# VULNERABILITY AND FERTILITY IN THE EASTERN CAPE, SOUTH AFRICA: A HOUSEHOLDS' ANALYSIS

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> It is often taken for granted that the year 1956 heralds the birth of regional science. In this year Walter Isard's classic *Location and Space-Economy* was published.
>
> Nijkamp, Rose, and Kourtit (2015: 1)

> It seems plausible that the future of regional science will be marked by many uncertainties on the dynamics of the spatial economy. Prominent sources of such uncertainties are: global population dynamics and its spatial distribution (including the urban-rural divide), the future of urbanization in an era where the megatrend is towards urbanized settlement patterns, the complementary (sometimes mutually supportive) interface between physical-material and virtual-digital space interaction, and the complexity of governance systems in an age of unprecedented spatial transformation in our world. All such phenomena call for advanced research tools in regional science, for instance, on individual-collective spatial behaviour, design of early warning systems, for critical transitions ('tipping points') in space, self-organizing or resilient systems models on adaptability and vulnerability in space, or data mining in case of large-scale or massive databases.

> After the above exposition, it goes without saying that regional science is an *'Unvollendete'*[1]: there will always be more secrets behind the horizon which prompt our curiosity. Issues like the analysis of continuous space, the nature of spatial complexity, the future of data driven models, the spatial importance of the digital society, or dynamic space-time interactions will be a source of scholarly concern and scientific inspiration. It is predictable that regional science in the future will not be a boring a dismal science!
>
> Nijkamp and Ratajczak (2015: 24)

[1] '*Unvollendete*' – which is 'the unfinished' in German is understood in the discipline of Music as an unfinished symphony (Prompsit Language Engineering, 2017).

# AUTHOR'S DECLARATION

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Date: December 2018

# ABSTRACT

Poverty continues to be a significant challenge for countries of the Global South. However, the antecedent is volatile, hence the persistence of vulnerability. Surveillance of poverty and fertility in the Eastern Cape suggests that there is a relationship between households' vulnerability and fertility. The study analyses this relationship. The analysis validates or invalidates by means of deductive reasoning the hypothesis that there is a positive relationship between the vulnerability and fertility of Eastern Cape households. The study utilises descriptive (i.e. numerical and graphical summaries of vulnerability and fertility, and graphical summaries of their relationship) and inferential (i.e. correlation and regression analyses of the relationship between vulnerability and fertility) parametric statistical methods, as well as secondary and cross-sectional datasets (i.e. the 10% samples of the 2001 and 2011 South African censuses). The study concludes that there is no relationship between the vulnerability and fertility of the Eastern Cape's households. Policy implications of the study – in accordance with South Africa's National Development Plan (NDP) – include social security intervention strategies to reduce the Eastern Cape's poverty by 2030. This study recommends future studies to control socio-economic and spatial dynamics of vulnerability and fertility, and the utilisation of a longitudinal approach.

**Keywords and phrases:** fertility; National Development Plan (NDP); poverty; social security; vulnerability; vulnerability and fertility.

# OPSOMMING

Armoede bly 'n belangrike uitdaging vir lande van die Globale Suid. Die antesedent is egter onstabiel, daarom volhou kwesbaarheid. Oorsig oor armoede en vrugbaarheid in die Oos-Kaap dui daarop dat daar 'n verband tussen huishoudings se kwesbaarheid en vrugbaarheid is. Die studie analiseer dié verhouding. Die analise bekragtig of ongeldig deur middel van deduktiewe redenering die hipotese dat daar 'n positiewe verband bestaan tussen die kwesbaarheid en vrugbaarheid van Oos-Kaapse huishoudings. Die studie gebruik beskrywende (d.w.s numeriese en grafiese opsommings van kwesbaarheid en vrugbaarheid en grafiese opsommings van hul verhouding) en inferensiële (d.w.s korrelasie en regressie ontledings van die verhouding tussen kwesbaarheid en vrugbaarheid) parametriese statistiese metodes, sowel as sekondêre en dwarsdeursnee datastelle (d.w.s die 10% monsters van die 2001 en 2011 Suid-Afrikaanse sensusse). Die studie het tot die gevolgtrekking gekom dat daar geen verband is tussen die kwesbaarheid en vrugbaarheid van die Oos-Kaap se huishoudings nie. Beleidsimplikasies van die studie - in ooreenstemming met Suid-Afrika se Nasionale Ontwikkelingsplan (NGD) - sluit in maatskaplike sekuriteitsintervensiestrategieë om die Oos-Kaapse armoede teen 2030 te verminder. Hierdie studie beveel toekomstige studies aan om sosio-ekonomiese en ruimtelike dinamika van kwesbaarheid en vrugbaarheid te beheer, en die benutting van 'n longitudinale benadering.

