit between the (revised) strong invariance model and the configural invariance model. In addition it was also possible that once differences in specific slope and intercept parameters across groups are controlled for those differences in error variances still exist and that once these are also controlled for differences in phi parameters still exist. A clear unambiguous stance on the manner in which the measurement model parameters differ across the three cultural / ethnic groups can therefore not be described. From the results presented in this study it is not clear for each of the items which of the parameters differ and neither is it clear if differences should exist between which groups the parameter differs.

What can be unambiguously concluded is that the current study found no evidence of construct bias in the 15FQ+. What can in addition be unambiguously concluded is that the current study found evidence that one or more slope parameters/factor loadings differ across two or more groups. This means that the 15FQ+ contains at least one or more items that display non-uniform bias.

It is evident from the CFA results that the item parcels of the 15FQ+ in this study were reasonably noisy measures of the latent personality variables they represent. This was also evident from the item analysis and dimensionality analysis results. Personality measures are generally seen to be prone to lower reliabilities than those typically found in cognitive ability tests and aptitude tests (Smit, 1996). It should also be kept in mind that personality dimensions are broad constructs and that each item designed to primarily reflect a specific personality dimension at the same time also reflects to varying degrees the other dimensions of the personality (Gerbring & Tuley, 1991). Despite these mitigating factors the results of this study raised some concern regarding the use of the 15FQ+ for personality assessment across the three groups including White, Black and Coloured groups.

Given the importance of the implications of demonstrated lack of equivalence it is believed that this study did add valuable empirical evidence towards understanding the implications of cross-cultural use of the 15FQ+ especially in a cultural diverse environment such as South Africa.

CHAPTER 7
DISCUSSION, LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

This research study aimed to address the issue of the measurement equivalence and invariance of the 15FQ+ across various cultural / ethnic groups in South Africa. Historically most personality instruments were developed in Western cultures. Hence, the validity of personality measures utilised in South Africa's multi-cultural setting needs to be scientifically proven. The confident utilisation of the 15FQ+ personality measuring instrument in South Africa requires evidence that ethnic group membership does not systematically explain variance in the item scores (either as a main effect or a group*latent variable interaction effect) once respondents' standing on the latent personality dimension have been controlled for. Evidence is therefore required that, once the variance that can be explained by the latent personality dimension main effect is partialed out, the interaction between group membership and the latent personality dimension does not explain variance in the observed score variance and that group membership *per se* does not explain variance in the observed scores. This study did not aim to investigate cultural definitions of personality and resulting bias effects. The study merely evaluated the measurement equivalence and invariance of a popular personality instrument, i.e. the second edition of the Fifteen Personality Factor Questionnaire (15FQ+), across Black, Coloured and White ethnic groups in South Africa. The 15FQ+ is a normative, trichotomous response personality test developed by *Psytech International* as an update to their original version the 15FQ (Tyler, 2003). The second edition of the 15FQ named the 15FQ+ resembles the original version, which measures 15 of the core personality factors identified by Cattell. However, *Psytech International* took advantage of recent developments in psychometrics and information technology which allowed for the inclusion of factor B that was excluded from the original version (Psychometrics Limited, 2002). According to Tyler (2003) the 15FQ+ is a full revision of the original 15FQ with a completely new item set that was developed from extensive item trailing. The main aim of the 15FQ+ was to produce a relatively short, yet robust measure of Cattell's primary personality factors (Meiring et al., 2005). The 15FQ+ has been written in simple, clear and concise modern European business English whilst attempting to avoid cultural, age and gender bias in items. The technical manual states that the items have been selected to maximize reliability, while maintaining the breadth of the original personality factors at the same time as avoiding the production of narrow, highly homogenous ‘cohesive’ scales that measure nothing more than surface characteristics (Psycometric Limited, 2002; Tyler, 2003).

The 15FQ+ attaches a specific connotative definition to the personality latent variable. Specific latent dimensions are distinguished in terms of this conceptualisation. Specific items have been designed to serve as effect indicators of these latent dimensions. It would, however, not be possible to isolate behavioural indicators to ensure a reflection of only one single personality dimension (Gerbing & Tuley, 1991). Although the 15FQ+ items were designed to primarily reflect a specific latent dimension, the items also reflect the whole personality. The items designed for a specific subscale would primarily reflect the personality dimension measured by that subscale but would also be influenced by the remaining factors (i.e. other personality dimensions), albeit to a lesser degree. When computing a subscale total score the positive and negative loading patterns on the remaining factors cancel each other out in what is referred as a suppressor action (Cattell et al., 1970). A very specific measurement model is implied by the design intentions and the scoring key of the developers of the 15FQ+ to ensure a true and uncontaminated measure of each personality dimension.

In order for the 15FQ+ to be used with more confidence across various cultural/ethnic groups evidence on the reliability, validity and measurement equivalence and invariance is seen as a necessary requirement which will justify the use of the instrument in a decision making process. As referred to in Chapter 2, two studies have been conducted addressing the cross-cultural applicability of the 15FQ+. Meiring et al. (2005) conducted a study to examine the cross-cultural applicability of the 15FQ+ at construct and item level. They concluded in their study that the usefulness of the 15FQ+ was limited, and that certain semantic revisions of items needed to take place in order for the items to be more easily understood. Further to this, Moyo (2009) conducted a preliminary factor analytical investigation into the first-order factor structure of the 15FQ+. The study was conducted on a sample of Black South African managers. The magnitude of the estimated model parameters suggested that the items generally do not reflect the latent personality dimensions they were designed to reflect with a great degree of success (Moyo, 2009). Although the measurement model did succeed in reproducing a co-variance matrix that closely approximates the observed co-variance matrix the results obtained in this study did point to some reason for concern regarding the use of the 15FQ+ for personality assessment, specifically on Black South African managers (Moyo, 2009). Given the concerns raised, based on the research evidence above, it is clear that the15FQ+ should be investigated for its suitability in the multicultural South African context. The lack of demonstrated measurement equivalence and invariance could complicate the interpretation made, and use of, the 15FQ+ scores across cultural/ethnic groups. Measurement equivalence and invariance represents a different perspective on measurement errors than measurement bias and articulates it in different terms, although both refer to the same issue of how comparable scores are across groups. That is, the measurement implications of bias for comparability are addressed in the concept of equivalence. It relates to the scope for comparing the scores over different cultures. The absence of bias in the personality assessment indicates measurement equivalence and invariance. Bias refers to all nuisance factors leading to the inability to conduct cross-cultural comparisons (Van de Vijver & Leung, 1997). There are three sources of measurement bias including construct bias, method bias and item bias. Construct bias occurs when the construct being measured by the instrument is not identical across cultural groups. Method bias arises from particular characteristics of the instrument or its associated administration, and item bias refers to the presence of undesirable measurement artifacts at item level (Theron, 2006). Only when measurement equivalence and invariance has been demonstrated may observed scores from measurement instruments be meaningfully compared across different cultural groups.

The objective of this study was to determine whether the measurement model (reflecting the design intentions of the developers of the 15FQ+) fits data from Black, Coloured and White ethnic groups at least reasonably well, when a series of multi-group CFAs over these three groups were conducted. This chapter intends to provide a basic overview of the principal findings of the study, the limitations of the study, as well as recommendations for future research.

7.1 RESULTS

The fundamental hypothesis that was tested in this study was that the 15FQ+ measures the personality construct as constitutively defined and that the construct was measured in the same manner across different cultural / ethnic groups, including Black, Coloured and White South Africans. A series of single- and multi-group CFA's were conducted in order to determine the validity of this hypothesis. The CFA's evaluated the fit of the implied measurement model. The measurement model of the 15FQ+ portrays the manner in which the items of the specific subscales should load on their designated latent personality dimensions. The measurement model was applied to the co-variance matrix computed from the parceled 15FQ+ data obtained from the participating test distributor. LISREL 9 was used to test the hypothesis that the measurement model could reproduce the observed co-variance matrix. However, prior to conducting CFA's item analysis and dimensionality analysis were necessary in order to assist in determining the psychometric integrity of the observed variables that represents the various latent personality variables of the 15FQ+. Therefore this section will firstly summarise the results of the item analysis and dimensionality analysis.

7.1.1 Item analyses

The purpose of the item analyses was to facilitate the process of identifying whether the items are consistent measures of the 16 latent personality variables comprising the 15FQ+ that they were designed to reflect which would provide credence to the design intentions of the test developers of the 15FQ+. Reliability analysis was conducted and a variety of item statistics were calculated for all the 15FQ+ subscales on each of the datasets from the three different ethnic groups separately. High reliability and good item statistics do not provide conclusive proof that the items of a measuring instrument successfully represent the various latent variables they were earmarked to reflect. It does, however mean that that the opposite cannot be claimed. The results of the item analyses for this study revealed rather extensive consistent results generally suggesting that the items, comprising the various 15FQ+ subscales, do not consistently reflect the intended latent personality variables across the three cultural/ethnic groups.

Overall, the results of the item analyses revealed rather extensive consistent results suggesting that the items comprising the various 15FQ+ subscales do not consistently reflect the intended latent personality variables for the Black data, this is more so than the results obtained for the White and Coloured data and more so for the results obtained for the Coloured data than the results obtained for the White data. The subscale reliabilities results for the Black group revealed that only three of the sixteen subscales obtained alphas above the .70 cut-off point. The results for the Coloured group revealed that nine of the sixteen subscales obtained values above .70, whereas the results for the White group revealed fourteen subscales with alpha values above the cut-off point. The item statistics results indicated only one subscale (Factor M) with a definite set of incoherent items in the White group. A clear lack of coherence in the items of three subscales (Factor G, Factor M and Factor Q_3) was indicated for the Coloured sample. However, the results for the Black group indicated seven subscales (Factor A, Factor B, Factor E, Factor M, Factor N, Factor Q_3 and Factor Q_4) with a definite set of incoherent items. In general, low internal consistencies were more evident in the Black group than in the Coloured group. Furthermore, only 3 items (Q2, Q83 & Q105) were revealed as possible problematic items across all three cultural-groups. Overall the Black data revealed 17 items (Q2, Q83, Q105, Q30, Q188, Q63, Q140, Q164, Q16, Q166, Q93, Q118, Q119, Q46, Q47, Q98 & Q124) that can be considered as problematic items, the Coloured data revealed 12 items (Q2, Q83, Q105, Q30, Q84, Q110, Q188, Q90, Q166, Q120, Q21 & Q72) as possible problematic items and the White data revealed 6 items (Q2, Q83, Q105, Q187, Q120 & Q21) that can be considered as problematic items. The intention was to retain all items but report on poor items that failed to discriminate between the different levels of latent variables they were designed to reflect which could be a possible reason for poor model fit in the confirmatory factor analysis. If the deletion of poor items was an option it would probably have resulted in the sequential deletion of the majority of items in 7 of the 16 subscales for the Black sample, and 3 of the 16 subscales for the Coloured sample. Overall the Black and Coloured group results indicated a lack of coherence in the items which were all designed to reflect a specific personality variable, although the Coloured group results did so to a lesser degree. The item statistics for the Black and Coloured groups indicate that the items comprising the various subscales do not really respond in unity to systematic differences in a single underlying latent personality variable.

7.1.2 Dimensionality analyses

Unidimensionality occurs when a single common underlying latent variable can account for the covariance between the items selected for each subscale, to represent the different latent variables. A finding of unidimensionality does not necessarily mean that the single common latent variable is in fact measuring the intended latent variable (Hair et al. 2006). To examine the unidimensionality assumption exploratory factor analyses was performed on each of the subscales of the 15FQ+. Unrestricted principle axis factor analysis was used as extraction technique (Tabachnick & Fidell, 2001) with oblique rotation. The purpose of the analyses was to investigate lack of unidimensionality as a possible indicator of poor model fit in the subsequent CFA results. The results of the dimensionality analyses revealed rather extensive consistent results suggesting that the design intention of the 15FQ+ across the three groups have not succeeded.

Overall the dimensionality analyses results indicated that more than one factor had eigen-values greater than unity for all the subscales across all three cultural/ethnic groups. This signifies the need for more than one factor to satisfactorily explain the observed correlations between all the items in the subscales which results in the conclusion that the current structure of the subscales could be viewed as problematic. The suppressor principle cannot be seen as a cause due to the fact that not all twelve items in the subscales showed a reasonably high loading on the first factor. To meet the requirements of the suppressor principle the extraction of a single factor or the extraction of multiple factors with satisfactory loadings on the first factor would have been sufficient. When applying a strict criterion the unidimensionality assumption for the 15FQ+ was therefore not corroborated.

The investigation of how well the items represent a single underlying factor indicated that the items represent a single underlying latent variable good for thirteen of the subscales in the White group. However, the items of three subscales did not represent a single underlying latent variable well (Factor M, Factor Q_1 and Factor Q_3) in the White group. The items of eleven of the subscales for the Coloured sample represent a single underlying latent variable good, whilst the items of five subscales in this group did not represent a single underlying latent variable well (Factor L, Factor M, Factor O, Factor Q_1 and Factor Q_3). However, the results for the Black group revealed that the items of eight of the sixteen subscales did not represent a single underlying factor very well (Factor I, Factor L, Factor M, Factor N, Factor O, Factor Q_1, Factor Q_2 and Factor Q_4). This signifies that the majority of items in the sixteen subscales represent the single underlying variable in the White and Coloured groups with much less support indicating the items in the subscales reflecting one invisible underlying theme for the Black group. The percentage of large residual correlations obtained for the single-factor solution was sufficiently small for eleven subscales across the three samples (Factor A, Factor B, Factor C, Factor E, Factor G, Factor H, Factor N, Factor O, Factor Q_2, Factor Q_3 and Factor Q_4) which allows the one-factor solution to be regarded as a permissible explanation for the observed correlation matrix in eleven of the sixteen subscales. Therefore, when the results of these eleven subscales are interpreted somewhat more leniently the position is supported that a single common factor underlies the items of the eleven subscales over the three groups. The percentage of large residual correlations obtained for the single-factor solution for five of the subscales was moreover large enough across the three samples to bring the credibility of the single factor solution as a permissible explanation for the observed correlation matrix into question (Factor F, Factor I, Factor L, Factor M and Factor Q_1). Therefore even when the results of these five subscales are interpreted somewhat more leniently the position is not supported that a single common factor underlies the items of these five subscales. The dimensionality analyses results indicates support for and against the design assumption that all items comprising the specific subscale reflect one invisible underlying theme. The residual correlation calculated from the inter-item correlation matrix and the reproduced matrix indicated that the initial solutions, prior to forcing a single factor, provide a more convincing explanation for the observed inter-item correlation matrix. This suggests that these factors could be better explained by further sub facets of the personality construct. The 15FQ+ instrument does not however make provision for the subdivision of factors.

Based on the above mentioned observations made from the dimensionality analyses results it may have been expected that the model fit would be jeopardized. The results indicated the possibility that the 15FQ+ may not define the personality construct completely as per the design intention of the instrument, especially in the Black group. However, conclusions on how the data fits the measurement model can only be provided from the results of the confirmatory factor analyses that will be discussed next. The dimensionality analyses, however, provide rationalization for possible poor model fit.

7.1.3 Single-group measurement model fit

The measurement model was firstly fitted on each of the groups separately by representing each latent personality dimension by means of six item parcels.

The overall Goodness of Fit (GOF) statistics results for the three groups (as discussed in Chapter 6) indicated that good fit was evident for the White group and good-reasonable fit for the Black and Coloured groups. The RMSEA for all three groups was < .05 indicating that the measurement model of all three groups showed good model fit. However, the results consistently pointed towards the fact the measurement model to a certain extent failed to capture the complexity of the dynamics underlying the 15FQ+. This was reflected by the measurement model residuals for all three groups which indicated that all three models would benefit from adding additional pathways. Modification indices calculated for the factor loading matrix also indicated a number of paths that could be added to improve the fit of all three models. Therefore, the results revealed that all three of the models would benefit from adding additional pathways. The results also suggested that the items of the 15FQ+ are relatively noisy measures of the latent personality dimensions they were designed to reflect. The completely standardised factor loading matrix obtained low factor loadings across all three groups and the completely standardised measurement error variance indicated that the variables was not exclusively explained by the latent variables they were meant to reflect. However, these findings need to be interpreted in terms of the effect of the suppressor effect built into the instrument. All these findings seemed to suggest that the behavioural responses to the items allocated to a specific personality sub-scale, although primarily determined by the latent personality dimension they were tasked to reflect, nonetheless depend on the whole of the personality domain. This phenomenon can adversely affect the fit of the measurement models.

In conclusion the results suggested that all three models did adequately account for the covariance observed between the item parcels even though the results seemed to raise some concerns. A series of multi-group CFAs over the three groups was therefore conducted to determine whether the 15FQ+ measures the personality construct in the same manner across the different cultural / ethnic groups.

7.1.4 Multi-group measurement model fit

A series of measurement invariance and measurement equivalence tests as set out by Dunbar et al. (2011) was used to test the stability of the model parameters estimates. This series of tests would determine on which measurement model parameters group differences exist. The multi-group measurement model was fitted simultaneously to samples from the White, Black and Coloured groups in a series of multi-group analyses with gradually increasing constraints imposed on the equality of the model parameters.

Measurement invariance was evaluated through the interpretation of the GOF statistics. The overall GOF statistics revealed at least good-reasonable fit for the configural, weak, strong, strict and complete invariance measurement models across the three cultural groups. These results suggested that the invariance measurement models could adequately account for the covariance observed between the item parcels over all three cultural / ethnic groups.

The presence of measurement equivalence was tested by determining whether a specific multi-group measurement model with some of its parameters constrained to be equal across groups fitted substantially poorer than a multi-group configural invariance model with none of its parameters constrained to be equal across groups. The results indicated lack of metric equivalence. Lack of metric equivalence necessarily implied that the scalar, conditional probability and full equivalence models will fit practically significantly poorer than the configural invariance model with fewer constraints. No formal tests were therefore conducted for scalar, conditional probability and full equivalence. Metric equivalence was investigated through the scaled Satorra-Bentler chi-square difference test, as well as calculating the differences in the CFI index, Gamma Hat fit index and the Mcdonald non-centrality index between the two specified models. The decision on metric equivalence was based on the practical significance that existed between the fit of the weak and configural invariance models.

When the results of the multi-group invariance and equivalence analyses were combined a number of conclusions are permissible. The 15FQ+ does not display construct bias. The fact that the multi-group configural invariance model showed close fit warrants the conclusion that the 15FQ+ measures the same construct in the three groups. The position that the slope, intercept and error variance of the regression of the item parcels on the latent personality dimensions they were earmarked to reflect are the same across the three groups is a tenable position. The position that the latent personality dimension variances and inter-correlations are the same across the three groups is also a permissible position. These positions are tenable in that support was obtained for the hypotheses that the multi-group weak, strong, strict and complete invariance measurement models show close fit in the parameter ($p>.05$). Although the position that the slope, intercept and error variance of the regression of the item parcels on the latent personality dimensions they were earmarked to reflect are the same across the three groups, survived the opportunity to be refuted, the position that at least the slope of the regression of the item parcels on the latent personality dimensions differ for one or more items across two or more groups is a more tenable position. This position is more plausible because the multi-group configural invariance model fitted the collective data practically (and statistically) significantly better than the multi-group weak invariance model (i.e., the configural invariance model was able to reproduce the observed covariance matrices more closely).

Since the possibility of partial metric equivalence was not investigated the extent to which these slope differences occur is not known. It might be a relatively small number of items that caused the lack of full metric equivalence but at the same time it is possible that the slope differences extend across most of the items. The differences in the factor loadings might occur mostly between specific groups or on the other hand might occur between all groups to the same extent. Since partial metric equivalence was not investigated it was not possible to investigate scalar, equivalence in a manner that acknowledges practically significant slope differences and, if lack of scalar equivalence would still be found when the significant slope differences are controlled for, it also was not possible to investigate partial scalar equivalence. In the same manner it was then not possible to investigate conditional probability equivalence, partial conditional probability equivalence (if required), full equivalence and partial full equivalence (if required). The consequence of this was that it really is not clear to what extent the other measurement model parameters (i.e., intercepts, error variances, latent variable variances and latent variable correlations[16]) differ across groups. The most optimistic position would be that only the slope parameters differ practically significantly. The most pessimistic position would be that practically significant differences occur in all the measurement parameter estimates and occur on a substantial number of items.

The consequence of the practically significant differences in especially the slope and intercept parameter estimates would depend on the direction of the bias across different items. The critical question is therefore whether the nature of the uniform and/or non-uniform bias works in the same direction against a specific groups (or groups) or whether the bias tends to cancel itself out across the items of a subscale. Decisions are made based on subscale raw scores that are transformed to norm scales. It could therefore be argued that the bias brought about by group differences in measurement model parameters therefore only really is of practical concern if they translate into differences in raw scores that are large enough to affect the derived norm scores[17]. When bias in the items translates into bias in the observed dimension scores the potential for wrong and unfairly discriminating decisions increases. Care should, however, be taken not to equate bias in the observed dimension scores with errors in decision-making and unfair discrimination (Theron, 2009).

The traditional remedy with which the problem of item bias has been treated in the past is to either attempt rewriting the item or, more likely, to delete the item from the instrument. The use of structural equation modelling to obtain unbiased latent score estimates from biased observed scores on items presents itself as a possible alternative worth investigating. This option is discussed in greater depth in paragraph 7.3.

Given the importance of the implications of demonstrated lack of equivalence as discussed above it is believed that this study did add valuable empirical evidence towards understanding the implications of cross-cultural use of the 15FQ+ especially in a cultural diverse environment such as South Africa.

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[16] The latter two parameters are not really important from a measurement bias perspective.
[17] The possibility should be kept in mind that the effect of item bias on raw scores could have erroneously resulted in the development of separate norm tables for different groups.

7.2 LIMITATIONS

In this study it would have been ideal to use individual items, as an alternative to the item parcels (Marsh et al., 1998), as indicator variables that represent the personality dimensions in the model. This argument is based on the recommendations made regarding the appropriateness of the utilisation of items as opposed to item parcels for measurement invariance and measurement equivalence tests in Chapter 5.

The initial CFA analysis did attempt to utilise individual items in fitting the single-group measurement models for the three samples but the LISREL 9 syntax refused to run. The unsuccessful results were produced due to memory incapacity. This can be attributed to the size of the model, which was too large for the 64-bit LISREL.EXE programme (Personal Communication with Gerhard Mels, 2012). The problem was with the calculation of the inverse of the estimated asymptotic covariance matrices that required very large memory and processing capacity (Personal Communication with Gerhard Mels, 2012). Consequently, the use of item parcelling was a more practical measure for this study.

A limitation of the sample includes the lack of descriptive demographic information regarding the composition of the sample, for example, educational background and stage of employment. Some of the observations made during the analyses could have been a function of the composition of the sample. The availability of demographic information might have supported the creation of further hypothesis to be tested and further invariance testing.

This study did not investigate whether the measurement model reflects the design intention of the developers of the 15FQ+ across the different language groups in the Black sample. This information would have been important in evaluating the success with which the 15FQ+ measure personality as it is constitutively defined across the different language groups in the Black sample in the South African context. This study also did not investigate the difference in scores across genders groups which would have been valuable in understanding the composition of the personality latent variable as constitutively defined by the 15FQ+ in the South African context across gender groups. The objective of this study was to determine measurement equivalence and measurement invariance of the 15FQ+ across the Black, Coloured and White groups. This study, therefore, did not include any other ethnic group.

Although these limitations are important and must be taken into account, the researcher is nevertheless convinced that this study will contribute to a better understanding of the psychometric properties of the 15FQ+ across the different ethnic groups in South Africa (included in this study). It's also believed that this study will lead to more research on the establishment of the psychometric effectiveness of the 15FQ+ as a valuable personality assessment tool in South Africa.

7.3 RECOMMENDATIONS FOR FUTURE RESEARCH

If possible individual items should be used, as an alternative to the item parcels, as indicator variables to represent the personality dimensions in the model. Solutions in confirmatory factor analysis tend to be better when larger numbers of indicator variables are used to represent latent variables (Marsh et al., 1998). Item parcelling decreased the number of indicator variables used to represent the latent variables in this study. Measurement invariance and equivalence are more likely to be precise when using item level data (Meade & Lautenschleager, 2004). Model fit could be poorer when using item data but the lack of equivalence and invariance may be masked through the utilisation of item parcels (Meade & Kroustalis, 2006). Therefore, it is recommended that a study on the measurement equivalence and invariance of the 15FQ+ be done using individual items. This recommendation is, however, contingent on the availability of a sufficiently powerful computer and software[18].

The purpose of the multi-group CFA analyses is to evaluate the extent to which the observed scores are biased. The solution to the problem of biased observed scores is typically to delete (or to rewrite) the offending items. The rewriting and/or deletion of items were not a viable solution for this study. The deletion of poor items would have resulted in the sequential deletion of the majority of the items in some subscales. The possibility of rewriting those items that have been identified as poor items should be further explored. There might, however, also exist an alternative approach that ought to be investigated.

The residual correlations calculated from the inter-item correlation matrix and the reproduced matrix indicated that the initial solutions, prior to forcing a single factor, provide a more convincing explanation for the observed inter-item correlation matrix.

[18] The computer used in this study had a 64 bit operating system, a 3.40 GHz CPU and 4.0 GB of RAM.

The possibility that the current factors of the personality construct could be explained better by further sub-facets of the personality construct should be further investigated.

The study did not investigate partial metric, partial scalar, partial conditional probability and partial full equivalence. Clarity on the manner in which the multi-group 15FQ+ measurement model parameters differ across the three cultural /ethnic groups can, however, only be obtained if these partial equivalence analyses are conducted. Time and logistical constraints prevented it in the current study. Creative solutions nonetheless need to be sought to overcome these constraints in future research.

LISREL allows the calculation of latent scores in single-group models. These latent scores are typically calculated for the current data set on which the model is fitted and from which the measurement model parameters are derived. Jöreskog, (2000) provides an equation that allows for the calculation of latent scores given the parameter estimates obtained for the validation/calibration sample. LISREL does, however, not offer the possibility of utilising equation 1 to derive latent score estimates for new data sets. One possibility is to write the LISREL syntax used to fit the measurement model to the data of a new sample in a manner that specifies the values of all the parameters that normally would be estimated, to the values obtained in the validation/calibration sample. LISREL could then be requested to calculate latent score estimates in this syntax file.

The ideal would be to extend this facility of LISREL to multi-group measurement models. This would then allow utilising all items in estimating respondents standing on latent variables in a manner that acknowledges the differences that exist between groups in the relationship between the items and the latent personality variable. LISREL, however, does not extend the facility to calculate latent scores to multi-group measurement models. When the multi-group CFA analysis procedure is carried to its logical conclusion the end result would most likely be a partial metric, scalar, conditional probability or full equivalence multi-group measurement model in which some measurement model parameters have to be allowed to differ across (specific) groups while others may be constrained to be equal. Such a partial equivalence model can be translated to separate single-group measurement models.

The same procedure suggested above can then be used to calculate latent score estimates from the observed scores obtained on new observations in a manner that acknowledges that the nature of the regression relationship between latent scores and observed scores differ for specific items across specific groups. Unbiased estimates of latent scores can therefore be obtained even when the same raw item score does not hold the same meaning in terms of the respondent's standing on the latent variable across different groups.

Structural equation modelling is a large sample technique (Diamantopoulos & Siguaw, 2000). This suggested procedure will only be feasible if the new data set is sufficiently large to satisfy the typical data requirements set in the SEM literature (Bentler and Chou as cited in Kelloway, 1998). The size of the group that is typically assessed at a time will, however, almost never meet these criteria. Accumulating data over time is not an option because an unbiased interpretation of the test results is required immediately after the assessments. A more realistic solution is to either simulate a larger data set or to use the original validation/calibration data set, insert the data for the newly assessed respondents the data set (with unique identity numbers) and to run the syntax file in which all measurement parameters are fixed to the values obtained from the validation/calibration study.

Lastly, this study only aimed at evaluating the measurement equivalence and measurement invariance of the 15FQ+. The possibility of investigating the cultural definitions of personality and resulting bias effects should be explored further.

7.4 CONCLUSION

The 15FQ+ is a prominent personality questionnaire and plays an important role in ensuring that organisations employ, develop and promote competent employees into the right positions which should ultimately lead to the maximisation of profits. Subsequently, the lack of demonstrated measurement equivalence and measurement invariance could complicate the interpretation made, and use of, the 15FQ+ scores across ethnic groups, thereby impeding the abovementioned objectives. Only when measurement equivalence and measurement invariance has been demonstrated may observed scores from the 15FQ+ be meaningfully compared across different ethnic groups.

The data used for this study were drawn from a large archival database of the 15FQ+ psychometric test scores provided by the participating test distributor company. The database included respondents from the following ethnic groups: Blacks, Coloureds and Whites. Item raw scores were provided for all relevant ethnic groups and self-reported biographical information included gender, age, language, education and ethnic group membership. Given the objective of the study the item raw scores for the sample of Black, Coloured and White respondents of the 15FQ+ were needed and therefore separated.

The main objective of the study was to investigate whether the 15FQ+ measures the personality construct as constitutively defined and that the construct is measured in the same manner across different ethnic groups, specifically Black, Coloured and White South Africans. A series of confirmatory factor analyses (CFA's) were required in order to evaluate the fit of the single-group measurement model in the three groups implied by the constitutive definition of personality and the design intention of the 15FQ+, as well as the fit of the multi-group measurement models implied by the various levels of measurement invariance. Item and dimensionality analyses were used to determine the extent to which each of the items of the 15FQ+ satisfactorily reflects the intended latent variables they were task to reflect. A measurement model was fitted using item parceling that reflects the design intention of the 15FQ+.

It is evident from the CFA results that the item parcels of the 15FQ+ in this study were reasonably noisy measures of the latent personality variables they represent. This was also evident from the item analysis and dimensionality analysis results. What can be unambiguously concluded is that the current study found no evidence of construct bias in the 15FQ+. What can in addition be unambiguously concluded is that the current study found evidence that one or more slope parameters/factor loadings differ across two or more groups. This means that the 15FQ+ contains at least one or more items that display non-uniform bias. Personality measures are generally seen to be prone to lower reliabilities than those typically found in cognitive ability tests and aptitude tests (Smit, 1996). It should also be kept in mind that personality dimensions are broad constructs and that each item designed to primarily reflect a specific personality dimension at the same time also reflects to varying degrees the other dimensions of the personality (Gerbring & Tuley, 1991). Despite these mitigating factors the results of this study raised some concern regarding the use of the 15FQ+ for personality assessment across the three groups including White, Black and Coloured groups.

In order to confidently demonstrate the measurement equivalence of the 15FQ+ the above mentioned recommendations for future research should be taken into account. However, it is believed that this study did add valuable empirical evidence towards understanding the implications of the cross-cultural use of the 15FQ+ especially in a cultural diverse environment such as South Africa.

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APPENDIX 1: ITEM STATISTICS OF THE 15FQ+ ACROSS THE THREE SAMPLES

	WHITE GROUP					BLACK GROUP					COLOURED GROUP				
Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item - Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item - Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item - Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
FA_Q1	16.53	16.354	0.427	0.246	0.697	17.04	8.91	0.193	0.066	0.501	17.31	10.285	0.273	0.108	0.562
FA_Q2	17.17	16.68	0.095	0.023	0.75	18.43	8.553	-0.005	0.018	0.566	18.4	9.795	0.027	0.033	0.631
FA_Q26	17.28	16.12	0.278	0.094	0.712	17.82	8.25	0.151	0.036	0.504	18.14	9.692	0.154	0.042	0.577
FA_Q27	16.5	17.149	0.294	0.119	0.711	17.1	8.671	0.216	0.064	0.493	17.35	10.208	0.246	0.098	0.562
FA_Q51	16.64	15.776	0.411	0.205	0.695	17.3	7.955	0.219	0.062	0.485	17.51	9.282	0.313	0.138	0.541
FA_Q52	16.95	14.288	0.508	0.3	0.677	17.35	7.456	0.335	0.163	0.45	17.7	8.405	0.413	0.254	0.51
FA_Q76	16.89	15.84	0.43	0.212	0.693	17.51	7.932	0.266	0.079	0.473	17.69	9.22	0.379	0.168	0.529
FA_Q77	16.63	15.326	0.543	0.372	0.68	17.11	8.361	0.313	0.137	0.475	17.38	9.611	0.419	0.256	0.534
FA_Q101	17.39	14.882	0.339	0.151	0.708	17.59	7.492	0.213	0.093	0.49	17.93	8.662	0.259	0.124	0.556
FA_Q126	16.51	17.084	0.265	0.085	0.713	17.06	8.933	0.125	0.021	0.507	17.32	10.615	0.098	0.025	0.579
FA_Q151	16.75	14.814	0.541	0.372	0.675	17.18	7.981	0.339	0.169	0.46	17.47	9.133	0.434	0.266	0.52
FA_Q176	16.82	15.564	0.337	0.127	0.705	17.49	7.466	0.254	0.088	0.474	17.69	9.281	0.205	0.067	0.568
B_Q3	18.1	16.209	0.337	0.141	0.727	17.62	12.819	0.315	0.136	0.63	18.39	13.757	0.323	0.138	0.699
B_Q28	18.09	16.47	0.288	0.134	0.733	17.46	13.309	0.314	0.145	0.632	18.38	13.552	0.378	0.196	0.692
B_Q53	18.4	15.422	0.321	0.28	0.734	18.24	12.446	0.236	0.158	0.652	18.78	12.824	0.317	0.263	0.706
B_Q78	18.26	15.531	0.399	0.21	0.72	17.55	12.893	0.34	0.163	0.626	18.43	13.494	0.367	0.183	0.693
B_Q102	18.06	15.423	0.47	0.27	0.71	17.8	11.972	0.361	0.155	0.621	18.49	12.917	0.401	0.18	0.688
B_Q103	17.99	16.672	0.293	0.106	0.732	17.4	13.749	0.213	0.064	0.646	18.27	14.424	0.234	0.069	0.71
B_Q127	18.02	15.902	0.42	0.208	0.717	17.39	13.476	0.3	0.118	0.635	18.3	13.838	0.357	0.15	0.695
B_Q128	17.98	16.496	0.357	0.146	0.725	17.37	13.712	0.283	0.118	0.638	18.22	14.528	0.299	0.111	0.703

B_Q152	17.95	16.325	0.404	0.211	0.72	17.39	13.756	0.225	0.077	0.645	18.23	14.345	0.305	0.115	0.702
B_Q153	18.17	15.477	0.423	0.23	0.716	17.6	12.5	0.377	0.208	0.619	18.46	13.215	0.391	0.194	0.689
B_Q177	18.17	15.15	0.441	0.353	0.714	18.02	11.842	0.338	0.204	0.628	18.58	12.337	0.457	0.332	0.678
B_Q178	17.89	16.779	0.378	0.191	0.725	17.38	13.464	0.308	0.141	0.634	18.21	14.144	0.39	0.193	0.694
FC_Q4	15.64	21.003	0.519	0.291	0.756	15.92	15.579	0.404	0.198	0.674	15.98	15.727	0.38	0.17	0.67
FC_Q5	15.17	23.803	0.392	0.203	0.771	15.62	17.805	0.211	0.066	0.7	15.57	17.722	0.275	0.113	0.686
FC_Q29	15.74	23.182	0.363	0.17	0.773	16.6	16.449	0.278	0.127	0.693	16.33	16.842	0.301	0.112	0.682
FC_Q30	15.47	23.114	0.316	0.149	0.779	16.15	16.482	0.2	0.062	0.709	16.02	16.923	0.207	0.065	0.7
FC_Q54	15.3	23.55	0.44	0.221	0.768	15.71	17.323	0.324	0.113	0.69	15.65	17.564	0.347	0.139	0.68
FC_Q55	15.76	22.621	0.443	0.224	0.765	16.41	15.893	0.376	0.169	0.679	16.19	16.539	0.349	0.139	0.675
FC_Q79	15.84	21.343	0.442	0.206	0.766	16.12	15.264	0.377	0.169	0.679	16.29	15.603	0.34	0.136	0.679
FC_Q80	15.3	22.482	0.479	0.256	0.762	15.97	15.976	0.317	0.129	0.688	15.7	16.65	0.37	0.146	0.673
FC_Q104	15.36	23.383	0.437	0.242	0.767	16.02	16.141	0.44	0.289	0.673	15.75	17.212	0.37	0.221	0.676
FC_Q129	15.47	23.385	0.387	0.212	0.771	16.1	16.413	0.379	0.259	0.68	15.88	17.11	0.348	0.202	0.677
FC_Q154	15.86	21.569	0.419	0.214	0.769	16.08	15.513	0.36	0.173	0.682	16.19	15.563	0.362	0.167	0.674
FC_Q179	15.71	21.036	0.502	0.276	0.758	15.89	15.392	0.458	0.241	0.666	15.93	15.55	0.43	0.203	0.661
FE_Q6	15.07	20.303	0.397	0.199	0.713	14.72	12.655	0.295	0.126	0.515	14.97	13.777	0.349	0.18	0.569
FE_Q31	14.9	20.902	0.392	0.179	0.714	14.82	12.828	0.216	0.054	0.532	14.88	14.617	0.241	0.076	0.59
FE_Q56	14.85	21.386	0.366	0.162	0.717	14.5	13.914	0.192	0.05	0.541	14.8	14.798	0.282	0.098	0.585
FE_Q81	15.06	20.331	0.395	0.169	0.713	15.08	12.287	0.234	0.065	0.528	15.14	13.956	0.258	0.077	0.588
FE_Q105	16.05	21.813	0.218	0.072	0.735	16.04	13.41	0.129	0.034	0.551	16.22	15.268	0.107	0.033	0.615
FE_Q106	15.46	20.5	0.319	0.139	0.724	15.34	12.57	0.172	0.049	0.547	15.65	14.138	0.187	0.052	0.606
FE_Q130	15.02	19.858	0.491	0.293	0.7	14.93	12.183	0.296	0.115	0.511	15.07	13.22	0.408	0.2	0.554
FE_Q131	15.19	20.517	0.335	0.12	0.722	14.88	12.404	0.265	0.093	0.52	15.09	13.845	0.282	0.1	0.582
FE_Q155	15.11	19.783	0.475	0.265	0.702	14.99	11.944	0.327	0.142	0.503	15.14	13.291	0.392	0.217	0.557
FE_Q156	14.87	21.157	0.363	0.156	0.717	14.64	13.177	0.231	0.097	0.53	14.8	14.662	0.274	0.112	0.585
FE_Q180	15.47	19.899	0.397	0.206	0.713	15.83	12.847	0.17	0.063	0.545	15.67	13.808	0.241	0.109	0.593
FE_Q181	14.66	22.565	0.288	0.12	0.727	14.59	13.56	0.183	0.048	0.539	14.66	15.886	0.102	0.035	0.609
FF_Q7	12.9	29.296	0.423	0.247	0.77	12.74	24.174	0.368	0.168	0.7	13.42	25.071	0.314	0.195	0.719

FF_Q8	13.84	27.114	0.505	0.325	0.76	13.74	22.572	0.458	0.259	0.686	14.47	22.689	0.422	0.242	0.704
FF_Q32	13.74	28.092	0.394	0.203	0.772	13.3	22.957	0.381	0.229	0.697	14.2	23.043	0.372	0.212	0.711
FF_Q33	13.32	28.745	0.326	0.125	0.779	13.18	24.081	0.254	0.079	0.715	13.92	23.896	0.28	0.099	0.724
FF_Q57	13.24	27.823	0.439	0.219	0.767	12.9	23.723	0.343	0.14	0.702	13.76	23.37	0.375	0.16	0.711
FF_Q58	14.04	28.376	0.436	0.23	0.768	13.88	24.491	0.269	0.106	0.711	14.6	23.445	0.378	0.184	0.711
FF_Q82	13.29	27.779	0.435	0.327	0.768	13.26	22.269	0.45	0.358	0.686	13.97	22.879	0.396	0.318	0.708
FF_Q83	12.94	30.342	0.242	0.069	0.785	13.01	24.411	0.231	0.062	0.718	13.69	24.519	0.248	0.084	0.727
FF_Q107	13.23	27.768	0.49	0.262	0.762	12.91	23.814	0.351	0.147	0.701	13.69	23.7	0.398	0.193	0.709
FF_Q132	13.24	27.805	0.453	0.27	0.766	13.04	23.496	0.34	0.167	0.703	13.69	23.997	0.327	0.211	0.717
FF_Q157	13.21	28.704	0.37	0.218	0.774	12.78	24.836	0.259	0.126	0.712	13.63	24.107	0.339	0.239	0.715
FF_Q182	13.46	26.405	0.562	0.455	0.753	13.43	21.716	0.514	0.41	0.676	14.05	21.83	0.508	0.393	0.691
FG_Q9	17.04	21.977	0.524	0.302	0.763	18.15	12.867	0.452	0.225	0.65	17.61	15.608	0.466	0.242	0.685
FG_Q34	17.38	20.912	0.466	0.272	0.766	18.34	12.631	0.32	0.128	0.665	17.98	14.657	0.403	0.2	0.69
FG_Q59	17.34	21.537	0.429	0.21	0.77	18.48	12.453	0.311	0.112	0.667	17.91	15.52	0.325	0.129	0.702
FG_Q84	17.57	21.874	0.312	0.116	0.785	18.89	12.159	0.258	0.091	0.684	18.29	15.74	0.201	0.06	0.727
FG_Q108	17.05	22.706	0.379	0.173	0.775	18.27	13.191	0.239	0.083	0.677	17.6	16.641	0.251	0.091	0.709
FG_Q109	17.45	21.145	0.422	0.199	0.771	18.66	11.985	0.335	0.122	0.665	18.08	14.544	0.406	0.189	0.69
FG_Q133	17.13	21.146	0.587	0.366	0.755	18.22	12.338	0.494	0.265	0.64	17.63	15.229	0.54	0.327	0.675
FG_Q134	17.06	23.165	0.306	0.138	0.781	18.2	13.686	0.191	0.059	0.682	17.64	16.472	0.271	0.123	0.707
FG_Q158	17.26	21.71	0.41	0.186	0.772	18.18	12.947	0.386	0.169	0.657	17.71	15.57	0.389	0.192	0.692
FG_Q159	17.07	22.406	0.422	0.215	0.771	18.12	13.65	0.276	0.086	0.672	17.62	16.242	0.326	0.146	0.701
FG_Q183	17.03	23.115	0.335	0.126	0.778	18.07	14.029	0.234	0.068	0.677	17.51	17.234	0.209	0.073	0.713
FG_Q184	17.33	20.334	0.57	0.361	0.754	18.25	12.169	0.491	0.273	0.638	17.73	14.885	0.501	0.289	0.676
FH_Q10	13.38	34.708	0.544	0.352	0.815	15.5	22.672	0.424	0.215	0.726	14.68	27.614	0.483	0.282	0.771
FH_Q11	13.06	35.194	0.527	0.335	0.816	15.02	23.514	0.448	0.248	0.724	14.33	27.746	0.547	0.345	0.764
FH_Q35	13.45	35.855	0.455	0.269	0.822	15.28	23.065	0.421	0.223	0.727	14.58	28.194	0.443	0.235	0.775
FH_Q36	12.89	34.937	0.593	0.413	0.811	15.05	23.106	0.484	0.281	0.719	14.15	28.495	0.517	0.323	0.768
FH_Q60	12.67	37.321	0.448	0.243	0.823	14.72	25.658	0.349	0.149	0.738	13.87	31.192	0.358	0.185	0.784
FH_Q61	13.33	35.706	0.45	0.262	0.823	15.73	24.097	0.27	0.104	0.747	14.77	28.737	0.375	0.205	0.783
FH_Q85	13.13	34.423	0.575	0.381	0.812	15.01	23.383	0.453	0.268	0.723	14.24	28.299	0.487	0.307	0.771

FH_Q86	12.76	36.597	0.468	0.278	0.821	14.84	24.723	0.371	0.157	0.734	14.11	28.991	0.478	0.26	0.772
FH_Q110	13.43	36.996	0.344	0.151	0.832	15.55	23.59	0.324	0.129	0.74	14.81	30.264	0.224	0.111	0.798
FH_Q135	13.08	34.32	0.595	0.377	0.811	15.39	22.379	0.466	0.234	0.72	14.5	26.825	0.584	0.36	0.759
FH_Q160	13.02	36.883	0.425	0.197	0.824	15.18	24.214	0.305	0.115	0.741	14.31	29.782	0.337	0.133	0.785
FH_Q185	12.87	36.286	0.466	0.286	0.821	15.12	23.958	0.342	0.157	0.736	14.27	29.041	0.407	0.209	0.778
FI_Q12	12.83	25.236	0.37	0.163	0.732	13.39	18.704	0.291	0.094	0.592	13.67	21.879	0.397	0.173	0.678
FI_Q37	13.29	24.726	0.381	0.238	0.731	13.67	18.855	0.257	0.196	0.599	14.14	22.305	0.294	0.201	0.694
FI_Q62	13.38	23.961	0.463	0.266	0.719	13.61	18.416	0.304	0.174	0.589	14.11	21.518	0.377	0.201	0.68
FI_Q87	13.16	24.27	0.426	0.226	0.725	13.74	18.7	0.282	0.123	0.594	13.95	21.439	0.402	0.196	0.676
FI_Q111	13.56	24.454	0.436	0.258	0.723	13.76	18.44	0.309	0.187	0.588	14.23	21.584	0.38	0.186	0.68
FI_Q112	12.9	25.004	0.386	0.194	0.73	13.02	19.909	0.219	0.098	0.605	13.52	22.926	0.318	0.137	0.689
FI_Q136	13.64	25.649	0.31	0.127	0.739	13.7	18.892	0.246	0.127	0.602	14.4	22.328	0.309	0.156	0.691
FI_Q137	13.25	23.208	0.552	0.358	0.707	13.53	18.257	0.335	0.225	0.583	14.05	21.067	0.443	0.278	0.669
FI_Q161	12.61	26.589	0.285	0.097	0.741	13.43	19.189	0.216	0.076	0.608	13.55	22.979	0.29	0.105	0.693
FI_Q162	13.33	24.264	0.428	0.272	0.724	13.61	18.325	0.335	0.193	0.583	14	21.531	0.388	0.204	0.679
FI_Q186	12.64	26.459	0.301	0.141	0.739	12.81	20.893	0.166	0.073	0.613	13.38	24.06	0.233	0.131	0.699
FI_Q187	12.38	28.365	0.16	0.071	0.749	12.89	20.276	0.228	0.084	0.605	13.24	24.842	0.189	0.099	0.703
FL_Q13	7.01	22.601	0.332	0.166	0.731	9.25	17.749	0.228	0.091	0.637	7.74	21.052	0.291	0.145	0.697
FL_Q14	7.44	21.007	0.479	0.275	0.71	9.36	16.511	0.377	0.183	0.608	8.04	19.166	0.48	0.271	0.667
FL_Q38	7.94	22.43	0.419	0.226	0.719	10	17.573	0.279	0.111	0.627	8.63	20.499	0.397	0.203	0.682
FL_Q39	7.57	20.991	0.496	0.276	0.708	9.33	16.446	0.39	0.195	0.605	8.04	19.149	0.48	0.277	0.667
FL_Q63	7.69	23.02	0.268	0.101	0.739	10.07	18.246	0.169	0.048	0.647	8.52	21.457	0.232	0.079	0.706
FL_Q64	8.13	23.69	0.347	0.145	0.729	10.38	18.695	0.203	0.047	0.639	8.89	22.242	0.255	0.08	0.701
FL_Q88	7.69	21.698	0.432	0.219	0.717	9.67	16.661	0.337	0.151	0.616	8.22	20.411	0.328	0.14	0.693
FL_Q89	8.13	23.819	0.339	0.292	0.73	10.2	17.305	0.367	0.306	0.612	8.93	22.452	0.261	0.214	0.7
FL_Q113	7.93	22.631	0.398	0.325	0.722	10	16.863	0.364	0.296	0.611	8.69	20.929	0.366	0.252	0.687
FL_Q138	7.24	22.474	0.314	0.139	0.734	9	18.438	0.201	0.051	0.639	7.95	20.257	0.355	0.157	0.688
FL_Q163	7.2	21.184	0.474	0.249	0.711	9.22	16.707	0.384	0.18	0.607	7.88	19.616	0.442	0.234	0.674
FL_Q188	8.33	25.435	0.206	0.062	0.742	10.54	19.739	0.096	0.016	0.649	9.07	23.457	0.169	0.056	0.708

FM_Q15	9.56	17.975	0.275	0.13	0.651	9.9	9.988	0.132	0.059	0.383	9.58	13.185	0.169	0.067	0.521
FM_Q40	9.5	17.609	0.323	0.157	0.642	9.73	9.324	0.222	0.079	0.347	9.39	12.42	0.27	0.118	0.492
FM_Q65	8.94	17.957	0.333	0.235	0.639	8.65	10.092	0.192	0.145	0.365	8.72	12.964	0.275	0.199	0.493
FM_Q90	10.12	19.707	0.226	0.154	0.656	10.13	11.176	-0.038	0.051	0.424	10.1	14.743	0.063	0.053	0.535
FM_Q114	8.85	18.174	0.32	0.221	0.642	8.77	9.804	0.191	0.126	0.362	8.65	12.974	0.292	0.202	0.489
FM_Q115	9.09	17.969	0.286	0.1	0.648	8.86	10.165	0.093	0.047	0.397	8.87	13.118	0.194	0.066	0.514
FM_Q139	9.72	17.217	0.416	0.235	0.624	9.93	9.345	0.285	0.12	0.327	9.66	12.354	0.329	0.163	0.475
FM_Q140	10.16	19.372	0.319	0.178	0.647	10.11	10.797	0.041	0.049	0.407	10.13	14.595	0.121	0.064	0.527
FM_Q164	9.52	18.04	0.274	0.118	0.651	9.86	10.291	0.068	0.053	0.406	9.56	13.384	0.143	0.068	0.529
FM_Q165	10	18.363	0.368	0.198	0.636	9.76	9.657	0.188	0.07	0.362	9.85	13.252	0.239	0.103	0.502
FM_Q189	8.96	19.201	0.258	0.091	0.652	9.26	10.201	0.139	0.045	0.38	9.08	13.61	0.218	0.077	0.508
FM_Q190	9.26	18.016	0.287	0.113	0.648	8.93	9.862	0.15	0.129	0.376	9.11	13.126	0.185	0.093	0.517
FN_Q16	16.76	21.242	0.386	0.156	0.755	19.07	8.353	0.153	0.04	0.559	17.84	13.435	0.317	0.117	0.662
FN_Q17	16.2	23.681	0.327	0.235	0.761	18.36	9.602	0.159	0.043	0.542	17.3	15.401	0.253	0.132	0.67
FN_Q41	17.12	21.079	0.377	0.186	0.757	19.13	7.933	0.23	0.082	0.533	18.33	13.326	0.294	0.12	0.668
FN_Q42	16.96	20.596	0.436	0.248	0.749	18.86	8.104	0.258	0.093	0.52	18.04	12.895	0.367	0.177	0.652
FN_Q66	16.31	22.792	0.372	0.236	0.756	18.39	9.245	0.272	0.129	0.524	17.35	14.834	0.339	0.201	0.66
FN_Q67	16.45	22.387	0.344	0.174	0.758	18.52	8.724	0.278	0.139	0.515	17.53	14.504	0.253	0.139	0.669
FN_Q91	16.47	21.179	0.513	0.303	0.74	18.41	8.936	0.358	0.166	0.508	17.4	14.147	0.439	0.229	0.645
FN_Q92	16.61	20.803	0.498	0.287	0.741	18.5	8.556	0.345	0.189	0.501	17.53	13.384	0.472	0.302	0.634
FN_Q116	16.57	21.216	0.449	0.278	0.747	18.47	9.015	0.239	0.083	0.525	17.54	13.905	0.362	0.18	0.652
FN_Q141	16.29	22.456	0.45	0.314	0.749	18.4	9.188	0.27	0.11	0.523	17.33	14.526	0.451	0.282	0.649
FN_Q166	16.59	21.624	0.406	0.191	0.752	18.69	9.052	0.107	0.047	0.559	17.63	14.943	0.145	0.044	0.688
FN_Q191	16.44	22.349	0.352	0.222	0.757	18.42	9.185	0.248	0.117	0.526	17.47	14.511	0.287	0.169	0.664
FO_Q18	11.31	31.564	0.31	0.109	0.763	10.64	21.039	0.203	0.067	0.6	10.69	26.14	0.2	0.05	0.697
FO_Q43	11.79	30.891	0.33	0.131	0.761	11.1	20.842	0.225	0.073	0.596	11.27	25.154	0.282	0.106	0.687
FO_Q68	11.61	29.277	0.494	0.289	0.743	10.78	18.972	0.449	0.274	0.548	10.94	23.295	0.487	0.293	0.655
FO_Q93	12.02	30.672	0.369	0.16	0.757	11.16	22.843	-0.006	0.007	0.639	11.55	25.77	0.246	0.08	0.691
FO_Q117	11.64	29.797	0.434	0.228	0.75	11.11	19.843	0.344	0.159	0.571	11.18	23.821	0.41	0.201	0.667
FO_Q118	11.71	30.803	0.332	0.133	0.761	10.91	22.13	0.062	0.014	0.629	11.1	25.364	0.242	0.084	0.693