**Sleutelwoorde en frases:** vrugbaarheid; Nasionale Ontwikkelingsplan (NGD); armoede; sosiale sekerheid; kwesbaarheid; kwesbaarheid en vrugbaarheid.

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# CHAPTER 1: INTRODUCTION

Poverty – the ex-post assessment of the current welfare status of an arrangement, like a household[2], is a notable provocation for countries of the Global South[3] (Günther & Harttgen, 2009; Kaul & Tomaselli-Moschovitis, 1999; Lister, 2004). The former disturbs not only those who are unequivocally linked with it, but the world at large. The manner in which poverty affects society is through its linkage with some of humanity's most critical social and political dilemmas such as overpopulation which is argued to be linked with fertility (Banerjee, Bénabou, & Mookherjee, 2006; Brym & Lie, 2010; Hinde, 2014; Macfarlane, 2013; Starbuck & Lundy, 2016; Trommsdorff, 2009). Poverty is dynamic, with welfare status changing over time (Yaqub, 2000). Notwithstanding the advancement on how to conceptualise poverty, empirical studies of the antecedent have failed to keep pace (Klasen & Waibel, 2013). Hence, the World Bank[4] is endorsing the utilisation of poverty assessments of future welfare status to understand its sources (Haughton & Khandker, 2009). This abstraction leads to the concept of vulnerability[5], a notion which has emerged in the Development Studies and Economics literature and has thus become a point of focus in society because of the major economic shocks that cause households to transition into poverty (Feeney & McDonald, 2016; Knottnerus, 2009; Walliman, 2011; Zhang & Wan, 2008).

The conceptualisation of the notion of households' vulnerability is the ex-ante assessment of the future welfare status of households because of negative idiosyncratic (i.e. micro or stochastic – household level) and covariate (i.e. macro or deterministic – regional level) welfare shocks (Alwang,

[2] 'Poverty' in this study is not characterised by a mere lack of income, it is characterised by a wide array of disadvantages (Alkire et al., 2015; Clarke, Feeney, & McDonald, 2014; Lok-Dessallien, 1999).

[3] 'Global South' is term that has emanated in post-colonial scholarship alluding to the countries of Africa, Asia, Latin America and the Caribbean, which are sometimes referred to as 'Third World' countries or the 'Developing World' countries (Braveboy-Wagner, 2009; Roy, 2014; Williams, Meth, & Willis, 2014).

[4] 'The World Bank' (Uniform Resource Locator (URL): http://www.worldbank.org/) is a constituent of the World Bank Group. The World Bank Group, through its five institutions; the International Bank for Reconstruction and Development (IBRD), the International Development Association (IDA), the International Finance Corporation (IFC), the Multilateral Investment Guarantee Agency (MIGA), and the International Centre for Settlement of Investment Disputes (ICSID); collaborates with poor people and poor countries to reduce their poverty. The World Bank consists of the IBRD and the IDA (The World Bank 2011).

[5] 'Vulnerability' originates from the word *vulnerare* in Latin which means 'to wound' (United Nations Development Programme, 2010).

Siegel, & Jorgensen, 2001; Chaudhuri, Jalan, & Suryahadi, 2002; Naudé, Santos-Paulino, & McGillivray, 2009b; Pritchett, Suryahadi, & Sumarto, 2000).

Statistics South Africa (Stats SA)[6] operationalises vulnerability in terms of the deprivation score of the South African Multidimensional Poverty Index (SAMPI). The SAMPI is a measure of acute poverty, which assesses deprivation to eleven (weighted) indicators, which are grouped into the four dimensions of health, education, standard of living, and economic activity. The SAMPI is argued to be an extremely useful systematic technique for the identification of vulnerable households (Alkire, Conconi, & Seth, 2014; Statistics South Africa, 2014).