FO_Q142	11.57	29.843	0.437	0.196	0.749	10.56	19.842	0.36	0.158	0.568	10.99	24.006	0.4	0.178	0.669
FO_Q143	12.32	31.144	0.393	0.172	0.755	11.57	21.731	0.215	0.064	0.597	11.81	26.387	0.247	0.074	0.69
FO_Q167	11.58	28.933	0.531	0.321	0.738	10.75	18.984	0.443	0.279	0.549	10.93	23.527	0.461	0.271	0.659
FO_Q168	11.32	31.832	0.281	0.104	0.766	10.81	20.924	0.203	0.064	0.6	10.76	25.775	0.23	0.074	0.694
FO_Q192	11.91	29.509	0.462	0.227	0.746	10.9	19.597	0.36	0.171	0.567	11.23	23.936	0.397	0.183	0.669
FO_Q193	11.61	29.503	0.477	0.238	0.745	10.48	20.399	0.309	0.128	0.579	11	24.313	0.367	0.149	0.674
FQ1_Q19	7.91	23.929	0.306	0.173	0.713	8.15	16.062	0.191	0.104	0.514	8.1	20.392	0.192	0.098	0.645
FQ1_Q20	7.86	24.511	0.253	0.135	0.72	8.47	16.747	0.136	0.044	0.527	8.18	20.433	0.209	0.096	0.641
FQ1_Q44	7.66	23.397	0.363	0.244	0.705	7.89	16.243	0.175	0.12	0.518	7.74	19.196	0.342	0.205	0.617
FQ1_Q45	7.98	23.55	0.37	0.241	0.703	8.19	16.571	0.128	0.062	0.531	7.96	19.61	0.283	0.175	0.628
FQ1_Q69	7.91	23.231	0.397	0.297	0.7	8.5	15.428	0.329	0.237	0.479	8.24	19.671	0.303	0.26	0.624
FQ1_Q70	7.99	22.865	0.462	0.26	0.691	8.34	15.733	0.275	0.116	0.492	8.16	18.938	0.403	0.219	0.605
FQ1_Q94	7.33	24.129	0.318	0.204	0.71	7.97	15.815	0.234	0.133	0.503	7.57	20.026	0.266	0.19	0.631
FQ1_Q95	8.26	25.129	0.244	0.092	0.719	8.56	16.514	0.186	0.063	0.515	8.41	20.11	0.292	0.1	0.626
FQ1_Q119	8.11	24.08	0.337	0.207	0.708	8.21	16.792	0.112	0.059	0.534	8.15	20.118	0.239	0.14	0.636
FQ1_Q144	8.2	23.606	0.422	0.313	0.697	8.72	15.81	0.351	0.244	0.479	8.54	20.31	0.306	0.245	0.625
FQ1_Q169	8.18	24.097	0.359	0.15	0.705	8.33	16.508	0.144	0.037	0.526	8.36	20.042	0.289	0.103	0.627
FQ1_Q194	8.31	23.738	0.463	0.241	0.694	8.71	16.004	0.327	0.153	0.485	8.53	19.931	0.375	0.175	0.615
FQ2_Q21	7.11	27.565	0.194	0.13	0.763	5.54	16.078	0.213	0.103	0.629	5.88	20.048	0.148	0.095	0.689
FQ2_Q46	8.07	26.949	0.289	0.091	0.752	6.76	17.447	0.118	0.024	0.638	7.09	19.844	0.238	0.069	0.674
FQ2_Q71	7.55	24.594	0.481	0.301	0.729	5.81	15.347	0.281	0.12	0.616	6.37	17.968	0.36	0.196	0.655
FQ2_Q96	7.96	25.228	0.458	0.228	0.733	6.49	15.801	0.305	0.111	0.61	6.96	18.374	0.404	0.202	0.649
FQ2_Q120	8.29	28.302	0.193	0.04	0.759	6.71	17.015	0.166	0.035	0.633	7.13	20.668	0.117	0.027	0.689
FQ2_Q121	7.86	25.387	0.431	0.207	0.736	6.27	14.851	0.374	0.163	0.595	6.82	18.433	0.352	0.141	0.657
FQ2_Q145	7.9	26.268	0.324	0.139	0.749	6.66	16.543	0.235	0.088	0.623	6.97	19.265	0.284	0.114	0.668
FQ2_Q146	7.67	24.036	0.544	0.361	0.721	6.3	14.712	0.397	0.203	0.59	6.72	17.661	0.431	0.266	0.642
FQ2_Q170	8.21	26.537	0.414	0.196	0.739	6.76	16.519	0.309	0.132	0.613	7.07	19.267	0.332	0.138	0.661
FQ2_Q171	7.71	25.711	0.352	0.211	0.746	6.25	15.585	0.256	0.131	0.621	6.55	18.471	0.292	0.149	0.668
FQ2_Q195	8.07	25.59	0.454	0.263	0.734	6.8	16.715	0.299	0.13	0.615	7.16	19.225	0.396	0.181	0.654

FQ2_Q196	7.79	24.331	0.547	0.318	0.721	6.37	14.843	0.41	0.184	0.588	6.82	17.717	0.466	0.249	0.637
FQ3_Q22	18.22	11.24	0.339	0.201	0.637	18.49	6.797	0.217	0.091	0.438	18.81	7.9	0.309	0.21	0.518
FQ3_Q23	18.2	11.437	0.326	0.169	0.64	18.48	6.868	0.204	0.07	0.441	18.76	8.264	0.252	0.127	0.533
FQ3_Q47	18.41	11	0.249	0.071	0.652	18.79	6.532	0.085	0.014	0.479	18.92	7.904	0.194	0.055	0.541
FQ3_Q48	18.18	11.362	0.388	0.194	0.634	18.45	6.985	0.219	0.065	0.443	18.74	8.481	0.2	0.08	0.542
FQ3_Q72	18.51	10.793	0.248	0.088	0.654	18.75	6.313	0.162	0.04	0.45	19.04	7.897	0.129	0.042	0.563
FQ3_Q73	18.14	11.699	0.343	0.188	0.642	18.48	6.782	0.248	0.1	0.433	18.73	8.39	0.252	0.15	0.535
FQ3_Q97	18.24	11.847	0.173	0.044	0.66	18.55	6.658	0.213	0.061	0.435	18.8	8.286	0.194	0.066	0.541
FQ3_Q98	19.26	10.2	0.269	0.078	0.657	19.76	6.022	0.128	0.02	0.475	19.75	6.758	0.251	0.071	0.537
FQ3_Q122	18.17	11.411	0.398	0.203	0.634	18.48	6.827	0.236	0.094	0.436	18.73	8.327	0.297	0.15	0.53
FQ3_Q147	18.31	10.925	0.343	0.212	0.634	18.52	6.62	0.251	0.122	0.427	18.83	7.714	0.356	0.246	0.507
FQ3_Q172	18.55	10.263	0.336	0.123	0.636	18.89	6.131	0.155	0.029	0.456	19.15	7.315	0.231	0.064	0.536
FQ3_Q197	18.4	10.292	0.422	0.236	0.618	18.66	6.194	0.256	0.094	0.417	19.04	7.328	0.282	0.141	0.518
FQ4_Q24	9.92	32.507	0.406	0.194	0.789	7.32	17.332	0.25	0.098	0.56	7.3	24.84	0.366	0.173	0.723
FQ4_Q49	10.32	32.66	0.447	0.23	0.785	7.25	16.855	0.309	0.108	0.548	7.77	26.345	0.317	0.136	0.728
FQ4_Q74	10.09	30.578	0.622	0.427	0.768	7.28	17.312	0.24	0.075	0.562	7.66	24.658	0.487	0.287	0.709
FQ4_Q99	10.44	31.906	0.557	0.393	0.776	7.23	16.982	0.267	0.134	0.556	7.8	25.585	0.43	0.294	0.717
FQ4_Q123	10.37	33.862	0.347	0.148	0.794	7.25	18.031	0.154	0.041	0.578	7.67	26.221	0.305	0.116	0.73
FQ4_Q124	9.72	33.614	0.321	0.146	0.797	6.67	17.879	0.087	0.035	0.598	7.25	25.881	0.252	0.068	0.738
FQ4_Q148	9.97	32.633	0.397	0.181	0.79	6.95	16.905	0.234	0.074	0.563	7.33	25.091	0.349	0.149	0.725
FQ4_Q149	9.85	32.778	0.391	0.182	0.791	6.85	16.654	0.246	0.089	0.56	7.33	25.257	0.322	0.145	0.729
FQ4_Q173	9.75	32.136	0.454	0.219	0.785	6.79	16.21	0.3	0.109	0.547	7.2	24.087	0.439	0.234	0.713
FQ4_Q174	10.32	32.346	0.467	0.256	0.783	7.12	16.761	0.27	0.12	0.555	7.53	24.83	0.405	0.219	0.718
FQ4_Q198	10.4	32.305	0.503	0.283	0.78	7.34	17.431	0.279	0.105	0.556	7.69	25.409	0.407	0.193	0.718
FQ4_Q199	9.46	33.155	0.433	0.24	0.787	6.89	16.314	0.299	0.152	0.547	7.06	24.31	0.427	0.246	0.715

APPENDIX 2: INTER-ITEM CORRELATION MATRIX

WHITE SAMPLE

	15FQ+_ FA_Q1	15FQ+_ FA_Q2	15FQ+_ FA_Q26	15FQ+_ FA_Q27	15FQ+_ FA_Q51	15FQ+_ FA_Q52	15FQ+_ FA_Q76	15FQ+_ FA_Q77	15FQ+_ FA_Q101	15FQ+_ FA_Q126	15FQ+_ FA_Q151	15FQ+_ FA_Q176
15FQ+_FA_Q1	1	0.074	0.165	0.271	0.242	0.284	0.216	0.354	0.157	0.17	0.416	0.149
15FQ+_FA_Q2	0.074	1	0.053	0.084	0.118	0.045	0.061	0.046	0.004	0.029	0.044	0.05
15FQ+_FA_Q26	0.165	0.053	1	0.151	0.137	0.203	0.197	0.151	0.119	0.088	0.161	0.198
15FQ+_FA_Q27	0.271	0.084	0.151	1	0.146	0.189	0.213	0.212	0.084	0.092	0.207	0.104
15FQ+_FA_Q51	0.242	0.118	0.137	0.146	1	0.296	0.215	0.396	0.181	0.128	0.292	0.18
15FQ+_FA_Q52	0.284	0.045	0.203	0.189	0.296	1	0.302	0.407	0.267	0.173	0.444	0.247
15FQ+_FA_Q76	0.216	0.061	0.197	0.213	0.215	0.302	1	0.349	0.282	0.112	0.28	0.189
15FQ+_FA_Q77	0.354	0.046	0.151	0.212	0.396	0.407	0.349	1	0.264	0.223	0.47	0.204
15FQ+_FA_Q101	0.157	0.004	0.119	0.084	0.181	0.267	0.282	0.264	1	0.147	0.269	0.178
15FQ+_FA_Q126	0.17	0.029	0.088	0.092	0.128	0.173	0.112	0.223	0.147	1	0.225	0.161
15FQ+_FA_Q151	0.416	0.044	0.161	0.207	0.292	0.444	0.28	0.47	0.269	0.225	1	0.254
15FQ+_FA_Q176	0.149	0.05	0.198	0.104	0.18	0.247	0.189	0.204	0.178	0.161	0.254	1

	15FQ+_ B_Q3	15FQ+_ B_Q28	15FQ+_ B_Q53	15FQ+_ B_Q78	15FQ+_ B_Q102	15FQ+_ B_Q103	15FQ+_ B_Q127	15FQ+_ B_Q128	15FQ+_ B_Q152	15FQ+_ B_Q153	15FQ+_ B_Q177	15FQ+_ B_Q178
15FQ+_B_Q3	1	0.117	0.198	0.252	0.146	0.127	0.159	0.221	0.14	0.175	0.247	0.114
15FQ+_B_Q28	0.117	1	0.028	0.264	0.142	0.154	0.269	0.153	0.162	0.218	0.063	0.143
15FQ+_B_Q53	0.198	0.028	1	0.122	0.261	0.055	0.13	0.112	0.131	0.107	0.515	0.117
15FQ+_B_Q78	0.252	0.264	0.122	1	0.187	0.166	0.274	0.224	0.218	0.313	0.124	0.153
15FQ+_B_Q102	0.146	0.142	0.261	0.187	1	0.199	0.284	0.206	0.363	0.258	0.357	0.245
15FQ+_B_Q103	0.127	0.154	0.055	0.166	0.199	1	0.197	0.212	0.155	0.187	0.133	0.154
15FQ+_B_Q127	0.159	0.269	0.13	0.274	0.284	0.197	1	0.165	0.284	0.264	0.178	0.212
15FQ+_B_Q128	0.221	0.153	0.112	0.224	0.206	0.212	0.165	1	0.186	0.208	0.185	0.206
15FQ+_B_Q152	0.14	0.162	0.131	0.218	0.363	0.155	0.284	0.186	1	0.239	0.189	0.275
15FQ+_B_Q153	0.175	0.218	0.107	0.313	0.258	0.187	0.264	0.208	0.239	1	0.171	0.332
15FQ+_B_Q177	0.247	0.063	0.515	0.124	0.357	0.133	0.178	0.185	0.189	0.171	1	0.237
15FQ+_B_Q178	0.114	0.143	0.117	0.153	0.245	0.154	0.212	0.206	0.275	0.332	0.237	1
	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+

	_FC_Q4	_FC_Q5	_FC_Q29	_FC_Q30	_FC_Q54	_FC_Q55	_FC_Q79	_FC_Q80	_FC_Q104	_FC_Q129	_FC_Q154	_FC_Q179
15FQ+_FC_Q4	1	0.259	0.233	0.183	0.316	0.307	0.32	0.286	0.304	0.266	0.245	0.398
15FQ+_FC_Q5	0.259	1	0.148	0.322	0.31	0.183	0.184	0.258	0.22	0.164	0.166	0.223
15FQ+_FC_Q29	0.233	0.148	1	0.157	0.171	0.335	0.207	0.17	0.219	0.246	0.186	0.178
15FQ+_FC_Q30	0.183	0.322	0.157	1	0.24	0.153	0.15	0.209	0.145	0.098	0.169	0.192
15FQ+_FC_Q54	0.316	0.31	0.171	0.24	1	0.209	0.22	0.292	0.279	0.209	0.201	0.266
15FQ+_FC_Q55	0.307	0.183	0.335	0.153	0.209	1	0.269	0.24	0.255	0.26	0.213	0.266
15FQ+_FC_Q79	0.32	0.184	0.207	0.15	0.22	0.269	1	0.274	0.24	0.196	0.263	0.322
15FQ+_FC_Q80	0.286	0.258	0.17	0.209	0.292	0.24	0.274	1	0.229	0.206	0.373	0.325
15FQ+_FC_Q104	0.304	0.22	0.219	0.145	0.279	0.255	0.24	0.229	1	0.386	0.2	0.236
15FQ+_FC_Q129	0.266	0.164	0.246	0.098	0.209	0.26	0.196	0.206	0.386	1	0.169	0.229
15FQ+_FC_Q154	0.245	0.166	0.186	0.169	0.201	0.213	0.263	0.373	0.2	0.169	1	0.327
15FQ+_FC_Q179	0.398	0.223	0.178	0.192	0.266	0.266	0.322	0.325	0.236	0.229	0.327	1

	15FQ+ _FE_Q6	15FQ+ _FE_Q31	15FQ+ _FE_Q56	15FQ+ _FE_Q81	15FQ+ _FE_Q105	15FQ+ _FE_Q106	15FQ+ _FE_Q130	15FQ+ _FE_Q131	15FQ+ _FE_Q155	15FQ+ _FE_Q156	15FQ+ _FE_Q180	15FQ+ _FE_Q181
15FQ+_FE_Q6	1	0.18	0.193	0.194	0.1	0.168	0.215	0.196	0.37	0.278	0.164	0.191
15FQ+_FE_Q31	0.18	1	0.206	0.214	0.102	0.167	0.346	0.158	0.243	0.163	0.266	0.149
15FQ+_FE_Q56	0.193	0.206	1	0.178	0.058	0.277	0.235	0.163	0.241	0.175	0.164	0.178
15FQ+_FE_Q81	0.194	0.214	0.178	1	0.146	0.15	0.318	0.184	0.255	0.184	0.228	0.172
15FQ+_FE_Q105	0.1	0.102	0.058	0.146	1	0.204	0.124	0.093	0.109	0.084	0.161	0.02
15FQ+_FE_Q106	0.168	0.167	0.277	0.15	0.204	1	0.173	0.127	0.187	0.106	0.17	0.086
15FQ+_FE_Q130	0.215	0.346	0.235	0.318	0.124	0.173	1	0.223	0.279	0.232	0.397	0.147
15FQ+_FE_Q131	0.196	0.158	0.163	0.184	0.093	0.127	0.223	1	0.246	0.208	0.171	0.135
15FQ+_FE_Q155	0.37	0.243	0.241	0.255	0.109	0.187	0.279	0.246	1	0.258	0.206	0.281
15FQ+_FE_Q156	0.278	0.163	0.175	0.184	0.084	0.106	0.232	0.208	0.258	1	0.179	0.206
15FQ+_FE_Q180	0.164	0.266	0.164	0.228	0.161	0.17	0.397	0.171	0.206	0.179	1	0.104
15FQ+_FE_Q181	0.191	0.149	0.178	0.172	0.02	0.086	0.147	0.135	0.281	0.206	0.104	1

	15FQ+ _FF_Q7	15FQ+ _FF_Q8	15FQ+ _FF_Q32	15FQ+ _FF_Q33	15FQ+ _FF_Q57	15FQ+ _FF_Q58	15FQ+ _FF_Q82	15FQ+ _FF_Q83	15FQ+ _FF_Q107	15FQ+ _FF_Q132	15FQ+ _FF_Q157	15FQ+ _FF_Q182
15FQ+_FF_Q7	1	0.214	0.129	0.189	0.237	0.232	0.178	0.174	0.282	0.324	0.399	0.219
15FQ+_FF_Q8	0.214	1	0.24	0.215	0.363	0.341	0.291	0.118	0.318	0.254	0.149	0.471
15FQ+_FF_Q32	0.129	0.24	1	0.158	0.174	0.22	0.331	0.125	0.229	0.219	0.135	0.39
15FQ+_FF_Q33	0.189	0.215	0.158	1	0.244	0.162	0.128	0.132	0.256	0.18	0.171	0.173
15FQ+_FF_Q57	0.237	0.363	0.174	0.244	1	0.245	0.252	0.132	0.255	0.205	0.189	0.335
15FQ+_FF_Q58	0.232	0.341	0.22	0.162	0.245	1	0.187	0.084	0.284	0.357	0.241	0.262

15FQ+_FF_Q82	0.178	0.291	0.331	0.128	0.252	0.187	1	0.122	0.209	0.163	0.157	0.552
15FQ+_FF_Q83	0.174	0.118	0.125	0.132	0.132	0.084	0.122	1	0.176	0.159	0.124	0.164
15FQ+_FF_Q107	0.282	0.318	0.229	0.256	0.255	0.284	0.209	0.176	1	0.378	0.259	0.291
15FQ+_FF_Q132	0.324	0.254	0.219	0.18	0.205	0.357	0.163	0.159	0.378	1	0.303	0.228
15FQ+_FF_Q157	0.399	0.149	0.135	0.171	0.189	0.241	0.157	0.124	0.259	0.303	1	0.186
15FQ+_FF_Q182	0.219	0.471	0.39	0.173	0.335	0.262	0.552	0.164	0.291	0.228	0.186	1

	15FQ+ _FG_Q9	15FQ+ _FG_Q34	15FQ+ _FG_Q59	15FQ+ _FG_Q84	15FQ+ _FG_Q108	15FQ+ _FG_Q109	15FQ+ _FG_Q133	15FQ+ _FG_Q134	15FQ+ _FG_Q158	15FQ+ _FG_Q159	15FQ+ _FG_Q183	15FQ+ _FG_Q184
15FQ+_FG_Q9	1	0.308	0.253	0.233	0.348	0.309	0.363	0.175	0.241	0.304	0.202	0.412
15FQ+_FG_Q34	0.308	1	0.249	0.137	0.215	0.28	0.381	0.299	0.206	0.175	0.157	0.421
15FQ+_FG_Q59	0.253	0.249	1	0.209	0.172	0.264	0.389	0.159	0.255	0.213	0.177	0.264
15FQ+_FG_Q84	0.233	0.137	0.209	1	0.166	0.16	0.224	0.052	0.173	0.208	0.17	0.221
15FQ+_FG_Q108	0.348	0.215	0.172	0.166	1	0.186	0.275	0.159	0.174	0.195	0.165	0.301
15FQ+_FG_Q109	0.309	0.28	0.264	0.16	0.186	1	0.282	0.15	0.208	0.295	0.164	0.285
15FQ+_FG_Q133	0.363	0.381	0.389	0.224	0.275	0.282	1	0.27	0.312	0.294	0.253	0.452
15FQ+_FG_Q134	0.175	0.299	0.159	0.052	0.159	0.15	0.27	1	0.16	0.088	0.102	0.275
15FQ+_FG_Q158	0.241	0.206	0.255	0.173	0.174	0.208	0.312	0.16	1	0.292	0.213	0.294
15FQ+_FG_Q159	0.304	0.175	0.213	0.208	0.195	0.295	0.294	0.088	0.292	1	0.249	0.267
15FQ+_FG_Q183	0.202	0.157	0.177	0.17	0.165	0.164	0.253	0.102	0.213	0.249	1	0.229
15FQ+_FG_Q184	0.412	0.421	0.264	0.221	0.301	0.285	0.452	0.275	0.294	0.267	0.229	1

	15FQ+ _FH_Q10	15FQ+ _FH_Q11	15FQ+ _FH_Q35	15FQ+ _FH_Q36	15FQ+ _FH_Q60	15FQ+ _FH_Q61	15FQ+ _FH_Q85	15FQ+ _FH_Q86	15FQ+ _FH_Q110	15FQ+ _FH_Q135	15FQ+ _FH_Q160	15FQ+ _FH_Q185
15FQ+_FH_Q10	1	0.342	0.26	0.437	0.282	0.43	0.413	0.269	0.185	0.44	0.233	0.23
15FQ+_FH_Q11	0.342	1	0.455	0.32	0.261	0.318	0.315	0.363	0.186	0.351	0.243	0.285
15FQ+_FH_Q35	0.26	0.455	1	0.283	0.236	0.238	0.279	0.228	0.204	0.31	0.291	0.221
15FQ+_FH_Q36	0.437	0.32	0.283	1	0.422	0.292	0.521	0.276	0.24	0.452	0.299	0.3
15FQ+_FH_Q60	0.282	0.261	0.236	0.422	1	0.188	0.379	0.23	0.178	0.275	0.273	0.244
15FQ+_FH_Q61	0.43	0.318	0.238	0.292	0.188	1	0.3	0.268	0.124	0.388	0.206	0.197
15FQ+_FH_Q85	0.413	0.315	0.279	0.521	0.379	0.3	1	0.286	0.234	0.437	0.305	0.273
15FQ+_FH_Q86	0.269	0.363	0.228	0.276	0.23	0.268	0.286	1	0.192	0.345	0.21	0.422
15FQ+_FH_Q110	0.185	0.186	0.204	0.24	0.178	0.124	0.234	0.192	1	0.238	0.222	0.319
15FQ+_FH_Q135	0.44	0.351	0.31	0.452	0.275	0.388	0.437	0.345	0.238	1	0.272	0.328
15FQ+_FH_Q160	0.233	0.243	0.291	0.299	0.273	0.206	0.305	0.21	0.222	0.272	1	0.275
15FQ+_FH_Q185	0.23	0.285	0.221	0.3	0.244	0.197	0.273	0.422	0.319	0.328	0.275	1

	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+

	_FI_Q12	_FI_Q37	_FI_Q62	_FI_Q87	_FI_Q111	_FI_Q112	_FI_Q136	_FI_Q137	_FI_Q161	_FI_Q162	_FI_Q186	_FI_Q187
15FQ+_FI_Q12	1	0.161	0.244	0.266	0.195	0.176	0.161	0.242	0.17	0.189	0.128	0.203
15FQ+_FI_Q37	0.161	1	0.149	0.164	0.23	0.291	0.147	0.445	0.08	0.136	0.233	0.104
15FQ+_FI_Q62	0.244	0.149	1	0.364	0.256	0.176	0.316	0.306	0.212	0.319	0.116	0.061
15FQ+_FI_Q87	0.266	0.164	0.364	1	0.204	0.151	0.207	0.314	0.198	0.293	0.112	0.055
15FQ+_FI_Q111	0.195	0.23	0.256	0.204	1	0.218	0.168	0.316	0.146	0.437	0.16	0.024
15FQ+_FI_Q112	0.176	0.291	0.176	0.151	0.218	1	0.138	0.353	0.129	0.164	0.279	0.107
15FQ+_FI_Q136	0.161	0.147	0.316	0.207	0.168	0.138	1	0.196	0.106	0.16	0.077	0.043
15FQ+_FI_Q137	0.242	0.445	0.306	0.314	0.316	0.353	0.196	1	0.174	0.276	0.275	0.07
15FQ+_FI_Q161	0.17	0.08	0.212	0.198	0.146	0.129	0.106	0.174	1	0.212	0.101	0.107
15FQ+_FI_Q162	0.189	0.136	0.319	0.293	0.437	0.164	0.16	0.276	0.212	1	0.112	0.036
15FQ+_FI_Q186	0.128	0.233	0.116	0.112	0.16	0.279	0.077	0.275	0.101	0.112	1	0.165
15FQ+_FI_Q187	0.203	0.104	0.061	0.055	0.024	0.107	0.043	0.07	0.107	0.036	0.165	1

	15FQ+ _FL_Q13	15FQ+ _FL_Q14	15FQ+ _FL_Q38	15FQ+ _FL_Q39	15FQ+ _FL_Q63	15FQ+ _FL_Q64	15FQ+ _FL_Q88	15FQ+ _FL_Q89	15FQ+ _FL_Q113	15FQ+ _FL_Q138	15FQ+ _FL_Q163	15FQ+ _FL_Q188
15FQ+_FL_Q13	1	0.232	0.157	0.268	0.097	0.092	0.141	0.059	0.087	0.297	0.294	0.053
15FQ+_FL_Q14	0.232	1	0.374	0.372	0.128	0.222	0.328	0.148	0.188	0.197	0.314	0.11
15FQ+_FL_Q38	0.157	0.374	1	0.334	0.113	0.247	0.257	0.125	0.159	0.166	0.244	0.179
15FQ+_FL_Q39	0.268	0.372	0.334	1	0.148	0.204	0.266	0.149	0.215	0.24	0.373	0.113
15FQ+_FL_Q63	0.097	0.128	0.113	0.148	1	0.185	0.136	0.197	0.22	0.077	0.219	0.057
15FQ+_FL_Q64	0.092	0.222	0.247	0.204	0.185	1	0.234	0.19	0.211	0.117	0.165	0.169
15FQ+_FL_Q88	0.141	0.328	0.257	0.266	0.136	0.234	1	0.276	0.302	0.164	0.223	0.141
15FQ+_FL_Q89	0.059	0.148	0.125	0.149	0.197	0.19	0.276	1	0.516	0.055	0.156	0.128
15FQ+_FL_Q113	0.087	0.188	0.159	0.215	0.22	0.211	0.302	0.516	1	0.098	0.23	0.14
15FQ+_FL_Q138	0.297	0.197	0.166	0.24	0.077	0.117	0.164	0.055	0.098	1	0.243	0.068
15FQ+_FL_Q163	0.294	0.314	0.244	0.373	0.219	0.165	0.223	0.156	0.23	0.243	1	0.088
15FQ+_FL_Q188	0.053	0.11	0.179	0.113	0.057	0.169	0.141	0.128	0.14	0.068	0.088	1

	15FQ+ _FM_Q15	15FQ+ _FM_Q40	15FQ+ _FM_Q65	15FQ+ _FM_Q90	15FQ+ _FM_Q114	15FQ+ _FM_Q115	15FQ+ _FM_Q139	15FQ+ _FM_Q140	15FQ+ _FM_Q164	15FQ+ _FM_Q165	15FQ+ _FM_Q189	15FQ+ _FM_Q190
15FQ+_FM_Q15	1	0.111	0.073	0.108	0.066	0.17	0.114	0.216	0.248	0.087	0.194	0.086
15FQ+_FM_Q40	0.111	1	0.088	0.197	0.156	0.085	0.315	0.175	0.08	0.25	0.148	0.135
15FQ+_FM_Q65	0.073	0.088	1	0.007	0.432	0.183	0.182	0.082	0.189	0.16	0.048	0.207
15FQ+_FM_Q90	0.108	0.197	0.007	1	-0.014	0.042	0.196	0.322	0.112	0.22	0.079	0.017
15FQ+_FM_Q114	0.066	0.156	0.432	-0.014	1	0.159	0.17	0.063	0.147	0.121	0.064	0.199
15FQ+_FM_Q115	0.17	0.085	0.183	0.042	0.159	1	0.149	0.091	0.118	0.117	0.173	0.178

15FQ+_FM_Q139	0.114	0.315	0.182	0.196	0.17	0.149	1	0.213	0.1	0.363	0.171	0.203
15FQ+_FM_Q140	0.216	0.175	0.082	0.322	0.063	0.091	0.213	1	0.182	0.226	0.079	0.067
15FQ+_FM_Q164	0.248	0.08	0.189	0.112	0.147	0.118	0.1	0.182	1	0.111	0.118	0.052
15FQ+_FM_Q165	0.087	0.25	0.16	0.22	0.121	0.117	0.363	0.226	0.111	1	0.096	0.182
15FQ+_FM_Q189	0.194	0.148	0.048	0.079	0.064	0.173	0.171	0.079	0.118	0.096	1	0.134
15FQ+_FM_Q190	0.086	0.135	0.207	0.017	0.199	0.178	0.203	0.067	0.052	0.182	0.134	1

	15FQ+ _FN_Q16	15FQ+ _FN_Q17	15FQ+ _FN_Q41	15FQ+ _FN_Q42	15FQ+ _FN_Q66	15FQ+ _FN_Q67	15FQ+ _FN_Q91	15FQ+ _FN_Q92	15FQ+ _FN_Q116	15FQ+ _FN_Q141	15FQ+ _FN_Q166	15FQ+ _FN_Q191
15FQ+_FN_Q16	1	0.164	0.23	0.25	0.153	0.19	0.242	0.242	0.262	0.194	0.206	0.136
15FQ+_FN_Q17	0.164	1	0.125	0.138	0.245	0.111	0.183	0.165	0.191	0.461	0.143	0.15
15FQ+_FN_Q41	0.23	0.125	1	0.355	0.099	0.15	0.219	0.25	0.264	0.185	0.185	0.102
15FQ+_FN_Q42	0.25	0.138	0.355	1	0.116	0.181	0.261	0.221	0.323	0.182	0.331	0.122
15FQ+_FN_Q66	0.153	0.245	0.099	0.116	1	0.224	0.241	0.277	0.141	0.283	0.162	0.401
15FQ+_FN_Q67	0.19	0.111	0.15	0.181	0.224	1	0.222	0.351	0.079	0.203	0.148	0.216
15FQ+_FN_Q91	0.242	0.183	0.219	0.261	0.241	0.222	1	0.36	0.42	0.286	0.291	0.269
15FQ+_FN_Q92	0.242	0.165	0.25	0.221	0.277	0.351	0.36	1	0.244	0.303	0.233	0.296
15FQ+_FN_Q116	0.262	0.191	0.264	0.323	0.141	0.079	0.42	0.244	1	0.254	0.293	0.127
15FQ+_FN_Q141	0.194	0.461	0.185	0.182	0.283	0.203	0.286	0.303	0.254	1	0.223	0.242
15FQ+_FN_Q166	0.206	0.143	0.185	0.331	0.162	0.148	0.291	0.233	0.293	0.223	1	0.156
15FQ+_FN_Q191	0.136	0.15	0.102	0.122	0.401	0.216	0.269	0.296	0.127	0.242	0.156	1

	15FQ+ _FO_Q18	15FQ+ _FO_Q43	15FQ+ _FO_Q68	15FQ+ _FO_Q93	15FQ+ _FO_Q117	15FQ+ _FO_Q118	15FQ+ _FO_Q142	15FQ+ _FO_Q143	15FQ+ _FO_Q167	15FQ+ _FO_Q168	15FQ+ _FO_Q192	15FQ+ _FO_Q193
15FQ+_FO_Q18	1	0.128	0.169	0.097	0.19	0.13	0.175	0.189	0.224	0.117	0.203	0.233
15FQ+_FO_Q43	0.128	1	0.15	0.153	0.147	0.168	0.193	0.176	0.189	0.243	0.205	0.221
15FQ+_FO_Q68	0.169	0.15	1	0.257	0.356	0.2	0.279	0.236	0.429	0.163	0.337	0.282
15FQ+_FO_Q93	0.097	0.153	0.257	1	0.227	0.232	0.204	0.257	0.219	0.097	0.208	0.234
15FQ+_FO_Q117	0.19	0.147	0.356	0.227	1	0.128	0.27	0.211	0.381	0.155	0.24	0.238
15FQ+_FO_Q118	0.13	0.168	0.2	0.232	0.128	1	0.232	0.152	0.193	0.109	0.171	0.26
15FQ+_FO_Q142	0.175	0.193	0.279	0.204	0.27	0.232	1	0.229	0.293	0.152	0.258	0.275
15FQ+_FO_Q143	0.189	0.176	0.236	0.257	0.211	0.152	0.229	1	0.258	0.09	0.274	0.245
15FQ+_FO_Q167	0.224	0.189	0.429	0.219	0.381	0.193	0.293	0.258	1	0.192	0.328	0.351
15FQ+_FO_Q168	0.117	0.243	0.163	0.097	0.155	0.109	0.152	0.09	0.192	1	0.201	0.158
15FQ+_FO_Q192	0.203	0.205	0.337	0.208	0.24	0.171	0.258	0.274	0.328	0.201	1	0.28
15FQ+_FO_Q193	0.233	0.221	0.282	0.234	0.238	0.26	0.275	0.245	0.351	0.158	0.28	1

	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+

	_FQ1_Q19	_FQ1_Q20	_FQ1_Q44	_FQ1_Q45	_FQ1_Q69	_FQ1_Q70	_FQ1_Q94	_FQ1_Q95	_FQ1_Q119	_FQ1_Q144	_FQ1_Q169	_FQ1_Q194
15FQ+_FQ1_Q19	1	-0.004	0.32	0.091	0.187	0.144	0.197	0.106	0.103	0.174	0.088	0.319
15FQ+_FQ1_Q20	-0.004	1	0.003	0.287	0.134	0.261	0.045	0.084	0.198	0.135	0.165	0.132
15FQ+_FQ1_Q44	0.32	0.003	1	0.111	0.194	0.164	0.383	0.102	0.092	0.191	0.161	0.297
15FQ+_FQ1_Q45	0.091	0.287	0.111	1	0.111	0.36	0.052	0.155	0.369	0.121	0.202	0.202
15FQ+_FQ1_Q69	0.187	0.134	0.194	0.111	1	0.218	0.279	0.069	0.086	0.502	0.181	0.243
15FQ+_FQ1_Q70	0.144	0.261	0.164	0.36	0.218	1	0.113	0.237	0.308	0.219	0.239	0.273
15FQ+_FQ1_Q94	0.197	0.045	0.383	0.052	0.279	0.113	1	0.051	0.037	0.241	0.144	0.218
15FQ+_FQ1_Q95	0.106	0.084	0.102	0.155	0.069	0.237	0.051	1	0.229	0.086	0.127	0.14
15FQ+_FQ1_Q119	0.103	0.198	0.092	0.369	0.086	0.308	0.037	0.229	1	0.088	0.21	0.168
15FQ+_FQ1_Q144	0.174	0.135	0.191	0.121	0.502	0.219	0.241	0.086	0.088	1	0.263	0.295
15FQ+_FQ1_Q169	0.088	0.165	0.161	0.202	0.181	0.239	0.144	0.127	0.21	0.263	1	0.227
15FQ+_FQ1_Q194	0.319	0.132	0.297	0.202	0.243	0.273	0.218	0.14	0.168	0.295	0.227	1
	15FQ+ _FQ2_Q21	15FQ+ _FQ2_Q46	15FQ+ _FQ2_Q71	15FQ+ _FQ2_Q96	15FQ+ _FQ2_Q120	15FQ+ _FQ2_Q121	15FQ+ _FQ2_Q145	15FQ+ _FQ2_Q146	15FQ+ _FQ2_Q170	15FQ+ _FQ2_Q171	15FQ+ _FQ2_Q195	15FQ+ _FQ2_Q196
15FQ+_FQ2_Q21	1	0.081	0.061	0.102	0.067	0.073	0.027	0.08	0.101	0.348	0.041	0.155
15FQ+_FQ2_Q46	0.081	1	0.177	0.164	0.11	0.143	0.127	0.207	0.191	0.119	0.209	0.182
15FQ+_FQ2_Q71	0.061	0.177	1	0.296	0.112	0.274	0.197	0.465	0.201	0.172	0.383	0.368
15FQ+_FQ2_Q96	0.102	0.164	0.296	1	0.11	0.304	0.221	0.334	0.258	0.209	0.233	0.364
15FQ+_FQ2_Q120	0.067	0.11	0.112	0.11	1	0.103	0.075	0.134	0.107	0.079	0.137	0.122
15FQ+_FQ2_Q121	0.073	0.143	0.274	0.304	0.103	1	0.215	0.317	0.23	0.213	0.228	0.347
15FQ+_FQ2_Q145	0.027	0.127	0.197	0.221	0.075	0.215	1	0.281	0.252	0.079	0.188	0.233
15FQ+_FQ2_Q146	0.08	0.207	0.465	0.334	0.134	0.317	0.281	1	0.241	0.162	0.398	0.418
15FQ+_FQ2_Q170	0.101	0.191	0.201	0.258	0.107	0.23	0.252	0.241	1	0.234	0.304	0.259
15FQ+_FQ2_Q171	0.348	0.119	0.172	0.209	0.079	0.213	0.079	0.162	0.234	1	0.157	0.277
15FQ+_FQ2_Q195	0.041	0.209	0.383	0.233	0.137	0.228	0.188	0.398	0.304	0.157	1	0.313
15FQ+_FQ2_Q196	0.155	0.182	0.368	0.364	0.122	0.347	0.233	0.418	0.259	0.277	0.313	1
	15FQ+ _FQ3_Q22	15FQ+ _FQ3_Q23	15FQ+ _FQ3_Q47	15FQ+ _FQ3_Q48	15FQ+ _FQ3_Q72	15FQ+ _FQ3_Q73	15FQ+ _FQ3_Q97	15FQ+ _FQ3_Q98	15FQ+ _FQ3_Q122	15FQ+ _FQ3_Q147	15FQ+ _FQ3_Q172	15FQ+ _FQ3_Q197
15FQ+_FQ3_Q22	1	0.17	0.132	0.137	0.073	0.19	0.1	0.13	0.15	0.409	0.189	0.155
15FQ+_FQ3_Q23	0.17	1	0.111	0.23	0.103	0.349	0.112	0.112	0.177	0.17	0.164	0.176
15FQ+_FQ3_Q47	0.132	0.111	1	0.131	0.137	0.119	0.055	0.082	0.166	0.116	0.12	0.193
15FQ+_FQ3_Q48	0.137	0.23	0.131	1	0.141	0.249	0.099	0.161	0.296	0.153	0.192	0.32
15FQ+_FQ3_Q72	0.073	0.103	0.137	0.141	1	0.088	0.061	0.115	0.201	0.057	0.108	0.243
15FQ+_FQ3_Q73	0.19	0.349	0.119	0.249	0.088	1	0.162	0.102	0.181	0.193	0.159	0.167

15FQ+_FQ3_Q97	0.1	0.112	0.055	0.099	0.061	0.162	1	0.079	0.122	0.083	0.072	0.072
15FQ+_FQ3_Q98	0.13	0.112	0.082	0.161	0.115	0.102	0.079	1	0.129	0.152	0.183	0.176
15FQ+_FQ3_Q122	0.15	0.177	0.166	0.296	0.201	0.181	0.122	0.129	1	0.166	0.169	0.363
15FQ+_FQ3_Q147	0.409	0.17	0.116	0.153	0.057	0.193	0.083	0.152	0.166	1	0.22	0.166
15FQ+_FQ3_Q172	0.189	0.164	0.12	0.192	0.108	0.159	0.072	0.183	0.169	0.22	1	0.212
15FQ+_FQ3_Q197	0.155	0.176	0.193	0.32	0.243	0.167	0.072	0.176	0.363	0.166	0.212	1

	15FQ+ _FQ4_Q24	15FQ+ _FQ4_Q49	15FQ+ _FQ4_Q74	15FQ+ _FQ4_Q99	15FQ+ _FQ4_Q123	15FQ+ _FQ4_Q124	15FQ+ _FQ4_Q148	15FQ+ _FQ4_Q149	15FQ+ _FQ4_Q173	15FQ+ _FQ4_Q174	15FQ+ _FQ4_Q198	15FQ+ _FQ4_Q199
15FQ+_FQ4_Q24	1	0.183	0.305	0.262	0.159	0.099	0.301	0.226	0.266	0.221	0.257	0.255
15FQ+_FQ4_Q49	0.183	1	0.411	0.359	0.183	0.199	0.204	0.233	0.238	0.258	0.303	0.216
15FQ+_FQ4_Q74	0.305	0.411	1	0.53	0.275	0.246	0.299	0.272	0.355	0.37	0.402	0.315
15FQ+_FQ4_Q99	0.262	0.359	0.53	1	0.271	0.162	0.238	0.246	0.303	0.432	0.404	0.203
15FQ+_FQ4_Q123	0.159	0.183	0.275	0.271	1	0.139	0.182	0.142	0.171	0.234	0.315	0.124
15FQ+_FQ4_Q124	0.099	0.199	0.246	0.162	0.139	1	0.151	0.206	0.187	0.184	0.158	0.315
15FQ+_FQ4_Q148	0.301	0.204	0.299	0.238	0.182	0.151	1	0.151	0.287	0.208	0.229	0.225
15FQ+_FQ4_Q149	0.226	0.233	0.272	0.246	0.142	0.206	0.151	1	0.211	0.2	0.245	0.331
15FQ+_FQ4_Q173	0.266	0.238	0.355	0.303	0.171	0.187	0.287	0.211	1	0.292	0.244	0.258
15FQ+_FQ4_Q174	0.221	0.258	0.37	0.432	0.234	0.184	0.208	0.2	0.292	1	0.316	0.192
15FQ+_FQ4_Q198	0.257	0.303	0.402	0.404	0.315	0.158	0.229	0.245	0.244	0.316	1	0.241
15FQ+_FQ4_Q199	0.255	0.216	0.315	0.203	0.124	0.315	0.225	0.331	0.258	0.192	0.241	1

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	15FQ+_ FA_Q1	15FQ+_ FA_Q2	15FQ+_ FA_Q26	15FQ+_ FA_Q27	15FQ+_ FA_Q51	15FQ+_ FA_Q52	15FQ+_ FA_Q76	15FQ+_ FA_Q77	15FQ+_ FA_Q101	15FQ+_ FA_Q126	15FQ+_ FA_Q151	15FQ+_ FA_Q176
15FQ+_FA_Q1	1	-0.017	0.043	0.131	0.097	0.143	0.066	0.158	0.067	0.024	0.194	0.071
15FQ+_FA_Q2	-0.017	1	0.076	0.001	0.065	-0.038	0.021	-0.025	-0.064	0.022	-0.011	-0.034
15FQ+_FA_Q26	0.043	0.076	1	0.074	0.08	0.046	0.099	0.064	-0.003	0.033	0.076	0.116
15FQ+_FA_Q27	0.131	0.001	0.074	1	0.104	0.164	0.121	0.126	0.051	0.047	0.137	0.111
15FQ+_FA_Q51	0.097	0.065	0.08	0.104	1	0.146	0.135	0.148	0.053	0.051	0.124	0.065
15FQ+_FA_Q52	0.143	-0.038	0.046	0.164	0.146	1	0.136	0.229	0.211	0.074	0.281	0.199
15FQ+_FA_Q76	0.066	0.021	0.099	0.121	0.135	0.136	1	0.145	0.165	0.06	0.143	0.124
15FQ+_FA_Q77	0.158	-0.025	0.064	0.126	0.148	0.229	0.145	1	0.149	0.072	0.279	0.15
15FQ+_FA_Q101	0.067	-0.064	-0.003	0.051	0.053	0.211	0.165	0.149	1	0.052	0.16	0.173
15FQ+_FA_Q126	0.024	0.022	0.033	0.047	0.051	0.074	0.06	0.072	0.052	1	0.122	0.044
15FQ+_FA_Q151	0.194	-0.011	0.076	0.137	0.124	0.281	0.143	0.279	0.16	0.122	1	0.155
15FQ+_FA_Q176	0.071	-0.034	0.116	0.111	0.065	0.199	0.124	0.15	0.173	0.044	0.155	1
	15FQ+_ B_Q3	15FQ+_ B_Q28	15FQ+_ B_Q53	15FQ+_ B_Q78	15FQ+_ B_Q102	15FQ+_ B_Q103	15FQ+_ B_Q127	15FQ+_ B_Q128	15FQ+_ B_Q152	15FQ+_ B_Q153	15FQ+_ B_Q177	15FQ+_ B_Q178
15FQ+_B_Q3	1	0.231	0.097	0.233	0.118	0.084	0.097	0.205	0.073	0.236	0.142	0.149
15FQ+_B_Q28	0.231	1	0.017	0.24	0.154	0.111	0.191	0.189	0.127	0.234	0.067	0.168
15FQ+_B_Q53	0.097	0.017	1	0.058	0.198	0.036	0.074	0.013	0.056	0.061	0.38	0.051
15FQ+_B_Q78	0.233	0.24	0.058	1	0.13	0.148	0.205	0.189	0.093	0.282	0.093	0.181
15FQ+_B_Q102	0.118	0.154	0.198	0.13	1	0.142	0.187	0.135	0.203	0.152	0.269	0.112
15FQ+_B_Q103	0.084	0.111	0.036	0.148	0.142	1	0.105	0.177	0.062	0.137	0.066	0.106
15FQ+_B_Q127	0.097	0.191	0.074	0.205	0.187	0.105	1	0.154	0.191	0.176	0.09	0.151
15FQ+_B_Q128	0.205	0.189	0.013	0.189	0.135	0.177	0.154	1	0.121	0.194	0.057	0.139
15FQ+_B_Q152	0.073	0.127	0.056	0.093	0.203	0.062	0.191	0.121	1	0.098	0.088	0.094
15FQ+_B_Q153	0.236	0.234	0.061	0.282	0.152	0.137	0.176	0.194	0.098	1	0.139	0.327
15FQ+_B_Q177	0.142	0.067	0.38	0.093	0.269	0.066	0.09	0.057	0.088	0.139	1	0.153
15FQ+_B_Q178	0.149	0.168	0.051	0.181	0.112	0.106	0.151	0.139	0.094	0.327	0.153	1
	15FQ+ _FC_Q4	15FQ+ _FC_Q5	15FQ+ _FC_Q29	15FQ+ _FC_Q30	15FQ+ _FC_Q54	15FQ+ _FC_Q55	15FQ+ _FC_Q79	15FQ+ _FC_Q80	15FQ+ _FC_Q104	15FQ+ _FC_Q129	15FQ+ _FC_Q154	15FQ+ _FC_Q179

15FQ+_FC_Q4	1	0.173	0.148	0.112	0.17	0.195	0.275	0.157	0.239	0.184	0.185	0.354
15FQ+_FC_Q5	0.173	1	0.051	0.166	0.142	0.071	0.111	0.09	0.087	0.057	0.093	0.128
15FQ+_FC_Q29	0.148	0.051	1	0.078	0.086	0.271	0.115	0.111	0.229	0.26	0.072	0.135
15FQ+_FC_Q30	0.112	0.166	0.078	1	0.155	0.113	0.097	0.058	0.109	0.081	0.083	0.137
15FQ+_FC_Q54	0.17	0.142	0.086	0.155	1	0.184	0.183	0.157	0.177	0.143	0.169	0.208
15FQ+_FC_Q55	0.195	0.071	0.271	0.113	0.184	1	0.194	0.153	0.277	0.241	0.153	0.201
15FQ+_FC_Q79	0.275	0.111	0.115	0.097	0.183	0.194	1	0.162	0.191	0.145	0.249	0.306
15FQ+_FC_Q80	0.157	0.09	0.111	0.058	0.157	0.153	0.162	1	0.186	0.152	0.291	0.214
15FQ+_FC_Q104	0.239	0.087	0.229	0.109	0.177	0.277	0.191	0.186	1	0.466	0.177	0.256
15FQ+_FC_Q129	0.184	0.057	0.26	0.081	0.143	0.241	0.145	0.152	0.466	1	0.173	0.187
15FQ+_FC_Q154	0.185	0.093	0.072	0.083	0.169	0.153	0.249	0.291	0.177	0.173	1	0.287
15FQ+_FC_Q179	0.354	0.128	0.135	0.137	0.208	0.201	0.306	0.214	0.256	0.187	0.287	1

	15FQ+ _FE_Q6	15FQ+ _FE_Q31	15FQ+ _FE_Q56	15FQ+ _FE_Q81	15FQ+ _FE_Q105	15FQ+ _FE_Q106	15FQ+ _FE_Q130	15FQ+ _FE_Q131	15FQ+ _FE_Q155	15FQ+ _FE_Q156	15FQ+ _FE_Q180	15FQ+ _FE_Q181
15FQ+_FE_Q6	1	0.115	0.133	0.136	0.04	0.074	0.098	0.185	0.268	0.173	0.024	0.139
15FQ+_FE_Q31	0.115	1	0.104	0.09	0.032	0.086	0.132	0.086	0.146	0.075	0.056	0.097
15FQ+_FE_Q56	0.133	0.104	1	0.079	0	0.103	0.122	0.075	0.089	0.104	0.023	0.072
15FQ+_FE_Q81	0.136	0.09	0.079	1	0.106	0.056	0.157	0.11	0.148	0.072	0.074	0.049
15FQ+_FE_Q105	0.04	0.032	0	0.106	1	0.106	0.072	0.042	0.043	-0.02	0.108	0.01
15FQ+_FE_Q106	0.074	0.086	0.103	0.056	0.106	1	0.061	0.039	0.145	0.005	0.079	0.069
15FQ+_FE_Q130	0.098	0.132	0.122	0.157	0.072	0.061	1	0.15	0.127	0.152	0.219	0.059
15FQ+_FE_Q131	0.185	0.086	0.075	0.11	0.042	0.039	0.15	1	0.185	0.196	0.079	0.092
15FQ+_FE_Q155	0.268	0.146	0.089	0.148	0.043	0.145	0.127	0.185	1	0.184	0.031	0.133
15FQ+_FE_Q156	0.173	0.075	0.104	0.072	-0.02	0.005	0.152	0.196	0.184	1	0.035	0.135
15FQ+_FE_Q180	0.024	0.056	0.023	0.074	0.108	0.079	0.219	0.079	0.031	0.035	1	0.027
15FQ+_FE_Q181	0.139	0.097	0.072	0.049	0.01	0.069	0.059	0.092	0.133	0.135	0.027	1

	15FQ+ _FF_Q7	15FQ+ _FF_Q8	15FQ+ _FF_Q32	15FQ+ _FF_Q33	15FQ+ _FF_Q57	15FQ+ _FF_Q58	15FQ+ _FF_Q82	15FQ+ _FF_Q83	15FQ+ _FF_Q107	15FQ+ _FF_Q132	15FQ+ _FF_Q157	15FQ+ _FF_Q182
15FQ+_FF_Q7	1	0.223	0.111	0.14	0.234	0.138	0.17	0.121	0.218	0.242	0.252	0.199
15FQ+_FF_Q8	0.223	1	0.218	0.16	0.257	0.269	0.321	0.136	0.173	0.186	0.091	0.412
15FQ+_FF_Q32	0.111	0.218	1	0.1	0.111	0.09	0.399	0.158	0.176	0.178	0.071	0.404
15FQ+_FF_Q33	0.14	0.16	0.1	1	0.198	0.087	0.122	0.106	0.171	0.095	0.106	0.15
15FQ+_FF_Q57	0.234	0.257	0.111	0.198	1	0.167	0.171	0.115	0.167	0.137	0.132	0.215
15FQ+_FF_Q58	0.138	0.269	0.09	0.087	0.167	1	0.127	0.027	0.137	0.175	0.119	0.171
15FQ+_FF_Q82	0.17	0.321	0.399	0.122	0.171	0.127	1	0.147	0.146	0.121	0.084	0.557

15FQ+_FF_Q83	0.121	0.136	0.158	0.106	0.115	0.027	0.147	1	0.137	0.102	0.074	0.16
15FQ+_FF_Q107	0.218	0.173	0.176	0.171	0.167	0.137	0.146	0.137	1	0.265	0.204	0.16
15FQ+_FF_Q132	0.242	0.186	0.178	0.095	0.137	0.175	0.121	0.102	0.265	1	0.266	0.161
15FQ+_FF_Q157	0.252	0.091	0.071	0.106	0.132	0.119	0.084	0.074	0.204	0.266	1	0.091
15FQ+_FF_Q182	0.199	0.412	0.404	0.15	0.215	0.171	0.557	0.16	0.16	0.161	0.091	1

	15FQ+ _FG_Q9	15FQ+ _FG_Q34	15FQ+ _FG_Q59	15FQ+ _FG_Q84	15FQ+ _FG_Q108	15FQ+ _FG_Q109	15FQ+ _FG_Q133	15FQ+ _FG_Q134	15FQ+ _FG_Q158	15FQ+ _FG_Q159	15FQ+ _FG_Q183	15FQ+ _FG_Q184
15FQ+_FG_Q9	1	0.223	0.188	0.174	0.234	0.224	0.312	0.104	0.261	0.175	0.165	0.346
15FQ+_FG_Q34	0.223	1	0.129	0.083	0.119	0.164	0.247	0.139	0.154	0.104	0.116	0.287
15FQ+_FG_Q59	0.188	0.129	1	0.166	0.083	0.207	0.235	0.078	0.209	0.108	0.079	0.165
15FQ+_FG_Q84	0.174	0.083	0.166	1	0.063	0.14	0.203	0.006	0.169	0.144	0.063	0.197
15FQ+_FG_Q108	0.234	0.119	0.083	0.063	1	0.105	0.178	0.099	0.099	0.096	0.07	0.21
15FQ+_FG_Q109	0.224	0.164	0.207	0.14	0.105	1	0.206	0.075	0.196	0.14	0.115	0.233
15FQ+_FG_Q133	0.312	0.247	0.235	0.203	0.178	0.206	1	0.187	0.295	0.21	0.184	0.376
15FQ+_FG_Q134	0.104	0.139	0.078	0.006	0.099	0.075	0.187	1	0.099	0.06	0.097	0.165
15FQ+_FG_Q158	0.261	0.154	0.209	0.169	0.099	0.196	0.295	0.099	1	0.187	0.136	0.277
15FQ+_FG_Q159	0.175	0.104	0.108	0.144	0.096	0.14	0.21	0.06	0.187	1	0.121	0.176
15FQ+_FG_Q183	0.165	0.116	0.079	0.063	0.07	0.115	0.184	0.097	0.136	0.121	1	0.188
15FQ+_FG_Q184	0.346	0.287	0.165	0.197	0.21	0.233	0.376	0.165	0.277	0.176	0.188	1