The Eastern Cape features in South Africa's most elevated fertilities (Moultrie & Dorrington, 2004; Statistics South Africa, 2015; Udjo, 2005). Simultaneously, the province has amongst the country's most elevated vulnerabilities, the others being those of KwaZulu Natal and Limpopo, which also have the country's most elevated fertilities (Argent, Finn, Leibbrandt, & Woolard, 2009; Moultrie & Dorrington, 2004; Qizilbash, 2002; Statistics South Africa, 2015; Udjo, 2005).

The study is an analysis[7] of the relationship between the vulnerability[8] and fertility[9] of the Eastern Cape's households[10]. The analysis validates or invalidates by means of deductive reasoning the hypothesis, which emerges from Malthus (1798), that there is a positive relationship between the vulnerability and fertility of the Eastern Cape's households. The study which uses descriptive and

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[6] 'Stats SA' (URL: http://www.statssa.gov.za/) is a South African, "national government department accountable to the Minister in the Presidency: Planning, Monitoring and Evaluation. The activities of the department are regulated by the Statistics Act (Act No. 6 of 1999), which mandates the department to advance the production, dissemination, use and coordination of official and other statistics to assist organs of state, businesses, other organisations and the public in planning, monitoring, and decision-making. The Act also requires that the department coordinate statistical production among organs of state in line with the purpose of official statistics and statistical principles" (Statistics South Africa, 2017a: 24).

[7] An 'analysis' is the analytical decomposition of an issue (Castree, Kitchin, & Rogerson, 2013).

[8] 'Vulnerability' refers to the deprivation score of the SAMPI; and to the categories of 'invulnerable' and 'vulnerable', where households are categorised as 'invulnerable' if their deprivation score is less than 20%, and 'vulnerable' if their deprivation score is greater than or equal to 20%.

[9] 'Fertility' refers to the TFR; and to the categories of 'below replacement fertility' and 'above replacement fertility', where households are categorised to have 'below replacement fertility' if their TFR is less than 2.1 births per woman, and to have 'above replacement fertility' if their TFR is greater than or equal to 2.1 births per woman.

[10] A household – plural – 'households' – is a group of people that share a dwelling unit and combine their income to support each other (Castree et al., 2013).

inferential parametric statistical methods does so by means of two secondary and cross-sectional datasets, the 10% samples of the 2001 and 2011 South Africa censuses (on the nights 9-10 October 2001 and 2011 (Babbie, 2016; Field, Miles, & Field, 2012; Statistics South Africa, 2003, 2012).

The study aims to contribute to the knowledge of development studies and economics by enlightening as to whether the risk of the households of the Eastern Cape either remaining or entering into poverty in the future has the trajectory of the fertility of the households related to it. The policy implications of the study are social security intervention strategies to reduce poverty by 2030 in the Eastern Cape in accordance with South Africa's National Development Plan (NDP)[11] (National Planning Commission, 2011). The methods of this study are unique, since they will reveal new information since the quantitative, continuous ratio operationalisation of the vulnerability is in terms of the deprivation score of the SAMPI which is a contemporary method (published by Stats SA, for three full years to date, on 03 April 2014 at 11:30) (Statistics South Africa, 2014, 2017b).

Chapter 1 introduces the study and provides a background rationally contextualising the study. Chapter 2 presents a theoretical survey of the academic literature relevant to the study and a critical evaluation of the different ideas and arguments that support and contextualise the hypothesis of the study. Chapter 3 presents the methodology description and design of the analysis. Chapter 4 indicates the analysis results. Chapter 5 highlights the significance of the study.

[11] 'South Africa's NDP', "is a plan for the country [South Africa] to eliminate poverty and reduce inequality by 2030 through uniting South Africans, unleashing the energies of its citizens, growing an inclusive economy, building capabilities, enhancing the capability of the state and leaders working together to solve complex problems" (National Planning Commission, 2011: 1).

# CHAPTER 2: LITERATURE REVIEW

## 2.1 VULNERABILITY

The concept of poverty, which is the ex-post assessment of the current welfare status of households, forms the background to the notion of vulnerability. Vulnerability differs from poverty in that it is the ex-ante assessment of the future welfare status of households because of negative idiosyncratic and covariate welfare shocks. The welfare status of households is dynamic (Günther & Harttgen, 2009). Poverty assessments are criticised for not allowing for the ex-ante prevention of poverty, but rather solely focused on the ex-post alleviation of poverty. However, "it is better and more useful to meet a problem in time than seek a remedy after the damage is done," hence, it is necessary to provide indicators which evaluate the propensity for future poverty (Speake, 2015: 255). Adequate poverty assessments should measure the resilience of households to poverty to allow for the alleviation of the poverty of households through policy interventions, like social security (Suryahadi, Sumarto, & Pritchett, 2003). Hence, vulnerability, is argued to be a more accurate measure of poverty as it overcomes the aforementioned limitation of the poverty assessments, being that poverty assessments focus on the alleviation of diminished household welfare rather than for the prevention of the decline of households' welfare status (Alwang et al., 2001; Chaudhuri et al., 2002; Pritchett et al., 2000).