	15FQ+ _FH_Q10	15FQ+ _FH_Q11	15FQ+ _FH_Q35	15FQ+ _FH_Q36	15FQ+ _FH_Q60	15FQ+ _FH_Q61	15FQ+ _FH_Q85	15FQ+ _FH_Q86	15FQ+ _FH_Q110	15FQ+ _FH_Q135	15FQ+ _FH_Q160	15FQ+ _FH_Q185
15FQ+_FH_Q10	1	0.253	0.195	0.332	0.181	0.254	0.298	0.177	0.162	0.305	0.153	0.118
15FQ+_FH_Q11	0.253	1	0.395	0.247	0.186	0.166	0.268	0.274	0.161	0.291	0.152	0.178
15FQ+_FH_Q35	0.195	0.395	1	0.242	0.174	0.132	0.215	0.2	0.196	0.284	0.195	0.2
15FQ+_FH_Q36	0.332	0.247	0.242	1	0.283	0.155	0.416	0.225	0.196	0.29	0.217	0.189
15FQ+_FH_Q60	0.181	0.186	0.174	0.283	1	0.097	0.294	0.181	0.149	0.158	0.182	0.175
15FQ+_FH_Q61	0.254	0.166	0.132	0.155	0.097	1	0.147	0.134	0.08	0.243	0.055	0.103
15FQ+_FH_Q85	0.298	0.268	0.215	0.416	0.294	0.147	1	0.23	0.164	0.307	0.175	0.134
15FQ+_FH_Q86	0.177	0.274	0.2	0.225	0.181	0.134	0.23	1	0.17	0.235	0.112	0.236
15FQ+_FH_Q110	0.162	0.161	0.196	0.196	0.149	0.08	0.164	0.17	1	0.172	0.187	0.27
15FQ+_FH_Q135	0.305	0.291	0.284	0.29	0.158	0.243	0.307	0.235	0.172	1	0.161	0.195
15FQ+_FH_Q160	0.153	0.152	0.195	0.217	0.182	0.055	0.175	0.112	0.187	0.161	1	0.215
15FQ+_FH_Q185	0.118	0.178	0.2	0.189	0.175	0.103	0.134	0.236	0.27	0.195	0.215	1

	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+

	_FI_Q12	_FI_Q37	_FI_Q62	_FI_Q87	_FI_Q111	_FI_Q112	_FI_Q136	_FI_Q137	_FI_Q161	_FI_Q162	_FI_Q186	_FI_Q187
15FQ+_FI_Q12	1	0.147	0.15	0.17	0.135	0.077	0.148	0.12	0.133	0.123	0.05	0.145
15FQ+_FI_Q37	0.147	1	0.004	0.07	0.118	0.173	0.042	0.417	0.032	0.097	0.069	0.106
15FQ+_FI_Q62	0.15	0.004	1	0.248	0.117	0.055	0.332	0.078	0.165	0.138	0.053	0.091
15FQ+_FI_Q87	0.17	0.07	0.248	1	0.09	0.012	0.149	0.084	0.215	0.173	0.021	0.072
15FQ+_FI_Q111	0.135	0.118	0.117	0.09	1	0.143	0.069	0.187	0.07	0.396	0.066	0.094
15FQ+_FI_Q112	0.077	0.173	0.055	0.012	0.143	1	0.037	0.229	0.015	0.097	0.179	0.132
15FQ+_FI_Q136	0.148	0.042	0.332	0.149	0.069	0.037	1	0.073	0.092	0.099	0.054	0.082
15FQ+_FI_Q137	0.12	0.417	0.078	0.084	0.187	0.229	0.073	1	0.078	0.159	0.102	0.093
15FQ+_FI_Q161	0.133	0.032	0.165	0.215	0.07	0.015	0.092	0.078	1	0.128	0.022	0.08
15FQ+_FI_Q162	0.123	0.097	0.138	0.173	0.396	0.097	0.099	0.159	0.128	1	0.074	0.095
15FQ+_FI_Q186	0.05	0.069	0.053	0.021	0.066	0.179	0.054	0.102	0.022	0.074	1	0.213
15FQ+_FI_Q187	0.145	0.106	0.091	0.072	0.094	0.132	0.082	0.093	0.08	0.095	0.213	1

	15FQ+ _FL_Q13	15FQ+ _FL_Q14	15FQ+ _FL_Q38	15FQ+ _FL_Q39	15FQ+ _FL_Q63	15FQ+ _FL_Q64	15FQ+ _FL_Q88	15FQ+ _FL_Q89	15FQ+ _FL_Q113	15FQ+ _FL_Q138	15FQ+ _FL_Q163	15FQ+ _FL_Q188
15FQ+_FL_Q13	1	0.155	0.091	0.218	0.028	0.062	0.06	0.053	0.078	0.101	0.249	0.016
15FQ+_FL_Q14	0.155	1	0.263	0.295	0.055	0.088	0.251	0.113	0.143	0.149	0.233	0.04
15FQ+_FL_Q38	0.091	0.263	1	0.231	0.036	0.069	0.126	0.106	0.081	0.121	0.185	0.051
15FQ+_FL_Q39	0.218	0.295	0.231	1	0.046	0.089	0.173	0.136	0.151	0.156	0.316	0.04
15FQ+_FL_Q63	0.028	0.055	0.036	0.046	1	0.107	0.098	0.138	0.168	0.043	0.123	0.029
15FQ+_FL_Q64	0.062	0.088	0.069	0.089	0.107	1	0.137	0.139	0.142	0.047	0.098	0.045
15FQ+_FL_Q88	0.06	0.251	0.126	0.173	0.098	0.137	1	0.284	0.233	0.074	0.158	0.059
15FQ+_FL_Q89	0.053	0.113	0.106	0.136	0.138	0.139	0.284	1	0.517	0.071	0.132	0.107
15FQ+_FL_Q113	0.078	0.143	0.081	0.151	0.168	0.142	0.233	0.517	1	0.063	0.148	0.088
15FQ+_FL_Q138	0.101	0.149	0.121	0.156	0.043	0.047	0.074	0.071	0.063	1	0.15	0.004
15FQ+_FL_Q163	0.249	0.233	0.185	0.316	0.123	0.098	0.158	0.132	0.148	0.15	1	0.021
15FQ+_FL_Q188	0.016	0.04	0.051	0.04	0.029	0.045	0.059	0.107	0.088	0.004	0.021	1

	15FQ+ _FM_Q15	15FQ+ _FM_Q40	15FQ+ _FM_Q65	15FQ+ _FM_Q90	15FQ+ _FM_Q114	15FQ+ _FM_Q115	15FQ+ _FM_Q139	15FQ+ _FM_Q140	15FQ+ _FM_Q164	15FQ+ _FM_Q165	15FQ+ _FM_Q189	15FQ+ _FM_Q190
15FQ+_FM_Q15	1	0.111	-0.009	-0.003	0	0.015	0.084	0.039	0.185	-0.009	0.127	-0.021
15FQ+_FM_Q40	0.111	1	0.021	0.047	0.056	0.022	0.237	0.06	0.057	0.122	0.107	0.037
15FQ+_FM_Q65	-0.009	0.021	1	-0.078	0.312	0.135	0.059	-0.05	-0.027	0.093	-0.005	0.258
15FQ+_FM_Q90	-0.003	0.047	-0.078	1	-0.069	-0.094	0.038	0.154	0.042	-0.027	-0.001	-0.145
15FQ+_FM_Q114	0	0.056	0.312	-0.069	1	0.134	0.078	-0.024	-0.044	0.089	0.014	0.206
15FQ+_FM_Q115	0.015	0.022	0.135	-0.094	0.134	1	-0.005	-0.057	-0.04	0.051	0.048	0.139

15FQ+_FM_Q139	0.084	0.237	0.059	0.038	0.078	-0.005	1	0.104	0.08	0.205	0.135	0.085
15FQ+_FM_Q140	0.039	0.06	-0.05	0.154	-0.024	-0.057	0.104	1	0.067	0.037	-0.047	-0.087
15FQ+_FM_Q164	0.185	0.057	-0.027	0.042	-0.044	-0.04	0.08	0.067	1	-0.01	0.073	-0.086
15FQ+_FM_Q165	-0.009	0.122	0.093	-0.027	0.089	0.051	0.205	0.037	-0.01	1	0.035	0.146
15FQ+_FM_Q189	0.127	0.107	-0.005	-0.001	0.014	0.048	0.135	-0.047	0.073	0.035	1	0.032
15FQ+_FM_Q190	-0.021	0.037	0.258	-0.145	0.206	0.139	0.085	-0.087	-0.086	0.146	0.032	1

	15FQ+ _FN_Q16	15FQ+ _FN_Q17	15FQ+ _FN_Q41	15FQ+ _FN_Q42	15FQ+ _FN_Q66	15FQ+ _FN_Q67	15FQ+ _FN_Q91	15FQ+ _FN_Q92	15FQ+ _FN_Q116	15FQ+ _FN_Q141	15FQ+ _FN_Q166	15FQ+ _FN_Q191
15FQ+_FN_Q16	1	0.07	0.088	0.074	0.078	0.138	0.099	0.092	0.062	0.066	-0.044	0.056
15FQ+_FN_Q17	0.07	1	0.039	0.046	0.121	0.067	0.094	0.074	0.044	0.164	0.063	0.072
15FQ+_FN_Q41	0.088	0.039	1	0.241	0.067	0.11	0.114	0.127	0.121	0.061	0.02	0.039
15FQ+_FN_Q42	0.074	0.046	0.241	1	0.061	0.089	0.113	0.128	0.168	0.07	0.088	0.056
15FQ+_FN_Q66	0.078	0.121	0.067	0.061	1	0.192	0.181	0.214	0.081	0.179	0.041	0.257
15FQ+_FN_Q67	0.138	0.067	0.11	0.089	0.192	1	0.197	0.3	0.025	0.158	-0.005	0.136
15FQ+_FN_Q91	0.099	0.094	0.114	0.113	0.181	0.197	1	0.296	0.206	0.184	0.132	0.168
15FQ+_FN_Q92	0.092	0.074	0.127	0.128	0.214	0.3	0.296	1	0.123	0.184	0.033	0.197
15FQ+_FN_Q116	0.062	0.044	0.121	0.168	0.081	0.025	0.206	0.123	1	0.097	0.119	0.089
15FQ+_FN_Q141	0.066	0.164	0.061	0.07	0.179	0.158	0.184	0.184	0.097	1	0.1	0.197
15FQ+_FN_Q166	-0.044	0.063	0.02	0.088	0.041	-0.005	0.132	0.033	0.119	0.1	1	0.1
15FQ+_FN_Q191	0.056	0.072	0.039	0.056	0.257	0.136	0.168	0.197	0.089	0.197	0.1	1

	15FQ+ _FO_Q18	15FQ+ _FO_Q43	15FQ+ _FO_Q68	15FQ+ _FO_Q93	15FQ+ _FO_Q117	15FQ+ _FO_Q118	15FQ+ _FO_Q142	15FQ+ _FO_Q143	15FQ+ _FO_Q167	15FQ+ _FO_Q168	15FQ+ _FO_Q192	15FQ+ _FO_Q193
15FQ+_FO_Q18	1	0.042	0.181	-0.049	0.161	0.026	0.118	0.113	0.166	0.067	0.058	0.127
15FQ+_FO_Q43	0.042	1	0.13	0.003	0.094	0.066	0.118	0.07	0.089	0.137	0.171	0.181
15FQ+_FO_Q68	0.181	0.13	1	-0.008	0.284	0.008	0.275	0.178	0.439	0.111	0.292	0.212
15FQ+_FO_Q93	-0.049	0.003	-0.008	1	-0.007	0.04	-0.013	0.033	-0.025	-0.017	0.008	0.016
15FQ+_FO_Q117	0.161	0.094	0.284	-0.007	1	-0.007	0.235	0.174	0.296	0.122	0.182	0.116
15FQ+_FO_Q118	0.026	0.066	0.008	0.04	-0.007	1	0.064	0.003	0.014	0.055	-0.006	0.051
15FQ+_FO_Q142	0.118	0.118	0.275	-0.013	0.235	0.064	1	0.082	0.268	0.121	0.192	0.242
15FQ+_FO_Q143	0.113	0.07	0.178	0.033	0.174	0.003	0.082	1	0.142	0.027	0.146	0.085
15FQ+_FO_Q167	0.166	0.089	0.439	-0.025	0.296	0.014	0.268	0.142	1	0.156	0.306	0.22
15FQ+_FO_Q168	0.067	0.137	0.111	-0.017	0.122	0.055	0.121	0.027	0.156	1	0.168	0.033
15FQ+_FO_Q192	0.058	0.171	0.292	0.008	0.182	-0.006	0.192	0.146	0.306	0.168	1	0.198
15FQ+_FO_Q193	0.127	0.181	0.212	0.016	0.116	0.051	0.242	0.085	0.22	0.033	0.198	1

	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+

	_FQ1_Q19	_FQ1_Q20	_FQ1_Q44	_FQ1_Q45	_FQ1_Q69	_FQ1_Q70	_FQ1_Q94	_FQ1_Q95	_FQ1_Q119	_FQ1_Q144	_FQ1_Q169	_FQ1_Q194
15FQ+_FQ1_Q19	1	-0.012	0.196	-0.043	0.148	0.068	0.152	0.074	-0.049	0.14	-0.005	0.241
15FQ+_FQ1_Q20	-0.012	1	-0.05	0.14	0.073	0.125	0.027	0.07	0.094	0.078	0.046	0.05
15FQ+_FQ1_Q44	0.196	-0.05	1	-0.042	0.126	-0.002	0.28	0.003	-0.04	0.098	0.074	0.154
15FQ+_FQ1_Q45	-0.043	0.14	-0.042	1	0.068	0.135	-0.029	0.095	0.146	0.044	0.089	-0.003
15FQ+_FQ1_Q69	0.148	0.073	0.126	0.068	1	0.128	0.217	0.049	0.025	0.449	0.024	0.218
15FQ+_FQ1_Q70	0.068	0.125	-0.002	0.135	0.128	1	0.055	0.19	0.177	0.163	0.058	0.176
15FQ+_FQ1_Q94	0.152	0.027	0.28	-0.029	0.217	0.055	1	-0.001	-0.019	0.201	0.033	0.161
15FQ+_FQ1_Q95	0.074	0.07	0.003	0.095	0.049	0.19	-0.001	1	0.082	0.071	0.101	0.129
15FQ+_FQ1_Q119	-0.049	0.094	-0.04	0.146	0.025	0.177	-0.019	0.082	1	0.018	0.081	0.002
15FQ+_FQ1_Q144	0.14	0.078	0.098	0.044	0.449	0.163	0.201	0.071	0.018	1	0.075	0.248
15FQ+_FQ1_Q169	-0.005	0.046	0.074	0.089	0.024	0.058	0.033	0.101	0.081	0.075	1	0.099
15FQ+_FQ1_Q194	0.241	0.05	0.154	-0.003	0.218	0.176	0.161	0.129	0.002	0.248	0.099	1

	15FQ+_FQ2_Q21	15FQ+_FQ2_Q46	15FQ+_FQ2_Q71	15FQ+_FQ2_Q96	15FQ+_FQ2_Q120	15FQ+_FQ2_Q121	15FQ+_FQ2_Q145	15FQ+_FQ2_Q146	15FQ+_FQ2_Q170	15FQ+_FQ2_Q171	15FQ+_FQ2_Q195	15FQ+_FQ2_Q196
15FQ+_FQ2_Q21	1	0.053	0.074	0.098	0.031	0.114	0	0.083	0.086	0.296	0.049	0.128
15FQ+_FQ2_Q46	0.053	1	-0.003	0.07	0.06	0.044	0.056	0.043	0.099	0.075	0.089	0.06
15FQ+_FQ2_Q71	0.074	-0.003	1	0.128	0.076	0.211	0.072	0.291	0.08	0.07	0.134	0.204
15FQ+_FQ2_Q96	0.098	0.07	0.128	1	0.054	0.233	0.155	0.198	0.164	0.095	0.092	0.203
15FQ+_FQ2_Q120	0.031	0.06	0.076	0.054	1	0.132	0.094	0.089	0.101	0.057	0.077	0.09
15FQ+_FQ2_Q121	0.114	0.044	0.211	0.233	0.132	1	0.153	0.277	0.122	0.11	0.13	0.258
15FQ+_FQ2_Q145	0	0.056	0.072	0.155	0.094	0.153	1	0.2	0.183	0.033	0.139	0.138
15FQ+_FQ2_Q146	0.083	0.043	0.291	0.198	0.089	0.277	0.2	1	0.156	0.077	0.221	0.274
15FQ+_FQ2_Q170	0.086	0.099	0.08	0.164	0.101	0.122	0.183	0.156	1	0.168	0.254	0.184
15FQ+_FQ2_Q171	0.296	0.075	0.07	0.095	0.057	0.11	0.033	0.077	0.168	1	0.096	0.195
15FQ+_FQ2_Q195	0.049	0.089	0.134	0.092	0.077	0.13	0.139	0.221	0.254	0.096	1	0.236
15FQ+_FQ2_Q196	0.128	0.06	0.204	0.203	0.09	0.258	0.138	0.274	0.184	0.195	0.236	1

	15FQ+_FQ3_Q22	15FQ+_FQ3_Q23	15FQ+_FQ3_Q47	15FQ+_FQ3_Q48	15FQ+_FQ3_Q72	15FQ+_FQ3_Q73	15FQ+_FQ3_Q97	15FQ+_FQ3_Q98	15FQ+_FQ3_Q122	15FQ+_FQ3_Q147	15FQ+_FQ3_Q172	15FQ+_FQ3_Q197
15FQ+_FQ3_Q22	1	0.13	0.048	0.121	0.045	0.145	0.082	0.053	0.064	0.247	0.079	0.084
15FQ+_FQ3_Q23	0.13	1	0.03	0.067	0.063	0.209	0.12	0.048	0.077	0.111	0.071	0.1
15FQ+_FQ3_Q47	0.048	0.03	1	0.076	0.007	0.035	0.052	0.01	0.016	0.033	0.043	0.076
15FQ+_FQ3_Q48	0.121	0.067	0.076	1	0.064	0.091	0.075	0.053	0.127	0.107	0.063	0.189
15FQ+_FQ3_Q72	0.045	0.063	0.007	0.064	1	0.134	0.08	0.085	0.122	0.066	0.047	0.077
15FQ+_FQ3_Q73	0.145	0.209	0.035	0.091	0.134	1	0.157	0.051	0.122	0.157	0.053	0.095

15FQ+_FQ3_Q97	0.082	0.12	0.052	0.075	0.08	0.157	1	0.065	0.123	0.137	0.051	0.109
15FQ+_FQ3_Q98	0.053	0.048	0.01	0.053	0.085	0.051	0.065	1	0.043	0.048	0.065	0.064
15FQ+_FQ3_Q122	0.064	0.077	0.016	0.127	0.122	0.122	0.123	0.043	1	0.206	0.057	0.192
15FQ+_FQ3_Q147	0.247	0.111	0.033	0.107	0.066	0.157	0.137	0.048	0.206	1	0.061	0.136
15FQ+_FQ3_Q172	0.079	0.071	0.043	0.063	0.047	0.053	0.051	0.065	0.057	0.061	1	0.122
15FQ+_FQ3_Q197	0.084	0.1	0.076	0.189	0.077	0.095	0.109	0.064	0.192	0.136	0.122	1

	15FQ+ _FQ4_Q24	15FQ+ _FQ4_Q49	15FQ+ _FQ4_Q74	15FQ+ _FQ4_Q99	15FQ+ _FQ4_Q123	15FQ+ _FQ4_Q124	15FQ+ _FQ4_Q148	15FQ+ _FQ4_Q149	15FQ+ _FQ4_Q173	15FQ+ _FQ4_Q174	15FQ+ _FQ4_Q198	15FQ+ _FQ4_Q199
15FQ+_FQ4_Q24	1	0.095	0.115	0.033	0.085	-0.018	0.16	0.132	0.143	0.05	0.158	0.235
15FQ+_FQ4_Q49	0.095	1	0.162	0.214	0.071	0.079	0.11	0.133	0.153	0.158	0.139	0.139
15FQ+_FQ4_Q74	0.115	0.162	1	0.113	0.077	0.003	0.11	0.078	0.138	0.079	0.174	0.123
15FQ+_FQ4_Q99	0.033	0.214	0.113	1	0.11	0.151	0.05	0.083	0.094	0.275	0.127	0.027
15FQ+_FQ4_Q123	0.085	0.071	0.077	0.11	1	0.02	0.011	0.067	0.065	0.079	0.155	0.04
15FQ+_FQ4_Q124	-0.018	0.079	0.003	0.151	0.02	1	0.039	0.029	0.03	0.114	-0.014	-0.017
15FQ+_FQ4_Q148	0.16	0.11	0.11	0.05	0.011	0.039	1	0.083	0.175	0.105	0.091	0.168
15FQ+_FQ4_Q149	0.132	0.133	0.078	0.083	0.067	0.029	0.083	1	0.12	0.056	0.145	0.248
15FQ+_FQ4_Q173	0.143	0.153	0.138	0.094	0.065	0.03	0.175	0.12	1	0.187	0.089	0.201
15FQ+_FQ4_Q174	0.05	0.158	0.079	0.275	0.079	0.114	0.105	0.056	0.187	1	0.108	0.064
15FQ+_FQ4_Q198	0.158	0.139	0.174	0.127	0.155	-0.014	0.091	0.145	0.089	0.108	1	0.179
15FQ+_FQ4_Q199	0.235	0.139	0.123	0.027	0.04	-0.017	0.168	0.248	0.201	0.064	0.179	1

COLOURED SAMPLE

	15FQ+_ FA_Q1	15FQ+_ FA_Q2	15FQ+_ FA_Q26	15FQ+_ FA_Q27	15FQ+_ FA_Q51	15FQ+_ FA_Q52	15FQ+_ FA_Q76	15FQ+_ FA_Q77	15FQ+_ FA_Q101	15FQ+_ FA_Q126	15FQ+_ FA_Q151	15FQ+_ FA_Q176
15FQ+_FA_Q1	1	0.014	0.076	0.099	0.131	0.184	0.154	0.255	0.124	0.009	0.259	0.101
15FQ+_FA_Q2	0.014	1	0.04	0.04	0.136	-0.013	0.048	-0.025	-0.048	0.037	0.009	-0.039
15FQ+_FA_Q26	0.076	0.04	1	0.082	0.038	0.084	0.085	0.097	0.023	0	0.119	0.15
15FQ+_FA_Q27	0.099	0.04	0.082	1	0.147	0.153	0.116	0.221	0.101	0.035	0.266	0.037
15FQ+_FA_Q51	0.131	0.136	0.038	0.147	1	0.225	0.203	0.26	0.081	0.115	0.215	0.08
15FQ+_FA_Q52	0.184	-0.013	0.084	0.153	0.225	1	0.28	0.351	0.254	0.013	0.385	0.161
15FQ+_FA_Q76	0.154	0.048	0.085	0.116	0.203	0.28	1	0.283	0.25	0.042	0.229	0.139
15FQ+_FA_Q77	0.255	-0.025	0.097	0.221	0.26	0.351	0.283	1	0.203	0.081	0.349	0.105
15FQ+_FA_Q101	0.124	-0.048	0.023	0.101	0.081	0.254	0.25	0.203	1	0.086	0.191	0.128
15FQ+_FA_Q126	0.009	0.037	0	0.035	0.115	0.013	0.042	0.081	0.086	1	0.067	0.01
15FQ+_FA_Q151	0.259	0.009	0.119	0.266	0.215	0.385	0.229	0.349	0.191	0.067	1	0.152
15FQ+_FA_Q176	0.101	-0.039	0.15	0.037	0.08	0.161	0.139	0.105	0.128	0.01	0.152	1
	15FQ+_ B_Q3	15FQ+_ B_Q28	15FQ+_ B_Q53	15FQ+_ B_Q78	15FQ+_ B_Q102	15FQ+_ B_Q103	15FQ+_ B_Q127	15FQ+_ B_Q128	15FQ+_ B_Q152	15FQ+_ B_Q153	15FQ+_ B_Q177	15FQ+_ B_Q178
15FQ+_B_Q3	1	0.191	0.075	0.262	0.143	0.109	0.191	0.169	0.11	0.23	0.19	0.153
15FQ+_B_Q28	0.191	1	0.057	0.302	0.197	0.134	0.28	0.183	0.2	0.235	0.181	0.197
15FQ+_B_Q53	0.075	0.057	1	0.119	0.268	0.058	0.15	0.093	0.083	0.107	0.487	0.119
15FQ+_B_Q78	0.262	0.302	0.119	1	0.146	0.126	0.234	0.132	0.181	0.243	0.131	0.203
15FQ+_B_Q102	0.143	0.197	0.268	0.146	1	0.146	0.196	0.146	0.205	0.192	0.321	0.172
15FQ+_B_Q103	0.109	0.134	0.058	0.126	0.146	1	0.101	0.138	0.113	0.171	0.099	0.173
15FQ+_B_Q127	0.191	0.28	0.15	0.234	0.196	0.101	1	0.106	0.184	0.176	0.176	0.181
15FQ+_B_Q128	0.169	0.183	0.093	0.132	0.146	0.138	0.106	1	0.155	0.179	0.179	0.236
15FQ+_B_Q152	0.11	0.2	0.083	0.181	0.205	0.113	0.184	0.155	1	0.219	0.127	0.163
15FQ+_B_Q153	0.23	0.235	0.107	0.243	0.192	0.171	0.176	0.179	0.219	1	0.176	0.313
15FQ+_B_Q177	0.19	0.181	0.487	0.131	0.321	0.099	0.176	0.179	0.127	0.176	1	0.269
15FQ+_B_Q178	0.153	0.197	0.119	0.203	0.172	0.173	0.181	0.236	0.163	0.313	0.269	1
	15FQ+ _FC_Q4	15FQ+ _FC_Q5	15FQ+ _FC_Q29	15FQ+ _FC_Q30	15FQ+ _FC_Q54	15FQ+ _FC_Q55	15FQ+ _FC_Q79	15FQ+ _FC_Q80	15FQ+ _FC_Q104	15FQ+ _FC_Q129	15FQ+ _FC_Q154	15FQ+ _FC_Q179

15FQ+_FC_Q4	1	0.2	0.175	0.097	0.157	0.179	0.22	0.209	0.215	0.207	0.134	0.289
15FQ+_FC_Q5	0.2	1	0.063	0.15	0.233	0.167	0.117	0.122	0.169	0.127	0.075	0.145
15FQ+_FC_Q29	0.175	0.063	1	0.091	0.156	0.244	0.155	0.144	0.165	0.16	0.133	0.168
15FQ+_FC_Q30	0.097	0.15	0.091	1	0.193	0.121	0.063	0.124	0.072	0.075	0.112	0.113
15FQ+_FC_Q54	0.157	0.233	0.156	0.193	1	0.174	0.154	0.173	0.177	0.146	0.182	0.171
15FQ+_FC_Q55	0.179	0.167	0.244	0.121	0.174	1	0.138	0.166	0.171	0.18	0.198	0.186
15FQ+_FC_Q79	0.22	0.117	0.155	0.063	0.154	0.138	1	0.189	0.124	0.174	0.207	0.273
15FQ+_FC_Q80	0.209	0.122	0.144	0.124	0.173	0.166	0.189	1	0.195	0.155	0.265	0.228
15FQ+_FC_Q104	0.215	0.169	0.165	0.072	0.177	0.171	0.124	0.195	1	0.403	0.193	0.2
15FQ+_FC_Q129	0.207	0.127	0.16	0.075	0.146	0.18	0.174	0.155	0.403	1	0.158	0.174
15FQ+_FC_Q154	0.134	0.075	0.133	0.112	0.182	0.198	0.207	0.265	0.193	0.158	1	0.289
15FQ+_FC_Q179	0.289	0.145	0.168	0.113	0.171	0.186	0.273	0.228	0.2	0.174	0.289	1