The causes of vulnerability are negative social, economic and environmental factors at a household and regional level (Harttgen & Günther, 2006). Hence, the vulnerability of households within a region display a spatially clustered pattern, with the households that have a high risk of either remaining or entering into poverty in the future tend to be in proximity to others with a high risk of future poverty (Naudé, Santos-Paulino, & McGillivray, 2009a). The occurrence of negative welfare shocks is not uniform across regions. Negative idiosyncratic welfare shocks are more prevalent in urban areas, and negative covariate shocks are more prevalent in rural areas (Naudé, McGillivray, & Rossouw, 2009). Vulnerable households and regions are said to develop vulnerability reduction strategies through heterogeneous mechanisms like bearing children for labour, technological advancement and social security (Aassve et al., 2005; Haughton & Khandker, 2009).

Vulnerability is strongly linked to the disciplines of economics and development studies; and to the notions of climate change, terrorism and conflict, and urbanisation and demographic shifts (Naudé, Santos-Paulino, et al., 2009b; Zhang & Wan, 2008). Previous studies of vulnerability, employing analytical and statistical methods, have concluded that vulnerability differs spatially and that, some of the factors of vulnerability are, dependency, education, employment, health, household structure,

income and mobility (Cancian & Reed, 2009; Chaudhuri et al., 2002; Christiaensen & Subbarao, 2005; Kochar, 1995; Naudé, McGillivray, et al., 2009; Nguyen, Raabe, & Grote, 2015).

## 2.2 FERTILITY

The systematic decomposition of the spatial and temporal dynamics of fertility[12], requires an existential phenomenology (Brazzell & Gillespie, 1982; Miller, 2008; Pearce, 1994; Sack, 1973; Schutz, 1967; Yuan, 2008). The seven major goals of social research includes identifying general patterns and relationships, testing and refining theories, making predictions, interpreting culturally or historically significant phenomena, exploring diversity, giving voice and advancing new theories (Ragin & Amoroso, 2011). Fertility is directly influenced by biological and behavioural factors which are themselves influenced by socio-economic factors. Hence, socio-economic factors indirectly influence fertility.

The conceptualisation of the concept of households' fertility (of women of childbearing ages)[13] is the total number of biological children born to the women of the households. Demographers operationalise fertility in terms of total fertility rate (TFR). TFR is the period estimate of the average number biological children born to a cohort of women of childbearing ages in the households. It is weighted according to childbearing ages and thus the age-specific fertility rates vary between cohorts as tempura roll variations in welfare shocks (Hinde, 2014; Lundquist, Anderton, & Yaukey, 2015; Mostert, Hofmeyer, Oosthuizen, & van Zyl, 1998).

Regions are said to be undergoing demographic transitions, if mortalities and fertilities decline in concert with processes of modernisation and industrialisation. This occurs in five stages, with the first demographic transition (FDT), resulting in the decline of their fertilities failing to keep pace with the decline of their mortalities occurring in the first four stages. In the fifth stage, the second demographic transition (SDT) results in social transformation in concert with constant declines in both fertility and mortality. The FDT is characterised by population decline, if migration is not a significant factor, since population growth or decline are determined by the difference between fertility, mortality and

[12] 'Spatial and temporal dynamics of fertility refer to changing fertility through geographic and/or physical space (different populations – i.e. the different households in the study with different geographic and/or physical space) and time (i.e. the years 2001 and 2011 in the study) (Miller, 2008; Sack, 1973; Yuan, 2008).

[13] 'Childbearing ages' are assumed to be the ages between 15 and 49 years in the study (Hinde, 2014; Preston, Heuveline, & Guillot, 2000; Weinstein & Pillai, 2016).

migration (Dyson, 2011; Kirk, 1996; McNamara, 1982; S. K. Smith, Tayman, & Swanson, 2002; Zelinsky, 1971). Regions are said to be undergoing the process of an age structural transition, if they are undergoing demographic transitions, and if their age structures transition from young age structures to old age structures (Chesnais, 1990; Hesketh & Xing, 2006; Pool, Wong, & Vilquin, 2006).