	15FQ+_FE_Q6	15FQ+_FE_Q31	15FQ+_FE_Q56	15FQ+_FE_Q81	15FQ+_FE_Q105	15FQ+_FE_Q106	15FQ+_FE_Q130	15FQ+_FE_Q131	15FQ+_FE_Q155	15FQ+_FE_Q156	15FQ+_FE_Q180	15FQ+_FE_Q181
15FQ+_FE_Q6	1	0.151	0.18	0.156	-0.009	0.079	0.179	0.2	0.344	0.238	0.09	0.076
15FQ+_FE_Q31	0.151	1	0.123	0.12	0.019	0.1	0.223	0.063	0.126	0.095	0.1	0.039
15FQ+_FE_Q56	0.18	0.123	1	0.068	0.017	0.17	0.195	0.14	0.185	0.133	0.084	0.048
15FQ+_FE_Q81	0.156	0.12	0.068	1	0.101	0.067	0.184	0.102	0.174	0.097	0.127	0.031
15FQ+_FE_Q105	-0.009	0.019	0.017	0.101	1	0.081	0.07	0.088	0.044	0.022	0.08	-0.059
15FQ+_FE_Q106	0.079	0.1	0.17	0.067	0.081	1	0.113	0.05	0.081	0.064	0.089	0.06
15FQ+_FE_Q130	0.179	0.223	0.195	0.184	0.07	0.113	1	0.17	0.218	0.159	0.305	0.089
15FQ+_FE_Q131	0.2	0.063	0.14	0.102	0.088	0.05	0.17	1	0.237	0.146	0.113	0.066
15FQ+_FE_Q155	0.344	0.126	0.185	0.174	0.044	0.081	0.218	0.237	1	0.273	0.087	0.141
15FQ+_FE_Q156	0.238	0.095	0.133	0.097	0.022	0.064	0.159	0.146	0.273	1	0.059	0.033
15FQ+_FE_Q180	0.09	0.1	0.084	0.127	0.08	0.089	0.305	0.113	0.087	0.059	1	-0.021
15FQ+_FE_Q181	0.076	0.039	0.048	0.031	-0.059	0.06	0.089	0.066	0.141	0.033	-0.021	1

	15FQ+_FF_Q7	15FQ+_FF_Q8	15FQ+_FF_Q32	15FQ+_FF_Q33	15FQ+_FF_Q57	15FQ+_FF_Q58	15FQ+_FF_Q82	15FQ+_FF_Q83	15FQ+_FF_Q107	15FQ+_FF_Q132	15FQ+_FF_Q157	15FQ+_FF_Q182
15FQ+_FF_Q7	1	0.157	0.081	0.153	0.2	0.2	0.105	0.028	0.155	0.25	0.382	0.105
15FQ+_FF_Q8	0.157	1	0.156	0.196	0.246	0.278	0.302	0.113	0.216	0.128	0.109	0.392
15FQ+_FF_Q32	0.081	0.156	1	0.097	0.141	0.163	0.346	0.207	0.183	0.15	0.107	0.39
15FQ+_FF_Q33	0.153	0.196	0.097	1	0.209	0.162	0.113	0.066	0.201	0.096	0.143	0.166
15FQ+_FF_Q57	0.2	0.246	0.141	0.209	1	0.219	0.179	0.154	0.225	0.138	0.138	0.25
15FQ+_FF_Q58	0.2	0.278	0.163	0.162	0.219	1	0.099	0.114	0.213	0.278	0.241	0.176
15FQ+_FF_Q82	0.105	0.302	0.346	0.113	0.179	0.099	1	0.185	0.125	0.037	0.099	0.521

15FQ+_FF_Q83	0.028	0.113	0.207	0.066	0.154	0.114	0.185	1	0.152	0.075	0.081	0.201
15FQ+_FF_Q107	0.155	0.216	0.183	0.201	0.225	0.213	0.125	0.152	1	0.306	0.254	0.202
15FQ+_FF_Q132	0.25	0.128	0.15	0.096	0.138	0.278	0.037	0.075	0.306	1	0.336	0.139
15FQ+_FF_Q157	0.382	0.109	0.107	0.143	0.138	0.241	0.099	0.081	0.254	0.336	1	0.13
15FQ+_FF_Q182	0.105	0.392	0.39	0.166	0.25	0.176	0.521	0.201	0.202	0.139	0.13	1
	15FQ+ _FG_Q9	15FQ+ _FG_Q34	15FQ+ _FG_Q59	15FQ+ _FG_Q84	15FQ+ _FG_Q108	15FQ+ _FG_Q109	15FQ+ _FG_Q133	15FQ+ _FG_Q134	15FQ+ _FG_Q158	15FQ+ _FG_Q159	15FQ+ _FG_Q183	15FQ+ _FG_Q184
15FQ+_FG_Q9	1	0.307	0.192	0.154	0.2	0.319	0.322	0.148	0.183	0.256	0.106	0.324
15FQ+_FG_Q34	0.307	1	0.184	0.082	0.153	0.214	0.31	0.234	0.233	0.137	0.073	0.32
15FQ+_FG_Q59	0.192	0.184	1	0.126	0.078	0.221	0.28	0.138	0.206	0.097	0.031	0.215
15FQ+_FG_Q84	0.154	0.082	0.126	1	0.064	0.138	0.128	-0.016	0.096	0.147	0.091	0.138
15FQ+_FG_Q108	0.2	0.153	0.078	0.064	1	0.153	0.237	0.114	0.061	0.11	0.061	0.205
15FQ+_FG_Q109	0.319	0.214	0.221	0.138	0.153	1	0.265	0.1	0.21	0.241	0.107	0.275
15FQ+_FG_Q133	0.322	0.31	0.28	0.128	0.237	0.265	1	0.223	0.347	0.234	0.16	0.428
15FQ+_FG_Q134	0.148	0.234	0.138	-0.016	0.114	0.1	0.223	1	0.226	0.065	0.069	0.25
15FQ+_FG_Q158	0.183	0.233	0.206	0.096	0.061	0.21	0.347	0.226	1	0.2	0.153	0.257
15FQ+_FG_Q159	0.256	0.137	0.097	0.147	0.11	0.241	0.234	0.065	0.2	1	0.2	0.164
15FQ+_FG_Q183	0.106	0.073	0.031	0.091	0.061	0.107	0.16	0.069	0.153	0.2	1	0.171
15FQ+_FG_Q184	0.324	0.32	0.215	0.138	0.205	0.275	0.428	0.25	0.257	0.164	0.171	1
	15FQ+ _FH_Q10	15FQ+ _FH_Q11	15FQ+ _FH_Q35	15FQ+ _FH_Q36	15FQ+ _FH_Q60	15FQ+ _FH_Q61	15FQ+ _FH_Q85	15FQ+ _FH_Q86	15FQ+ _FH_Q110	15FQ+ _FH_Q135	15FQ+ _FH_Q160	15FQ+ _FH_Q185
15FQ+_FH_Q10	1	0.341	0.239	0.32	0.214	0.376	0.318	0.225	0.124	0.404	0.15	0.209
15FQ+_FH_Q11	0.341	1	0.411	0.346	0.197	0.284	0.324	0.375	0.12	0.441	0.19	0.249
15FQ+_FH_Q35	0.239	0.411	1	0.312	0.155	0.213	0.26	0.252	0.15	0.327	0.211	0.176
15FQ+_FH_Q36	0.32	0.346	0.312	1	0.341	0.228	0.443	0.283	0.085	0.359	0.243	0.23
15FQ+_FH_Q60	0.214	0.197	0.155	0.341	1	0.149	0.36	0.227	0.075	0.224	0.145	0.164
15FQ+_FH_Q61	0.376	0.284	0.213	0.228	0.149	1	0.23	0.23	0.013	0.33	0.104	0.142
15FQ+_FH_Q85	0.318	0.324	0.26	0.443	0.36	0.23	1	0.259	0.072	0.356	0.202	0.216
15FQ+_FH_Q86	0.225	0.375	0.252	0.283	0.227	0.23	0.259	1	0.181	0.358	0.196	0.34
15FQ+_FH_Q110	0.124	0.12	0.15	0.085	0.075	0.013	0.072	0.181	1	0.148	0.195	0.267
15FQ+_FH_Q135	0.404	0.441	0.327	0.359	0.224	0.33	0.356	0.358	0.148	1	0.242	0.297
15FQ+_FH_Q160	0.15	0.19	0.211	0.243	0.145	0.104	0.202	0.196	0.195	0.242	1	0.224
15FQ+_FH_Q185	0.209	0.249	0.176	0.23	0.164	0.142	0.216	0.34	0.267	0.297	0.224	1
	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+

	_FI_Q12	_FI_Q37	_FI_Q62	_FI_Q87	_FI_Q111	_FI_Q112	_FI_Q136	_FI_Q137	_FI_Q161	_FI_Q162	_FI_Q186	_FI_Q187
15FQ+_FI_Q12	1	0.151	0.243	0.244	0.193	0.143	0.213	0.217	0.192	0.224	0.109	0.19
15FQ+_FI_Q37	0.151	1	0.094	0.107	0.154	0.232	0.073	0.418	0.056	0.07	0.16	0.091
15FQ+_FI_Q62	0.243	0.094	1	0.284	0.161	0.124	0.331	0.174	0.189	0.241	0.03	0.072
15FQ+_FI_Q87	0.244	0.107	0.284	1	0.151	0.138	0.2	0.234	0.221	0.292	0.15	0.079
15FQ+_FI_Q111	0.193	0.154	0.161	0.151	1	0.196	0.191	0.285	0.14	0.326	0.105	0.084
15FQ+_FI_Q112	0.143	0.232	0.124	0.138	0.196	1	0.083	0.262	0.095	0.13	0.226	0.105
15FQ+_FI_Q136	0.213	0.073	0.331	0.2	0.191	0.083	1	0.151	0.113	0.195	0.009	-0.002
15FQ+_FI_Q137	0.217	0.418	0.174	0.234	0.285	0.262	0.151	1	0.132	0.192	0.158	0.057
15FQ+_FI_Q161	0.192	0.056	0.189	0.221	0.14	0.095	0.113	0.132	1	0.199	0.124	0.122
15FQ+_FI_Q162	0.224	0.07	0.241	0.292	0.326	0.13	0.195	0.192	0.199	1	0.062	0.064
15FQ+_FI_Q186	0.109	0.16	0.03	0.15	0.105	0.226	0.009	0.158	0.124	0.062	1	0.249
15FQ+_FI_Q187	0.19	0.091	0.072	0.079	0.084	0.105	-0.002	0.057	0.122	0.064	0.249	1

	15FQ+ _FL_Q13	15FQ+ _FL_Q14	15FQ+ _FL_Q38	15FQ+ _FL_Q39	15FQ+ _FL_Q63	15FQ+ _FL_Q64	15FQ+ _FL_Q88	15FQ+ _FL_Q89	15FQ+ _FL_Q113	15FQ+ _FL_Q138	15FQ+ _FL_Q163	15FQ+ _FL_Q188
15FQ+_FL_Q13	1	0.229	0.143	0.261	0.014	0.068	0.069	0.034	0.08	0.234	0.301	0.054
15FQ+_FL_Q14	0.229	1	0.367	0.368	0.13	0.125	0.269	0.106	0.19	0.256	0.303	0.074
15FQ+_FL_Q38	0.143	0.367	1	0.34	0.119	0.122	0.157	0.126	0.163	0.215	0.201	0.11
15FQ+_FL_Q39	0.261	0.368	0.34	1	0.144	0.174	0.198	0.065	0.167	0.269	0.363	0.055
15FQ+_FL_Q63	0.014	0.13	0.119	0.144	1	0.124	0.116	0.155	0.211	0.092	0.15	0.041
15FQ+_FL_Q64	0.068	0.125	0.122	0.174	0.124	1	0.135	0.127	0.17	0.127	0.125	0.146
15FQ+_FL_Q88	0.069	0.269	0.157	0.198	0.116	0.135	1	0.225	0.229	0.134	0.174	0.092
15FQ+_FL_Q89	0.034	0.106	0.126	0.065	0.155	0.127	0.225	1	0.426	0.023	0.082	0.152
15FQ+_FL_Q113	0.08	0.19	0.163	0.167	0.211	0.17	0.229	0.426	1	0.121	0.181	0.169
15FQ+_FL_Q138	0.234	0.256	0.215	0.269	0.092	0.127	0.134	0.023	0.121	1	0.285	0.061
15FQ+_FL_Q163	0.301	0.303	0.201	0.363	0.15	0.125	0.174	0.082	0.181	0.285	1	0.056
15FQ+_FL_Q188	0.054	0.074	0.11	0.055	0.041	0.146	0.092	0.152	0.169	0.061	0.056	1

	15FQ+ _FM_Q15	15FQ+ _FM_Q40	15FQ+ _FM_Q65	15FQ+ _FM_Q90	15FQ+ _FM_Q114	15FQ+ _FM_Q115	15FQ+ _FM_Q139	15FQ+ _FM_Q140	15FQ+ _FM_Q164	15FQ+ _FM_Q165	15FQ+ _FM_Q189	15FQ+ _FM_Q190
15FQ+_FM_Q15	1	0.101	0.033	0.019	-0.004	0.066	0.061	0.114	0.181	0.033	0.121	0.049
15FQ+_FM_Q40	0.101	1	0.058	0.125	0.118	0.041	0.284	0.071	0.098	0.159	0.123	0.049
15FQ+_FM_Q65	0.033	0.058	1	-0.037	0.406	0.155	0.096	-0.001	0.121	0.106	0.051	0.171
15FQ+_FM_Q90	0.019	0.125	-0.037	1	-0.017	-0.039	0.094	0.164	0.034	0.092	-0.027	-0.065
15FQ+_FM_Q114	-0.004	0.118	0.406	-0.017	1	0.165	0.165	0.024	0.035	0.109	0.085	0.158
15FQ+_FM_Q115	0.066	0.041	0.155	-0.039	0.165	1	0.063	-0.011	0.051	0.051	0.148	0.143

15FQ+_FM_Q139	0.061	0.284	0.096	0.094	0.165	0.063	1	0.134	0.087	0.263	0.128	0.1
15FQ+_FM_Q140	0.114	0.071	-0.001	0.164	0.024	-0.011	0.134	1	0.009	0.136	-0.02	-0.018
15FQ+_FM_Q164	0.181	0.098	0.121	0.034	0.035	0.051	0.087	0.009	1	0.013	0.06	-0.066
15FQ+_FM_Q165	0.033	0.159	0.106	0.092	0.109	0.051	0.263	0.136	0.013	1	0.035	0.108
15FQ+_FM_Q189	0.121	0.123	0.051	-0.027	0.085	0.148	0.128	-0.02	0.06	0.035	1	0.172
15FQ+_FM_Q190	0.049	0.049	0.171	-0.065	0.158	0.143	0.1	-0.018	-0.066	0.108	0.172	1
	15FQ+ _FN_Q16	15FQ+ _FN_Q17	15FQ+ _FN_Q41	15FQ+ _FN_Q42	15FQ+ _FN_Q66	15FQ+ _FN_Q67	15FQ+ _FN_Q91	15FQ+ _FN_Q92	15FQ+ _FN_Q116	15FQ+ _FN_Q141	15FQ+ _FN_Q166	15FQ+ _FN_Q191
15FQ+_FN_Q16	1	0.158	0.152	0.217	0.14	0.102	0.189	0.215	0.192	0.177	0.024	0.151
15FQ+_FN_Q17	0.158	1	0.088	0.101	0.12	0.101	0.135	0.182	0.102	0.344	0.021	0.121
15FQ+_FN_Q41	0.152	0.088	1	0.301	0.079	0.1	0.143	0.163	0.186	0.153	0.074	0.059
15FQ+_FN_Q42	0.217	0.101	0.301	1	0.109	0.089	0.222	0.183	0.276	0.172	0.111	0.077
15FQ+_FN_Q66	0.14	0.12	0.079	0.109	1	0.144	0.208	0.309	0.115	0.287	0.08	0.353
15FQ+_FN_Q67	0.102	0.101	0.1	0.089	0.144	1	0.207	0.342	0.072	0.212	-0.017	0.116
15FQ+_FN_Q91	0.189	0.135	0.143	0.222	0.208	0.207	1	0.324	0.335	0.27	0.153	0.164
15FQ+_FN_Q92	0.215	0.182	0.163	0.183	0.309	0.342	0.324	1	0.192	0.376	0.071	0.268
15FQ+_FN_Q116	0.192	0.102	0.186	0.276	0.115	0.072	0.335	0.192	1	0.207	0.12	0.093
15FQ+_FN_Q141	0.177	0.344	0.153	0.172	0.287	0.212	0.27	0.376	0.207	1	0.107	0.244
15FQ+_FN_Q166	0.024	0.021	0.074	0.111	0.08	-0.017	0.153	0.071	0.12	0.107	1	0.071
15FQ+_FN_Q191	0.151	0.121	0.059	0.077	0.353	0.116	0.164	0.268	0.093	0.244	0.071	1
	15FQ+ _FO_Q18	15FQ+ _FO_Q43	15FQ+ _FO_Q68	15FQ+ _FO_Q93	15FQ+ _FO_Q117	15FQ+ _FO_Q118	15FQ+ _FO_Q142	15FQ+ _FO_Q143	15FQ+ _FO_Q167	15FQ+ _FO_Q168	15FQ+ _FO_Q192	15FQ+ _FO_Q193
15FQ+_FO_Q18	1	0.091	0.149	0.033	0.116	0.055	0.131	0.084	0.093	0.081	0.101	0.157
15FQ+_FO_Q43	0.091	1	0.158	0.144	0.091	0.145	0.153	0.099	0.105	0.204	0.179	0.152
15FQ+_FO_Q68	0.149	0.158	1	0.154	0.333	0.096	0.294	0.143	0.424	0.179	0.332	0.244
15FQ+_FO_Q93	0.033	0.144	0.154	1	0.168	0.163	0.101	0.135	0.146	0.043	0.112	0.132
15FQ+_FO_Q117	0.116	0.091	0.333	0.168	1	0.145	0.267	0.135	0.33	0.123	0.255	0.179
15FQ+_FO_Q118	0.055	0.145	0.096	0.163	0.145	1	0.208	0.055	0.153	0.07	0.113	0.098
15FQ+_FO_Q142	0.131	0.153	0.294	0.101	0.267	0.208	1	0.151	0.275	0.111	0.201	0.201
15FQ+_FO_Q143	0.084	0.099	0.143	0.135	0.135	0.055	0.151	1	0.142	0.045	0.165	0.183
15FQ+_FO_Q167	0.093	0.105	0.424	0.146	0.33	0.153	0.275	0.142	1	0.146	0.29	0.273
15FQ+_FO_Q168	0.081	0.204	0.179	0.043	0.123	0.07	0.111	0.045	0.146	1	0.119	0.115
15FQ+_FO_Q192	0.101	0.179	0.332	0.112	0.255	0.113	0.201	0.165	0.29	0.119	1	0.221
15FQ+_FO_Q193	0.157	0.152	0.244	0.132	0.179	0.098	0.201	0.183	0.273	0.115	0.221	1
	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+	15FQ+

	_FQ1_Q19	_FQ1_Q20	_FQ1_Q44	_FQ1_Q45	_FQ1_Q69	_FQ1_Q70	_FQ1_Q94	_FQ1_Q95	_FQ1_Q119	_FQ1_Q144	_FQ1_Q169	_FQ1_Q194
15FQ+_FQ1_Q19	1	0.027	0.229	0.011	0.096	0.039	0.152	0.095	-0.031	0.1	0.073	0.229
15FQ+_FQ1_Q20	0.027	1	-0.006	0.222	0.041	0.234	0.018	0.099	0.162	0.073	0.082	0.122
15FQ+_FQ1_Q44	0.229	-0.006	1	0.111	0.134	0.146	0.327	0.179	0.089	0.094	0.192	0.229
15FQ+_FQ1_Q45	0.011	0.222	0.111	1	0.049	0.311	-0.052	0.168	0.26	0.077	0.145	0.131
15FQ+_FQ1_Q69	0.096	0.041	0.134	0.049	1	0.147	0.283	0.084	0.013	0.461	0.097	0.199
15FQ+_FQ1_Q70	0.039	0.234	0.146	0.311	0.147	1	0.096	0.214	0.253	0.111	0.199	0.251
15FQ+_FQ1_Q94	0.152	0.018	0.327	-0.052	0.283	0.096	1	0.076	0.029	0.214	0.069	0.156
15FQ+_FQ1_Q95	0.095	0.099	0.179	0.168	0.084	0.214	0.076	1	0.183	0.09	0.147	0.136
15FQ+_FQ1_Q119	-0.031	0.162	0.089	0.26	0.013	0.253	0.029	0.183	1	0.004	0.193	0.05
15FQ+_FQ1_Q144	0.1	0.073	0.094	0.077	0.461	0.111	0.214	0.09	0.004	1	0.12	0.226
15FQ+_FQ1_Q169	0.073	0.082	0.192	0.145	0.097	0.199	0.069	0.147	0.193	0.12	1	0.149
15FQ+_FQ1_Q194	0.229	0.122	0.229	0.131	0.199	0.251	0.156	0.136	0.05	0.226	0.149	1

	15FQ+ _FQ2_Q21	15FQ+ _FQ2_Q46	15FQ+ _FQ2_Q71	15FQ+ _FQ2_Q96	15FQ+ _FQ2_Q120	15FQ+ _FQ2_Q121	15FQ+ _FQ2_Q145	15FQ+ _FQ2_Q146	15FQ+ _FQ2_Q170	15FQ+ _FQ2_Q171	15FQ+ _FQ2_Q195	15FQ+ _FQ2_Q196
15FQ+_FQ2_Q21	1	0.073	-0.001	0.047	0.087	0.049	-0.014	0.009	0.095	0.276	0.045	0.124
15FQ+_FQ2_Q46	0.073	1	0.107	0.107	0.083	0.094	0.133	0.133	0.175	0.085	0.168	0.141
15FQ+_FQ2_Q71	-0.001	0.107	1	0.205	0.038	0.208	0.192	0.389	0.145	0.093	0.237	0.249
15FQ+_FQ2_Q96	0.047	0.107	0.205	1	0.051	0.229	0.208	0.254	0.218	0.185	0.198	0.362
15FQ+_FQ2_Q120	0.087	0.083	0.038	0.051	1	0.036	0.023	0.05	0.115	0.025	0.083	0.072
15FQ+_FQ2_Q121	0.049	0.094	0.208	0.229	0.036	1	0.188	0.266	0.141	0.16	0.214	0.23
15FQ+_FQ2_Q145	-0.014	0.133	0.192	0.208	0.023	0.188	1	0.237	0.146	0.046	0.128	0.2
15FQ+_FQ2_Q146	0.009	0.133	0.389	0.254	0.05	0.266	0.237	1	0.125	0.106	0.283	0.336
15FQ+_FQ2_Q170	0.095	0.175	0.145	0.218	0.115	0.141	0.146	0.125	1	0.193	0.25	0.172
15FQ+_FQ2_Q171	0.276	0.085	0.093	0.185	0.025	0.16	0.046	0.106	0.193	1	0.171	0.204
15FQ+_FQ2_Q195	0.045	0.168	0.237	0.198	0.083	0.214	0.128	0.283	0.25	0.171	1	0.267
15FQ+_FQ2_Q196	0.124	0.141	0.249	0.362	0.072	0.23	0.2	0.336	0.172	0.204	0.267	1

	15FQ+ _FQ3_Q22	15FQ+ _FQ3_Q23	15FQ+ _FQ3_Q47	15FQ+ _FQ3_Q48	15FQ+ _FQ3_Q72	15FQ+ _FQ3_Q73	15FQ+ _FQ3_Q97	15FQ+ _FQ3_Q98	15FQ+ _FQ3_Q122	15FQ+ _FQ3_Q147	15FQ+ _FQ3_Q172	15FQ+ _FQ3_Q197
15FQ+_FQ3_Q22	1	0.218	0.102	0.089	0.001	0.163	0.129	0.129	0.068	0.409	0.133	0.128
15FQ+_FQ3_Q23	0.218	1	0.068	0.124	-0.01	0.26	0.053	0.127	0.095	0.191	0.095	0.117
15FQ+_FQ3_Q47	0.102	0.068	1	0.136	0.116	0.008	0.075	0.079	0.093	0.066	0.079	0.117
15FQ+_FQ3_Q48	0.089	0.124	0.136	1	0.026	-0.003	-0.016	0.105	0.064	0.151	0.056	0.191
15FQ+_FQ3_Q72	0.001	-0.01	0.116	0.026	1	0.113	0.089	0.038	0.107	0.061	0.06	0.065
15FQ+_FQ3_Q73	0.163	0.26	0.008	-0.003	0.113	1	0.163	0.089	0.209	0.223	0.081	0.052

15FQ+_FQ3_Q97	0.129	0.053	0.075	-0.016	0.089	0.163	1	0.101	0.141	0.156	0.036	0.065
15FQ+_FQ3_Q98	0.129	0.127	0.079	0.105	0.038	0.089	0.101	1	0.121	0.157	0.141	0.142
15FQ+_FQ3_Q122	0.068	0.095	0.093	0.064	0.107	0.209	0.141	0.121	1	0.212	0.066	0.27
15FQ+_FQ3_Q147	0.409	0.191	0.066	0.151	0.061	0.223	0.156	0.157	0.212	1	0.148	0.094
15FQ+_FQ3_Q172	0.133	0.095	0.079	0.056	0.06	0.081	0.036	0.141	0.066	0.148	1	0.163
15FQ+_FQ3_Q197	0.128	0.117	0.117	0.191	0.065	0.052	0.065	0.142	0.27	0.094	0.163	1

	15FQ+ _FQ4_Q24	15FQ+ _FQ4_Q49	15FQ+ _FQ4_Q74	15FQ+ _FQ4_Q99	15FQ+ _FQ4_Q123	15FQ+ _FQ4_Q124	15FQ+ _FQ4_Q148	15FQ+ _FQ4_Q149	15FQ+ _FQ4_Q173	15FQ+ _FQ4_Q174	15FQ+ _FQ4_Q198	15FQ+ _FQ4_Q199
15FQ+_FQ4_Q24	1	0.092	0.212	0.142	0.152	0.124	0.254	0.172	0.197	0.165	0.216	0.329
15FQ+_FQ4_Q49	0.092	1	0.237	0.303	0.136	0.117	0.136	0.139	0.165	0.212	0.217	0.114
15FQ+_FQ4_Q74	0.212	0.237	1	0.431	0.205	0.174	0.225	0.21	0.307	0.284	0.27	0.211
15FQ+_FQ4_Q99	0.142	0.303	0.431	1	0.17	0.177	0.173	0.146	0.207	0.35	0.281	0.108
15FQ+_FQ4_Q123	0.152	0.136	0.205	0.17	1	0.095	0.143	0.117	0.152	0.138	0.275	0.193
15FQ+_FQ4_Q124	0.124	0.117	0.174	0.177	0.095	1	0.093	0.12	0.158	0.142	0.128	0.141
15FQ+_FQ4_Q148	0.254	0.136	0.225	0.173	0.143	0.093	1	0.111	0.286	0.167	0.166	0.219
15FQ+_FQ4_Q149	0.172	0.139	0.21	0.146	0.117	0.12	0.111	1	0.167	0.132	0.193	0.33
15FQ+_FQ4_Q173	0.197	0.165	0.307	0.207	0.152	0.158	0.286	0.167	1	0.343	0.183	0.284
15FQ+_FQ4_Q174	0.165	0.212	0.284	0.35	0.138	0.142	0.167	0.132	0.343	1	0.189	0.196
15FQ+_FQ4_Q198	0.216	0.217	0.27	0.281	0.275	0.128	0.166	0.193	0.183	0.189	1	0.223
15FQ+_FQ4_Q199	0.329	0.114	0.211	0.108	0.193	0.141	0.219	0.33	0.284	0.196	0.223	1

APPENDIX 3: TEST OF UNIVARIATE NORMALITY

WHITE GROUP

	Skewness		Kurtosis		Skewness and Kurtosis	
Variable	Z-Score	P-Value	Z-Score	P-Value	Chi-Square	P-Value
PFA1	-17.24	0.00	7.42	0.00	352.272	0.00
PFA2	-17.62	0.00	4.63	0.00	332.04	0.00
PFA3	-27.14	0.00	6.14	0.00	774.54	0.00
PFA4	-30.07	0.00	21.88	0.00	1382.94	0.00
PFA5	-11.02	0.00	-9.90	0.00	219.44	0.00
PFA6	-27.12	0.00	6.33	0.00	775.52	0.00
PFB1	-28.04	0.00	12.41	0.00	940.10	0.00
PFB2	-16.95	0.00	-8.60	0.00	361.19	0.00
PFB3	-33.27	0.00	28.02	0.00	1892.19	0.00
PFB4	-34.64	0.00	36.19	0.00	2509.74	0.00
PFB5	-31.47	0.00	22.19	0.00	1482.97	0.00
PFB6	-32.53	0.00	24.75	0.00	1671.08	0.00
PFC1	-24.28	0.00	0.60	0.55	589.69	0.00
PFC2	-17.57	0.00	-5.36	0.00	337.35	0.00
PFC3	-18.18	0.00	-0.19	0.85	330.48	0.00
PFC4	-17.58	0.00	-9.40	0.00	397.60	0.00
PFC5	-24.14	0.00	5.61	0.00	614.42	0.00
PFC6	-8.98	0.00	-18.22	0.00	412.83	0.00
PFE1	-24.01	0.00	0.61	0.54	577.01	0.00
PFE2	-24.67	0.00	2.34	0.02	614.25	0.00
PFE3	10.23	0.00	-12.46	0.00	259.82	0.00
PFE4	-19.23	0.00	-7.82	0.00	431.08	0.00
PFE5	-24.54	0.00	0.68	0.50	602.48	0.00
PFE6	-13.76	0.00	-6.87	0.00	236.40	0.00

PFF1	-6.43	0.00	-10.24	0.00	146.20	0.00
PFF2	-2.85	0.00	-15.33	0.00	243.09	0.00
PFF3	0.15	0.88	-14.00	0.00	196.00	0.00
PFF4	-19.90	0.00	-5.15	0.00	422.53	0.00
PFF5	-17.14	0.00	-12.43	0.00	448.29	0.00
PFF6	-11.24	0.00	-13.88	0.00	319.04	0.00
PFG1	-27.08	0.00	5.41	0.00	762.33	0.00
PFG2	-15.69	0.00	-10.66	0.00	359.79	0.00
PFG3	-23.70	0.00	0.73	0.47	562.01	0.00
PFG4	-33.35	0.00	27.19	0.00	1851.71	0.00
PFG5	-29.89	0.00	13.72	0.00	1081.58	0.00
PFG6	-27.77	0.00	8.81	0.00	848.72	0.00
PFH1	-2.85	0.00	-19.44	0.00	386.12	0.00
PFH2	-5.38	0.00	-16.49	0.00	300.93	0.00
PFH3	-10.34	0.00	-12.15	0.00	254.52	0.00
PFH4	-15.32	0.00	-12.82	0.00	398.98	0.00
PFH5	-1.35	0.18	-17.69	0.00	314.89	0.00
PFH6	-16.32	0.00	-10.67	0.00	379.98	0.00
PFI1	-9.59	0.00	-13.49	0.00	273.75	0.00
PFI2	0.13	0.90	-20.30	0.00	411.94	0.00
PFI3	-1.79	0.07	-15.10	0.00	231.15	0.00
PFI4	8.22	0.00	-15.15	0.00	296.96	0.00
PFI5	-12.38	0.00	-10.63	0.00	266.04	0.00
PFI6	-35.03	0.00	38.25	0.00	2690.15	0.00
PFL1	-7.86	0.00	-15.97	0.00	316.80	0.00
PFL2	17.15	0.00	-11.73	0.00	431.58	0.00
PFL3	22.01	0.00	-2.15	0.03	488.83	0.00
PFL4	23.08	0.00	-1.28	0.20	534.13	0.00
PFL5	6.59	0.00	-11.14	0.00	167.57	0.00
PFL6	-0.10	0.92	-12.34	0.00	152.25	0.00

PFM1	8.77	0.00	-14.46	0.00	285.86	0.00
PFM2	-2.57	0.01	-1.08	0.28	7.76	0.02
PFM3	-16.27	0.00	-9.72	0.00	359.31	0.00
PFM4	26.12	0.00	5.37	0.00	711.15	0.00
PFM5	17.04	0.00	-6.96	0.00	338.61	0.00
PFM6	-5.50	0.00	-14.25	0.00	233.40	0.00
PFN1	-23.42	0.00	1.02	0.31	549.66	0.00
PFN2	-1.63	0.10	-20.19	0.00	410.42	0.00
PFN3	-32.43	0.00	24.43	0.00	1648.03	0.00
PFN4	-25.81	0.00	0.95	0.34	667.05	0.00
PFN5	-29.63	0.00	13.67	0.00	1064.76	0.00
PFN6	-24.94	0.00	3.21	0.00	632.25	0.00
PFO1	-8.85	0.00	-12.84	0.00	243.24	0.00
PFO2	2.20	0.03	-17.49	0.00	310.89	0.00
PFO3	-3.60	0.00	-16.07	0.00	271.06	0.00
PFO4	7.62	0.00	-13.18	0.00	231.81	0.00
PFO5	-14.42	0.00	-12.22	0.00	357.13	0.00
PFO6	0.30	0.77	-18.63	0.00	347.19	0.00
PFQ11	7.20	0.00	-11.87	0.00	192.62	0.00
PFQ12	4.88	0.00	-14.56	0.00	235.86	0.00
PFQ13	11.79	0.00	-14.36	0.00	345.20	0.00
PFQ14	2.62	0.01	-6.63	0.00	50.79	0.00
PFQ15	19.45	0.00	-4.94	0.00	402.59	0.00
PFQ16	25.09	0.00	2.38	0.02	635.01	0.00
PFQ21	-0.34	0.73	-7.66	0.00	58.79	0.00
PFQ22	9.25	0.00	-16.44	0.00	355.82	0.00
PFQ23	20.87	0.00	-2.62	0.01	442.21	0.00
PFQ24	10.70	0.00	-16.22	0.00	377.52	0.00
PFQ25	16.90	0.00	-9.55	0.00	376.66	0.00
PFQ26	17.90	0.00	-10.48	0.00	430.28	0.00

PFQ31	-42.22	0.00	90.90	0.00	10044.67	0.00
PFQ32	-34.61	0.00	35.70	0.00	2472.60	0.00
PFQ33	-29.79	0.00	14.45	0.00	1096.17	0.00
PFQ34	-2.59	0.01	-10.22	0.00	111.09	0.00
PFQ35	-39.33	0.00	66.44	0.00	5960.67	0.00
PFQ36	-26.25	0.00	4.25	0.00	706.91	0.00
PFQ41	6.97	0.00	-15.40	0.00	285.68	0.00
PFQ42	15.51	0.00	-16.09	0.00	499.51	0.00
PFQ43	2.70	0.01	-13.21	0.00	181.82	0.00
PFQ44	-2.33	0.02	-16.67	0.00	283.28	0.00
PFQ45	3.26	0.00	-17.47	0.00	315.79	0.00
PFQ46	-1.44	0.15	-11.83	0.00	142.11	0.00

BLACK GROUP

	Skewness		Kurtosis		Skewness and Kurtosis	
Variable	Z-Score	P-Value	Z-Score	P-Value	Chi-Square	P-Value
PFA1	17.07	0.00	-7.36	0.00	345.56	0.00
PFA2	-19.75	0.00	14.10	0.00	588.90	0.00
PFA3	-30.35	0.00	18.60	0.00	1267.23	0.00
PFA4	-29.61	0.00	30.19	0.00	1788.19	0.00
PFA5	-23.81	0.00	-2.00	0.05	570.66	0.00
PFA6	-28.62	0.00	12.97	0.00	987.17	0.00
PFB1	-29.67	0.00	17.89	0.00	1200.28	0.00
PFB2	-8.37	0.00	-10.21	0.00	174.33	0.00
PFB3	-25.06	0.00	4.10	0.00	644.81	0.00
PFB4	-39.84	0.00	72.65	0.00	6865.37	0.00
PFB5	-30.91	0.00	22.63	0.00	1467.47	0.00
PFB6	-18.58	0.00	-4.93	0.00	369.56	0.00
PFC1	-32.68	0.00	26.35	0.00	1762.79	0.00
PFC2	-8.06	0.00	-10.76	0.00	180.74	0.00
PFC3	-16.06	0.00	-0.39	0.70	257.94	0.00
PFC4	-20.39	0.00	-5.59	0.00	447.07	0.00
PFC5	-16.58	0.00	-3.19	0.00	285.08	0.00
PFC6	-24.62	0.00	-0.08	0.94	606.09	0.00
PFE1	-27.48	0.00	9.96	0.00	854.44	0.00
PFE2	-20.72	0.00	-4.71	0.00	451.41	0.00
PFE3	10.30	0.00	-9.59	0.00	198.20	0.00
PFE4	-21.70	0.00	-3.04	0.00	480.18	0.00
PFE5	-25.83	0.00	6.04	0.00	703.88	0.00
PFE6	2.09	0.04	0.31	0.76	4.48	0.11
PFF1	-3.53	0.00	-9.83	0.00	109.05	0.00

PFF2	-5.84	0.00	-14.29	0.00	238.29	0.00
PFF3	-1.10	0.27	-9.12	0.00	84.34	0.00
PFF4	-10.57	0.00	-13.74	0.00	300.30	0.00
PFF5	-18.73	0.00	-8.89	0.00	429.97	0.00
PFF6	-9.24	0.00	-10.43	0.00	194.01	0.00
PFG1	-34.86	0.00	37.24	0.00	2601.66	0.00
PFG2	-12.37	0.00	-11.89	0.00	294.28	0.00
PFG3	-21.74	0.00	-0.45	0.65	472.89	0.00
PFG4	-37.19	0.00	51.40	0.00	4024.34	0.00
PFG5	-41.50	0.00	84.94	0.00	8937.02	0.00
PFG6	-39.74	0.00	70.19	0.00	6505.90	0.00
PFH1	-14.11	0.00	-12.23	0.00	348.49	0.00
PFH2	-19.52	0.00	-7.28	0.00	434.12	0.00
PFH3	-4.74	0.00	-10.32	0.00	128.84	0.00
PFH4	-30.12	0.00	15.50	0.00	1147.08	0.00
PFH5	-5.02	0.00	-16.36	0.00	292.91	0.00
PFH6	-19.81	0.00	-6.68	0.00	437.23	0.00
PFI1	-5.26	0.00	-15.31	0.00	262.04	0.00
PFI2	1.41	0.16	-18.14	0.00	330.87	0.00
PFI3	-8.95	0.00	-10.93	0.00	199.56	0.00
PFI4	-1.35	0.18	-14.68	0.00	217.26	0.00
PFI5	-5.68	0.00	-15.22	0.00	264.01	0.00
PFI6	-39.17	0.00	66.09	0.00	5901.83	0.00
PFL1	-14.86	0.00	-11.33	0.00	349.12	0.00
PFL2	-0.66	0.51	-14.86	0.00	221.34	0.00
PFL3	24.67	0.00	3.36	0.00	619.90	0.00
PFL4	12.81	0.00	-12.96	0.00	332.17	0.00
PFL5	-3.38	0.00	-5.26	0.00	39.03	0.00
PFL6	-8.80	0.00	-2.62	0.01	84.31	0.00
PFM1	20.07	0.00	-4.78	0.00	425.44	0.00

PFM2	-6.77	0.00	25.53	0.00	697.71	0.00
PFM3	-23.76	0.00	1.12	0.26	565.79	0.00
PFM4	28.64	0.00	13.30	0.00	997.28	0.00
PFM5	17.53	0.00	-5.02	0.00	332.37	0.00
PFM6	-10.37	0.00	-8.13	0.00	173.57	0.00
PFN1	-17.30	0.00	-8.65	0.00	374.12	0.00
PFN2	-13.72	0.00	-13.02	0.00	357.78	0.00
PFN3	-41.68	0.00	87.99	0.00	9479.67	0.00
PFN4	-42.79	0.00	96.58	0.00	11159.13	0.00
PFN5	-42.09	0.00	91.76	0.00	10191.79	0.00
PFN6	-31.86	0.00	25.34	0.00	1657.09	0.00
PFO1	-0.71	0.48	-12.45	0.00	155.38	0.00
PFO2	2.69	0.01	-11.60	0.00	141.84	0.00
PFO3	4.60	0.00	-12.36	0.00	173.79	0.00
PFO4	3.68	0.00	-6.72	0.00	58.75	0.00
PFO5	-5.27	0.00	-16.12	0.00	287.51	0.00
PFO6	-8.78	0.00	-14.84	0.00	297.33	0.00
PFQ11	7.86	0.00	-10.46	0.00	171.27	0.00
PFQ12	-2.11	0.04	-10.83	0.00	121.70	0.00
PFQ13	14.59	0.00	-9.85	0.00	309.82	0.00
PFQ14	5.07	0.00	-9.51	0.00	116.16	0.00
PFQ15	14.08	0.00	-6.18	0.00	236.41	0.00
PFQ16	16.80	0.00	-7.08	0.00	332.36	0.00
PFQ21	-2.31	0.02	-1.84	0.07	8.75	0.01
PFQ22	5.77	0.00	-12.10	0.00	179.70	0.00
PFQ23	21.33	0.00	-2.17	0.03	459.55	0.00
PFQ24	22.19	0.00	-2.36	0.02	498.08	0.00
PFQ25	21.62	0.00	-2.13	0.03	471.84	0.00
PFQ26	27.32	0.00	9.67	0.00	839.70	0.00
PFQ31	-47.51	0.00	162.25	0.00	28583.67	0.00

PFQ32	-32.26	0.00	23.17	0.00	1577.44	0.00
PFQ33	-34.70	0.00	37.10	0.00	2580.26	0.00
PFQ34	4.48	0.00	-6.20	0.00	58.47	0.00
PFQ35	-47.39	0.00	160.87	0.00	28125.89	0.00
PFQ36	-26.82	0.00	8.78	0.00	796.50	0.00
PFQ41	24.28	0.00	2.84	0.00	597.36	0.00
PFQ42	23.11	0.00	-0.09	0.93	533.87	0.00
PFQ43	6.07	0.00	-10.90	0.00	155.69	0.00
PFQ44	7.35	0.00	-13.87	0.00	246.47	0.00
PFQ45	10.19	0.00	-14.49	0.00	313.88	0.00
PFQ46	15.92	0.00	-9.09	0.00	336.11	0.00
PSD1	-12.19	0.00	-7.06	0.00	198.36	0.00
PSD2	-20.28	0.00	-3.30	0.00	422.01	0.00
PSD3	-8.51	0.00	-13.94	0.00	266.77	0.00
PSD4	-29.52	0.00	15.58	0.00	1113.94	0.00

COLOURED GROUP

	Skewness		Kurtosis		Skewness and Kurtosis	
Variable	Z-Score	P-Value	Z-Score	P-Value	Chi-Square	P-Value
PFA1	0.856	0.392	-8.27	0.00	69.133	0.00
PFA2	-7.829	0.00	2.363	0.018	66.876	0.00
PFA3	-15.072	0.00	9.322	0.00	314.058	0.00
PFA4	-17.49	0.00	29.971	0.00	1204.145	0.00
PFA5	-10.249	0.00	-3.102	0.002	114.66	0.00
PFA6	-14.952	0.00	9.729	0.00	318.224	0.00
PFB1	-15.126	0.00	10.928	0.00	348.212	0.00
PFB2	-9.302	0.00	-2.366	0.018	92.126	0.00
PFB3	-14.851	0.00	8.9	0.00	299.765	0.00
PFB4	-18.139	0.00	24.632	0.00	935.746	0.00
PFB5	-16.535	0.00	17.038	0.00	563.676	0.00
PFB6	-14.692	0.00	8.304	0.00	284.822	0.00
PFC1	-13.428	0.00	4.434	0.00	199.982	0.00
PFC2	-5.654	0.00	-4.71	0.00	54.151	0.00
PFC3	-8.982	0.00	0.577	0.564	81.003	0.00
PFC4	-8.123	0.00	-4.02	0.00	82.147	0.00
PFC5	-11.122	0.00	1.649	0.099	126.413	0.00
PFC6	-8.102	0.00	-5.796	0.00	99.23	0.00
PFE1	-13.861	0.00	5.95	0.00	227.529	0.00
PFE2	-11.154	0.00	0.42	0.675	124.577	0.00
PFE3	6.804	0.00	-4.138	0.00	63.421	0.00
PFE4	-10.367	0.00	-2.016	0.044	111.53	0.00
PFE5	-13.189	0.00	3.792	0.00	188.321	0.00
PFE6	-0.686	0.493	-5.91	0.00	35.397	0.00
PFF1	-2.185	0.029	-3.913	0.00	20.092	0.00

PFF2	-2.985	0.003	-6.714	0.00	53.997	0.00
PFF3	-0.661	0.509	-6.129	0.00	37.998	0.00
PFF4	-7.993	0.00	-4.897	0.00	87.869	0.00
PFF5	-11.38	0.00	-1.19	0.234	130.921	0.00
PFF6	-6.861	0.00	-4.979	0.00	71.857	0.00
PFG1	-13.429	0.00	3.622	0.00	193.464	0.00
PFG2	-5.734	0.00	-5.466	0.00	62.75	0.00
PFG3	-10.984	0.00	-0.064	0.949	120.641	0.00
PFG4	-17.922	0.00	22.894	0.00	845.352	0.00
PFG5	-16.868	0.00	17.337	0.00	585.094	0.00
PFG6	-17.061	0.00	17.533	0.00	598.48	0.00
PFH1	-4.286	0.00	-8.534	0.00	91.188	0.00
PFH2	-7.468	0.00	-5.912	0.00	90.725	0.00
PFH3	-4.629	0.00	-4.849	0.00	44.941	0.00
PFH4	-11.804	0.00	-0.379	0.705	139.472	0.00
PFH5	-0.739	0.46	-7.788	0.00	61.194	0.00
PFH6	-9.029	0.00	-3.881	0.00	96.577	0.00
PFI1	-4.353	0.00	-6.51	0.00	61.331	0.00
PFI2	-1.837	0.066	-9.114	0.00	86.436	0.00
PFI3	-4.687	0.00	-5.805	0.00	55.673	0.00
PFI4	2.656	0.008	-7.374	0.00	61.423	0.00
PFI5	-7.236	0.00	-5.277	0.00	80.209	0.00
PFI6	-19.419	0.00	33.959	0.00	1530.325	0.00
PFL1	-5.69	0.00	-7.038	0.00	81.915	0.00
PFL2	4.117	0.00	-7.972	0.00	80.508	0.00
PFL3	11.506	0.00	0.688	0.491	132.864	0.00
PFL4	7.741	0.00	-3.9	0.00	75.132	0.00
PFL5	2.937	0.003	-5.343	0.00	37.176	0.00
PFL6	-1.439	0.15	-4.915	0.00	26.231	0.00
PFM1	4.996	0.00	-6.374	0.00	65.592	0.00

PFM2	-4.994	0.00	3.919	0.00	40.298	0.00
PFM3	-10.483	0.00	-1.593	0.111	112.439	0.00
PFM4	12.714	0.00	2.72	0.007	169.036	0.00
PFM5	8.449	0.00	-2.922	0.003	79.932	0.00
PFM6	-1.985	0.047	-6.873	0.00	51.18	0.00
PFN1	-12.404	0.00	2.621	0.009	160.721	0.00
PFN2	-0.592	0.554	-9.219	0.00	85.346	0.00
PFN3	-17.446	0.00	20.608	0.00	729.032	0.00
PFN4	-17.783	0.00	20.861	0.00	751.437	0.00
PFN5	-17.88	0.00	22.75	0.00	837.269	0.00
PFN6	-13.721	0.00	6.035	0.00	224.696	0.00
PFO1	-2.71	0.007	-5.916	0.00	42.346	0.00
PFO2	2.03	0.042	-6.654	0.00	48.395	0.00
PFO3	0.276	0.783	-8.092	0.00	65.551	0.00
PFO4	4.543	0.00	-4.732	0.00	43.031	0.00
PFO5	-6.217	0.00	-6.092	0.00	75.755	0.00
PFO6	-0.224	0.822	-8.592	0.00	73.876	0.00
PFQ11	4.625	0.00	-5.611	0.00	52.871	0.00
PFQ12	-1.242	0.214	-7.318	0.00	55.1	0.00
PFQ13	6.607	0.00	-5.641	0.00	75.471	0.00
PFQ14	1.375	0.169	-4.173	0.00	19.305	0.00
PFQ15	8.02	0.00	-2.771	0.006	72.007	0.00
PFQ16	11.514	0.00	0.618	0.536	132.964	0.00
PFQ21	-0.462	0.644	-0.508	0.612	0.471	0.79
PFQ22	5.287	0.00	-6.102	0.00	65.183	0.00
PFQ23	10.814	0.00	-0.227	0.821	117.003	0.00
PFQ24	9.676	0.00	-3.372	0.001	104.997	0.00
PFQ25	7.978	0.00	-4.381	0.00	82.843	0.00
PFQ26	13.033	0.00	3.334	0.001	180.984	0.00
PFQ31	-22.396	0.00	65.297	0.00	4765.317	0.00

PFQ32	-19.492	0.00	34.264	0.00	1553.998	0.00
PFQ33	-16.663	0.00	16.045	0.00	535.093	0.00
PFQ34	-3.241	0.001	-5.712	0.00	43.13	0.00
PFQ35	-22.817	0.00	73.736	0.00	5957.598	0.00
PFQ36	-12.586	0.00	2.563	0.01	164.988	0.00
PFQ41	7.364	0.00	-4.124	0.00	71.244	0.00
PFQ42	13.96	0.00	3.593	0.00	207.778	0.00
PFQ43	6.025	0.00	-5.083	0.00	62.134	0.00
PFQ44	3.944	0.00	-6.975	0.00	64.21	0.00
PFQ45	5.225	0.00	-8.269	0.00	95.671	0.00
PFQ46	4.755	0.00	-6.247	0.00	61.633	0.00
PSD1	-4.556	0.00	-3.903	0.00	35.994	0.00
PSD2	-5.266	0.00	-4.457	0.00	47.596	0.00
PSD3	-3.737	0.00	-7.614	0.00	71.94	0.00
PSD4	-14.374	0.00	7.339	0.00	260.482	0.00

APPENDIX 4: PATTERN MATRIX

Pattern Matrix for the White Group

	Factor		
	1	2	3
15FQ+_FA_Q52	0.56	-0.093	
15FQ+_FA_Q101	0.548	0.136	
15FQ+_FA_Q76	0.5	-0.017	
15FQ+_FA_Q77	0.493	-0.242	
15FQ+_FA_Q151	0.422	-0.323	
15FQ+_FA_Q176	0.419	0.031	
15FQ+_FA_Q51	0.356	-0.165	
15FQ+_FA_Q26	0.27	-0.06	
15FQ+_FA_Q126	0.244	-0.091	
15FQ+_FA_Q1	-0.006	-0.679	
15FQ+_FA_Q27	0.071	-0.338	
15FQ+_FA_Q2	0.006	-0.124	
15FQ+_B_Q102	0.577	-0.208	-0.083
15FQ+_B_Q152	0.565	0	-0.014
15FQ+_B_Q178	0.469	-0.034	0.017
15FQ+_B_Q127	0.363	0.02	0.227
15FQ+_B_Q153	0.354	0.04	0.272
15FQ+_B_Q103	0.227	0.01	0.184
15FQ+_B_Q177	0.185	-0.728	-0.006
15FQ+_B_Q53	0.026	-0.628	0.051
15FQ+_B_Q78	0.03	0.024	0.598
15FQ+_B_Q3	-0.078	-0.227	0.42
15FQ+_B_Q28	0.161	0.12	0.343
15FQ+_B_Q128	0.165	-0.07	0.283
15FQ+_FC_Q129	0.633	-0.02	0.055
15FQ+_FC_Q104	0.556	0.101	0.033
15FQ+_FC_Q29	0.381	0.007	-0.093
15FQ+_FC_Q55	0.381	-0.011	-0.208
15FQ+_FC_Q5	0.026	0.673	0.064
15FQ+_FC_Q30	-0.042	0.473	-0.057
15FQ+_FC_Q54	0.151	0.366	-0.113
15FQ+_FC_Q154	-0.051	-0.021	-0.602
15FQ+_FC_Q179	0.061	0.034	-0.548
15FQ+_FC_Q80	-0.027	0.148	-0.505
15FQ+_FC_Q79	0.151	-0.009	-0.419
15FQ+_FC_Q4	0.263	0.108	-0.318
15FQ+_FE_Q155	0.623	0.032	-0.011
15FQ+_FE_Q6	0.543	0.047	0.036
15FQ+_FE_Q181	0.457	-0.03	0.041
15FQ+_FE_Q156	0.426	-0.035	-0.084

15FQ+_FE_Q131	0.289	0.021	-0.137
15FQ+_FE_Q56	0.254	0.227	-0.071
15FQ+_FE_Q106	0.016	0.794	0.081
15FQ+_FE_Q105	-0.015	0.206	-0.145
15FQ+_FE_Q130	0.011	-0.051	-0.733
15FQ+_FE_Q180	-0.04	0.032	-0.568
15FQ+_FE_Q31	0.109	0.041	-0.392
15FQ+_FE_Q81	0.195	0.024	-0.311
15FQ+_FF_Q132	0.626	0.042	
15FQ+_FF_Q7	0.602	0.069	
15FQ+_FF_Q157	0.576	0.098	
15FQ+_FF_Q107	0.516	-0.1	
15FQ+_FF_Q58	0.432	-0.122	
15FQ+_FF_Q33	0.326	-0.078	
15FQ+_FF_Q83	0.227	-0.073	
15FQ+_FF_Q182	-0.07	-0.885	
15FQ+_FF_Q82	-0.047	-0.65	
15FQ+_FF_Q8	0.224	-0.434	
15FQ+_FF_Q32	0.091	-0.421	
15FQ+_FF_Q57	0.276	-0.28	
15FQ+_FG_Q159	0.657	0.153	
15FQ+_FG_Q9	0.458	-0.201	
15FQ+_FG_Q158	0.444	-0.059	
15FQ+_FG_Q84	0.419	0.044	
15FQ+_FG_Q183	0.418	0.017	
15FQ+_FG_Q133	0.396	-0.363	
15FQ+_FG_Q109	0.394	-0.132	
15FQ+_FG_Q59	0.374	-0.158	
15FQ+_FG_Q108	0.303	-0.183	
15FQ+_FG_Q34	0.071	-0.595	
15FQ+_FG_Q134	-0.038	-0.486	
15FQ+_FG_Q184	0.308	-0.455	
15FQ+_FH_Q10	0.735	-0.121	
15FQ+_FH_Q36	0.689	-0.003	
15FQ+_FH_Q85	0.67	-0.005	
15FQ+_FH_Q135	0.583	0.112	
15FQ+_FH_Q61	0.537	-0.025	
15FQ+_FH_Q60	0.432	0.093	
15FQ+_FH_Q11	0.368	0.26	
15FQ+_FH_Q35	0.327	0.214	
15FQ+_FH_Q160	0.271	0.241	
15FQ+_FH_Q185	-0.092	0.76	
15FQ+_FH_Q86	0.126	0.483	
15FQ+_FH_Q110	0.079	0.366	
15FQ+_FI_Q62	0.67	-0.084	-0.057
15FQ+_FI_Q87	0.569	-0.022	-0.031

15FQ+_FI_Q12	0.417	0.095	0.073
15FQ+_FI_Q136	0.391	0.008	-0.001
15FQ+_FI_Q161	0.339	0.012	-0.027
15FQ+_FI_Q37	-0.066	0.625	-0.033
15FQ+_FI_Q137	0.152	0.578	-0.107
15FQ+_FI_Q112	0.019	0.52	-0.023
15FQ+_FI_Q186	-0.02	0.465	0.032
15FQ+_FI_Q111	0.114	0.288	-0.499
15FQ+_FI_Q162	0.336	0.051	-0.498
15FQ+_FI_Q187	0.141	0.142	0.172
15FQ+_FL_Q38	0.652	-0.13	0.042
15FQ+_FL_Q14	0.504	-0.057	0.219
15FQ+_FL_Q64	0.375	0.122	-0.014
15FQ+_FL_Q88	0.354	0.211	0.072
15FQ+_FL_Q188	0.275	0.068	-0.059
15FQ+_FL_Q113	0.008	0.723	0.032
15FQ+_FL_Q89	-0.001	0.709	-0.05
15FQ+_FL_Q63	0.048	0.249	0.13
15FQ+_FL_Q13	-0.069	-0.002	0.595
15FQ+_FL_Q163	0.098	0.122	0.49
15FQ+_FL_Q138	0.023	-0.004	0.452
15FQ+_FL_Q39	0.327	0.01	0.374
15FQ+_FN_Q42	0.636	0.057	0.033
15FQ+_FN_Q116	0.59	0.072	-0.098
15FQ+_FN_Q41	0.498	0.014	0.009
15FQ+_FN_Q166	0.445	-0.06	-0.03
15FQ+_FN_Q91	0.422	-0.247	-0.033
15FQ+_FN_Q16	0.382	-0.085	-0.042
15FQ+_FN_Q191	-0.062	-0.612	-0.021
15FQ+_FN_Q66	-0.087	-0.553	-0.157
15FQ+_FN_Q92	0.261	-0.46	0.027
15FQ+_FN_Q67	0.12	-0.408	0.049
15FQ+_FN_Q17	0.016	0.051	-0.737
15FQ+_FN_Q141	0.118	-0.152	-0.533
15FQ+_FO_Q43	0.541	0.12	
15FQ+_FO_Q193	0.419	-0.182	
15FQ+_FO_Q118	0.408	-0.011	
15FQ+_FO_Q168	0.325	-0.024	
15FQ+_FO_Q142	0.315	-0.231	
15FQ+_FO_Q143	0.288	-0.203	
15FQ+_FO_Q93	0.271	-0.191	
15FQ+_FO_Q18	0.226	-0.162	
15FQ+_FO_Q68	-0.002	-0.643	
15FQ+_FO_Q167	0.067	-0.617	
15FQ+_FO_Q117	-0.012	-0.569	
15FQ+_FO_Q192	0.288	-0.292	

15FQ+_FQ1_Q144	0.572	-0.259	-0.41
15FQ+_FQ1_Q70	0.538	0.293	0.003
15FQ+_FQ1_Q194	0.534	-0.08	0.11
15FQ+_FQ1_Q69	0.524	-0.256	-0.321
15FQ+_FQ1_Q44	0.478	-0.322	0.401
15FQ+_FQ1_Q45	0.445	0.428	0.047
15FQ+_FQ1_Q169	0.415	0.085	-0.057
15FQ+_FQ1_Q94	0.396	-0.316	0.112
15FQ+_FQ1_Q19	0.379	-0.196	0.234
15FQ+_FQ1_Q20	0.305	0.289	-0.133
15FQ+_FQ1_Q95	0.277	0.174	0.092
15FQ+_FQ1_Q119	0.397	0.402	0.092
15FQ+_FQ2_Q146	0.725	-0.12	
15FQ+_FQ2_Q71	0.63	-0.086	
15FQ+_FQ2_Q195	0.584	-0.078	
15FQ+_FQ2_Q196	0.578	0.122	
15FQ+_FQ2_Q96	0.495	0.075	
15FQ+_FQ2_Q121	0.471	0.065	
15FQ+_FQ2_Q145	0.418	-0.061	
15FQ+_FQ2_Q170	0.408	0.117	
15FQ+_FQ2_Q46	0.311	0.037	
15FQ+_FQ2_Q120	0.199	0.036	
15FQ+_FQ2_Q171	0.104	0.674	
15FQ+_FQ2_Q21	-0.019	0.489	
15FQ+_FQ3_Q197	0.691	0.012	0.055
15FQ+_FQ3_Q122	0.524	0.004	-0.052
15FQ+_FQ3_Q72	0.396	0.046	0.022
15FQ+_FQ3_Q48	0.39	0.037	-0.223
15FQ+_FQ3_Q47	0.254	-0.072	-0.026
15FQ+_FQ3_Q98	0.223	-0.135	-0.016
15FQ+_FQ3_Q172	0.219	-0.21	-0.062
15FQ+_FQ3_Q147	-0.02	-0.687	0.004
15FQ+_FQ3_Q22	-0.013	-0.587	-0.035
15FQ+_FQ3_Q73	-0.081	0.019	-0.721
15FQ+_FQ3_Q23	0.037	-0.011	-0.499
15FQ+_FQ3_Q97	0.041	-0.029	-0.2
15FQ+_FQ4_Q99	0.805	-0.149	
15FQ+_FQ4_Q74	0.661	0.094	
15FQ+_FQ4_Q174	0.569	-0.022	
15FQ+_FQ4_Q198	0.563	0.03	
15FQ+_FQ4_Q49	0.454	0.087	
15FQ+_FQ4_Q123	0.431	-0.033	
15FQ+_FQ4_Q173	0.35	0.209	
15FQ+_FQ4_Q148	0.292	0.195	
15FQ+_FQ4_Q24	0.289	0.216	
15FQ+_FQ4_Q199	-0.092	0.766	

15FQ+_FQ4_Q124	0.064	0.382
15FQ+_FQ4_Q149	0.153	0.371

Pattern Matrix for the Black Group

	Factor			
	1	2	3	4
FA_Q151	0.549	-0.062	0.036	
FA_Q77	0.436	-0.023	0.08	
FA_Q1	0.403	-0.033	-0.086	
FA_Q52	0.382	-0.077	0.216	
FA_Q27	0.261	0.101	0.034	
FA_Q51	0.22	0.196	0.033	
FA_Q126	0.127	0.042	0.041	
FA_Q26	0.03	0.314	0.078	
FA_Q2	-0.035	0.266	-0.077	
FA_Q101	-0.009	-0.148	0.528	
FA_Q176	0.096	0.051	0.314	
FA_Q76	0.053	0.192	0.301	
B_Q153	0.635	0.026	-0.093	
B_Q78	0.47	-0.03	0.059	
B_Q178	0.45	0.061	-0.053	
B_Q3	0.432	0.066	-0.031	
B_Q28	0.383	-0.072	0.154	
B_Q128	0.312	-0.072	0.172	
B_Q103	0.186	-0.005	0.145	
B_Q177	0.095	0.694	0.001	
B_Q53	-0.02	0.528	0.045	
B_Q152	-0.023	0.018	0.42	
B_Q102	0.011	0.264	0.408	
B_Q127	0.155	-0.011	0.349	
FC_Q4	0.42	-0.092	-0.112	
FC_Q179	0.361	-0.049	-0.294	
FC_Q5	0.358	0.04	0.012	
FC_Q30	0.317	-0.035	0.049	
FC_Q79	0.302	-0.024	-0.253	
FC_Q54	0.283	-0.073	-0.115	
FC_Q129	-0.143	-0.714	-0.047	
FC_Q104	0.004	-0.631	-0.057	
FC_Q29	0.072	-0.405	0.063	
FC_Q55	0.165	-0.351	-0.031	
FC_Q154	-0.019	0.031	-0.658	
FC_Q80	0.02	-0.075	-0.395	
FE_Q155	0.525	-0.077	0.116	
FE_Q6	0.512	-0.085	0.038	
FE_Q156	0.419	0.088	-0.261	
FE_Q131	0.351	0.119	-0.094	
FE_Q181	0.292	-0.032	0.004	
FE_Q31	0.228	0.073	0.088	
FE_Q56	0.227	0.051	0.035	

FE_Q81	0.196	0.145	0.103	
FE_Q130	0.12	0.539	-0.072	
FE_Q180	-0.061	0.407	0.08	
FE_Q106	0.141	-0.001	0.333	
FE_Q105	-0.014	0.139	0.245	
FF_Q182	0.711	-0.082	-0.171	0.056
FF_Q82	0.709	-0.063	-0.045	0.026
FF_Q32	0.578	0.111	0.065	-0.063
FF_Q132	0.061	0.605	-0.099	-0.124
FF_Q157	-0.054	0.451	0.003	0.071
FF_Q107	0.061	0.367	0.023	0.159
FF_Q7	0.011	0.296	-0.079	0.243
FF_Q8	0.26	-0.031	-0.435	0.181
FF_Q58	0.009	0.134	-0.403	0.017
FF_Q57	-0.012	0.006	-0.159	0.451
FF_Q33	0.013	0.028	0.008	0.372
FF_Q83	0.157	0.076	0.09	0.184
FG_Q184	0.51	0.18		
FG_Q34	0.408	0.041		
FG_Q133	0.37	0.31		
FG_Q9	0.354	0.263		
FG_Q134	0.353	-0.079		
FG_Q108	0.325	0.015		
FG_Q183	0.234	0.092		
FG_Q84	-0.078	0.446		
FG_Q59	-0.007	0.422		
FG_Q158	0.12	0.415		
FG_Q109	0.114	0.334		
FG_Q159	0.084	0.289		
FH_Q36	0.596	0.097	-0.022	
FH_Q85	0.585	0.001	-0.076	
FH_Q10	0.367	-0.077	-0.27	
FH_Q60	0.359	0.193	0.029	
FH_Q185	-0.037	0.553	-0.068	
FH_Q110	0.062	0.396	-0.058	
FH_Q160	0.156	0.319	-0.004	
FH_Q11	-0.051	0.062	-0.621	
FH_Q35	-0.077	0.176	-0.51	
FH_Q135	0.185	0.018	-0.419	
FH_Q61	0.122	-0.082	-0.302	
FH_Q86	0.084	0.193	-0.258	
FI_Q62	0.612	0.074	0.028	0.041
FI_Q136	0.466	0.014	0.067	0.056
FI_Q87	0.433	-0.029	-0.058	-0.069
FI_Q161	0.308	-0.013	-0.053	-0.027
FI_Q12	0.276	-0.12	-0.044	0.053

FI_Q37	0.001	-0.682	0.053	-0.024
FI_Q137	0.035	-0.611	-0.049	0.017
FI_Q162	0.055	0.05	-0.652	-0.008
FI_Q111	-0.031	-0.017	-0.605	0.028
FI_Q186	-0.032	0.05	0.003	0.554
FI_Q187	0.099	-0.011	-0.014	0.368
FI_Q112	-0.05	-0.196	-0.068	0.28
FL_Q14	0.6	0.001	0.071	
FL_Q38	0.353	-0.004	0.111	
FL_Q89	-0.047	-0.772	-0.063	
FL_Q113	-0.073	-0.707	0.015	
FL_Q88	0.277	-0.306	-0.036	
FL_Q63	-0.049	-0.221	0.092	
FL_Q64	0.048	-0.191	0.064	
FL_Q188	0.046	-0.132	-0.032	
FL_Q163	0.041	-0.066	0.563	
FL_Q13	-0.001	0.011	0.419	
FL_Q39	0.26	-0.034	0.376	
FL_Q138	0.133	-0.012	0.181	
FM_Q65	0.636	-0.039	0.03	0.044
FM_Q114	0.511	0.029	0.016	0.034
FM_Q190	0.312	0.172	-0.104	-0.214
FM_Q115	0.199	0.013	0.027	-0.159
FM_Q139	-0.009	0.58	0.042	0.108
FM_Q165	0.063	0.378	-0.119	-0.004
FM_Q40	-0.004	0.354	0.116	0.057
FM_Q15	0.048	-0.011	0.51	-0.03
FM_Q164	0.002	-0.019	0.364	0.098
FM_Q189	-0.058	0.178	0.215	-0.149
FM_Q140	0.029	0.088	0.028	0.399
FM_Q90	-0.054	0.019	0.016	0.355
FN_Q66	0.475	-0.05	-0.057	
FN_Q191	0.472	-0.074	0.056	
FN_Q92	0.44	0.139	-0.197	
FN_Q141	0.429	-0.01	0.057	
FN_Q91	0.399	0.173	0.036	
FN_Q67	0.373	0.078	-0.355	
FN_Q17	0.229	0.002	0.048	
FN_Q42	-0.049	0.514	0.053	
FN_Q41	-0.048	0.463	-0.068	
FN_Q116	0.115	0.304	0.206	
FN_Q166	0.16	0.079	0.318	
FN_Q16	0.11	0.131	-0.151	
FQ1_Q69	0.67	0.044	0.046	0.02
FQ1_Q144	0.625	0.034	-0.01	-0.084
FQ1_Q45	0.038	0.413	-0.009	0.079

FQ1_Q119	-0.029	0.396	-0.003	0.027
FQ1_Q70	0.075	0.326	-0.066	-0.266
FQ1_Q20	0.086	0.261	-0.049	-0.007
FQ1_Q169	-0.026	0.21	0.104	-0.061
FQ1_Q44	-0.044	0.023	0.692	-0.005
FQ1_Q94	0.205	0.001	0.36	-0.014
FQ1_Q194	0.157	-0.049	0.055	-0.482
FQ1_Q19	0.069	-0.157	0.149	-0.351
FQ1_Q95	-0.052	0.208	-0.054	-0.292
FQ2_Q146	0.583	-0.056	0.048	
FQ2_Q121	0.498	0.064	-0.007	
FQ2_Q71	0.488	0.018	-0.096	
FQ2_Q196	0.388	0.135	0.141	
FQ2_Q96	0.294	0.053	0.115	
FQ2_Q171	0.001	0.573	0.115	
FQ2_Q21	0.09	0.483	-0.042	
FQ2_Q170	-0.037	0.034	0.585	
FQ2_Q195	0.149	-0.032	0.364	
FQ2_Q145	0.179	-0.119	0.276	
FQ2_Q46	-0.034	0.056	0.198	
FQ2_Q120	0.119	0.003	0.124	
FQ3_Q73	0.553	-0.035	-0.051	-0.074
FQ3_Q23	0.355	-0.085	-0.052	0.042
FQ3_Q97	0.246	0.076	-0.05	0.049
FQ3_Q72	0.233	0.114	0.046	0.023
FQ3_Q122	0.078	0.457	-0.102	0.07
FQ3_Q147	0.025	0.2	-0.521	-0.026
FQ3_Q22	0.054	-0.132	-0.453	0.093
FQ3_Q197	-0.019	0.184	0.021	0.466
FQ3_Q48	-0.006	0.069	-0.06	0.324
FQ3_Q172	0.038	-0.017	-0.012	0.223
FQ3_Q47	-0.007	-0.047	-0.007	0.193
FQ3_Q98	0.101	0.01	0.01	0.102
FQ4_Q199	0.549	-0.131	-0.064	
FQ4_Q173	0.42	0.161	0.072	
FQ4_Q148	0.378	0.067	0.073	
FQ4_Q24	0.368	-0.098	-0.119	
FQ4_Q149	0.287	-0.019	-0.132	
FQ4_Q99	-0.082	0.526	-0.227	
FQ4_Q174	0.105	0.443	-0.039	
FQ4_Q124	-0.015	0.28	0.044	
FQ4_Q49	0.184	0.247	-0.143	
FQ4_Q198	0.095	-0.039	-0.492	
FQ4_Q123	-0.028	0.057	-0.288	
FQ4_Q74	0.17	0.063	-0.201	

Pattern Matrix for the Coloured Group

	Factor			
	1	2	3	4
FA_Q151	0.549	-0.062	0.036	
FA_Q77	0.436	-0.023	0.08	
FA_Q1	0.403	-0.033	-0.086	
FA_Q52	0.382	-0.077	0.216	
FA_Q27	0.261	0.101	0.034	
FA_Q51	0.22	0.196	0.033	
FA_Q126	0.127	0.042	0.041	
FA_Q26	0.03	0.314	0.078	
FA_Q2	-0.035	0.266	-0.077	
FA_Q101	-0.009	-0.148	0.528	
FA_Q176	0.096	0.051	0.314	
FA_Q76	0.053	0.192	0.301	
B_Q153	0.635	0.026	-0.093	
B_Q78	0.47	-0.03	0.059	
B_Q178	0.45	0.061	-0.053	
B_Q3	0.432	0.066	-0.031	
B_Q28	0.383	-0.072	0.154	
B_Q128	0.312	-0.072	0.172	
B_Q103	0.186	-0.005	0.145	
B_Q177	0.095	0.694	0.001	
B_Q53	-0.02	0.528	0.045	
B_Q152	-0.023	0.018	0.42	
B_Q102	0.011	0.264	0.408	
B_Q127	0.155	-0.011	0.349	
FC_Q4	0.42	-0.092	-0.112	
FC_Q179	0.361	-0.049	-0.294	
FC_Q5	0.358	0.04	0.012	
FC_Q30	0.317	-0.035	0.049	
FC_Q79	0.302	-0.024	-0.253	
FC_Q54	0.283	-0.073	-0.115	
FC_Q129	-0.143	-0.714	-0.047	
FC_Q104	0.004	-0.631	-0.057	
FC_Q29	0.072	-0.405	0.063	
FC_Q55	0.165	-0.351	-0.031	
FC_Q154	-0.019	0.031	-0.658	
FC_Q80	0.02	-0.075	-0.395	
FE_Q155	0.525	-0.077	0.116	
FE_Q6	0.512	-0.085	0.038	
FE_Q156	0.419	0.088	-0.261	
FE_Q131	0.351	0.119	-0.094	
FE_Q181	0.292	-0.032	0.004	
FE_Q31	0.228	0.073	0.088	
FE_Q56	0.227	0.051	0.035	

FE_Q81	0.196	0.145	0.103	
FE_Q130	0.12	0.539	-0.072	
FE_Q180	-0.061	0.407	0.08	
FE_Q106	0.141	-0.001	0.333	
FE_Q105	-0.014	0.139	0.245	
FF_Q182	0.711	-0.082	-0.171	0.056
FF_Q82	0.709	-0.063	-0.045	0.026
FF_Q32	0.578	0.111	0.065	-0.063
FF_Q132	0.061	0.605	-0.099	-0.124
FF_Q157	-0.054	0.451	0.003	0.071
FF_Q107	0.061	0.367	0.023	0.159
FF_Q7	0.011	0.296	-0.079	0.243
FF_Q8	0.26	-0.031	-0.435	0.181
FF_Q58	0.009	0.134	-0.403	0.017
FF_Q57	-0.012	0.006	-0.159	0.451
FF_Q33	0.013	0.028	0.008	0.372
FF_Q83	0.157	0.076	0.09	0.184
FG_Q184	0.51	0.18		
FG_Q34	0.408	0.041		
FG_Q133	0.37	0.31		
FG_Q9	0.354	0.263		
FG_Q134	0.353	-0.079		
FG_Q108	0.325	0.015		
FG_Q183	0.234	0.092		
FG_Q84	-0.078	0.446		
FG_Q59	-0.007	0.422		
FG_Q158	0.12	0.415		
FG_Q109	0.114	0.334		
FG_Q159	0.084	0.289		
FH_Q36	0.596	0.097	-0.022	
FH_Q85	0.585	0.001	-0.076	
FH_Q10	0.367	-0.077	-0.27	
FH_Q60	0.359	0.193	0.029	
FH_Q185	-0.037	0.553	-0.068	
FH_Q110	0.062	0.396	-0.058	
FH_Q160	0.156	0.319	-0.004	
FH_Q11	-0.051	0.062	-0.621	
FH_Q35	-0.077	0.176	-0.51	
FH_Q135	0.185	0.018	-0.419	
FH_Q61	0.122	-0.082	-0.302	
FH_Q86	0.084	0.193	-0.258	
FI_Q62	0.612	0.074	0.028	0.041
FI_Q136	0.466	0.014	0.067	0.056
FI_Q87	0.433	-0.029	-0.058	-0.069
FI_Q161	0.308	-0.013	-0.053	-0.027
FI_Q12	0.276	-0.12	-0.044	0.053

FI_Q37	0.001	-0.682	0.053	-0.024
FI_Q137	0.035	-0.611	-0.049	0.017
FI_Q162	0.055	0.05	-0.652	-0.008
FI_Q111	-0.031	-0.017	-0.605	0.028
FI_Q186	-0.032	0.05	0.003	0.554
FI_Q187	0.099	-0.011	-0.014	0.368
FI_Q112	-0.05	-0.196	-0.068	0.28
FL_Q14	0.6	0.001	0.071	
FL_Q38	0.353	-0.004	0.111	
FL_Q89	-0.047	-0.772	-0.063	
FL_Q113	-0.073	-0.707	0.015	
FL_Q88	0.277	-0.306	-0.036	
FL_Q63	-0.049	-0.221	0.092	
FL_Q64	0.048	-0.191	0.064	
FL_Q188	0.046	-0.132	-0.032	
FL_Q163	0.041	-0.066	0.563	
FL_Q13	-0.001	0.011	0.419	
FL_Q39	0.26	-0.034	0.376	
FL_Q138	0.133	-0.012	0.181	
FM_Q65	0.636	-0.039	0.03	0.044
FM_Q114	0.511	0.029	0.016	0.034
FM_Q190	0.312	0.172	-0.104	-0.214
FM_Q115	0.199	0.013	0.027	-0.159
FM_Q139	-0.009	0.58	0.042	0.108
FM_Q165	0.063	0.378	-0.119	-0.004
FM_Q40	-0.004	0.354	0.116	0.057
FM_Q15	0.048	-0.011	0.51	-0.03
FM_Q164	0.002	-0.019	0.364	0.098
FM_Q189	-0.058	0.178	0.215	-0.149
FM_Q140	0.029	0.088	0.028	0.399
FM_Q90	-0.054	0.019	0.016	0.355
FN_Q66	0.475	-0.05	-0.057	
FN_Q191	0.472	-0.074	0.056	
FN_Q92	0.44	0.139	-0.197	
FN_Q141	0.429	-0.01	0.057	
FN_Q91	0.399	0.173	0.036	
FN_Q67	0.373	0.078	-0.355	
FN_Q17	0.229	0.002	0.048	
FN_Q42	-0.049	0.514	0.053	
FN_Q41	-0.048	0.463	-0.068	
FN_Q116	0.115	0.304	0.206	
FN_Q166	0.16	0.079	0.318	
FN_Q16	0.11	0.131	-0.151	
FQ1_Q69	0.67	0.044	0.046	0.02
FQ1_Q144	0.625	0.034	-0.01	-0.084
FQ1_Q45	0.038	0.413	-0.009	0.079

FQ1_Q119	-0.029	0.396	-0.003	0.027
FQ1_Q70	0.075	0.326	-0.066	-0.266
FQ1_Q20	0.086	0.261	-0.049	-0.007
FQ1_Q169	-0.026	0.21	0.104	-0.061
FQ1_Q44	-0.044	0.023	0.692	-0.005
FQ1_Q94	0.205	0.001	0.36	-0.014
FQ1_Q194	0.157	-0.049	0.055	-0.482
FQ1_Q19	0.069	-0.157	0.149	-0.351
FQ1_Q95	-0.052	0.208	-0.054	-0.292
FQ2_Q146	0.583	-0.056	0.048	
FQ2_Q121	0.498	0.064	-0.007	
FQ2_Q71	0.488	0.018	-0.096	
FQ2_Q196	0.388	0.135	0.141	
FQ2_Q96	0.294	0.053	0.115	
FQ2_Q171	0.001	0.573	0.115	
FQ2_Q21	0.09	0.483	-0.042	
FQ2_Q170	-0.037	0.034	0.585	
FQ2_Q195	0.149	-0.032	0.364	
FQ2_Q145	0.179	-0.119	0.276	
FQ2_Q46	-0.034	0.056	0.198	
FQ2_Q120	0.119	0.003	0.124	
FQ3_Q73	0.553	-0.035	-0.051	-0.074
FQ3_Q23	0.355	-0.085	-0.052	0.042
FQ3_Q97	0.246	0.076	-0.05	0.049
FQ3_Q72	0.233	0.114	0.046	0.023
FQ3_Q122	0.078	0.457	-0.102	0.07
FQ3_Q147	0.025	0.2	-0.521	-0.026
FQ3_Q22	0.054	-0.132	-0.453	0.093
FQ3_Q197	-0.019	0.184	0.021	0.466
FQ3_Q48	-0.006	0.069	-0.06	0.324
FQ3_Q172	0.038	-0.017	-0.012	0.223
FQ3_Q47	-0.007	-0.047	-0.007	0.193
FQ3_Q98	0.101	0.01	0.01	0.102
FQ4_Q199	0.549	-0.131	-0.064	
FQ4_Q173	0.42	0.161	0.072	
FQ4_Q148	0.378	0.067	0.073	
FQ4_Q24	0.368	-0.098	-0.119	
FQ4_Q149	0.287	-0.019	-0.132	
FQ4_Q99	-0.082	0.526	-0.227	
FQ4_Q174	0.105	0.443	-0.039	
FQ4_Q124	-0.015	0.28	0.044	
FQ4_Q49	0.184	0.247	-0.143	
FQ4_Q198	0.095	-0.039	-0.492	
FQ4_Q123	-0.028	0.057	-0.288	
FQ4_Q74	0.17	0.063	-0.201	