The disciplines of demography and population studies; the notions of population growth, the addressing of basic needs, family planning and reproductive rights; are strongly linked to fertility (Department of Social Development, 2015; Department of Social Development National Population Unit, 2000; Hinde, 2014). Previous studies of fertility, employing demographic and statistical methods, have concluded that fertility differs spatially and that, some of the factors of fertility are, age at first birth, dependency, education, employment, health, household structure, income, mobility and type of residence (Bongaarts & Potter, 1983; Heerink, 1994; Mostert et al., 1998; Moultrie & Dorrington, 2004; Statistics South Africa, 2015).

Malthus (1798) postulates, based on his observations of rise in inferiority for a sizeable part of England's population during the eighteenth and nineteenth centuries, that the function of population growth is linear and positive. Exponential population growth occurring, with a constant growth in food production will result in the population growth reaching a point whereby it cannot feed itself. Therefore, the relationship between vulnerability and fertility is positive from a Malthusian perspective. It advocates that those in poverty are at fault for their welfare status (Cypher & Dietz, 2004; Winch, 2013). However, Boserup (1965), proclaims the counter argument to that of Malthus (1798) asserting that through research and development society will always develop approaches to feed itself, through innovation and production technologies (Gilbert, 2005; Moseley, Perramond, Hapke, & Laris, 2014). Hence, there is no relationship between vulnerability and fertility from a Boserupian perspective.

Policy in South Africa developed the Child Support Grant (CSG) system, which has the objective of redressing the past social welfare past inequities of the apartheid government, by supporting children up to the age of 14 years. However, a problem exists that there is a gap in the uptake of the CSG by those who qualify, especially those above the age of 6 (Lund, 2008; Patel, 2005). Hence, the CSG is not a factor that increases fertility. The monetary value of the child support is, further, argued to be of a level that is below that of those that are in employment in South Africa. Hence, the CSG has the potential of pushing households into poverty if they have a child with the aim of raising it with the CSG (Surender, Noble, Wright, & Ntshongwana, 2010).

# CHAPTER 3: METHODOLOGY

The purpose of this study is to determine whether there is a positive relationship between the vulnerability and fertility of the Eastern Cape's households (Kothari, 2004; E. Smith, 2008). Hence, the study for the years 2001 and 2011; employs, in Stata®, Excel® and RStudio®; numerical and graphical summaries, correlation analyses, and regression analyses, of the relationship between the vulnerability and fertility (Chawla & Sondhi, 2011; Faraway, 2005; Hamilton, 2009; Harris & Jarvis, 2011; Politano & Walton, 2017; Utts & Heckard, 2015; Verzani, 2011; Wackerly, Mendenhall III, & Scheaffer, 2008; Walkenbach, 2015).

The research paradigm is a positivist research paradigm (Blaikie & Priest, 2017; Corbetta, 2003; Kuhn, 1962). The conceptualisation of vulnerability is the ex-ante assessment of the future welfare status of households because of negative idiosyncratic and covariate welfare shocks (Alwang et al., 2001; Chaudhuri et al., 2002; Naudé, Santos-Paulino, et al., 2009b; Pritchett et al., 2000). The conceptualisation of the concept of fertility is the total number of biological children born to the women of the households (Preston et al., 2000; Weinstein & Pillai, 2016). The construct of vulnerability in the study is the deprivation score of the SAMPI of the households (Statistics South Africa, 2014). The aforementioned deprivation score of the SAMPI and TFR are quantitative, continuous, ratio operationalisations of the vulnerability and fertility variables, respectively.

The qualitative, ordinal operationalisations of the vulnerability and fertility variables are categorised as 'invulnerable' and 'vulnerable'; and 'below replacement fertility' and 'above replacement fertility', respectively. Households are categorised as 'invulnerable' if their deprivation score is less than 20%, and 'vulnerable' if their deprivation score is greater than or equal to 20%. Fertility is categorised to have 'below replacement fertility' if their TFR is less than 2.1 births per woman, and to have 'above replacement' if their TFR is greater than or equal to 2.1 births per woman (Alkire et al., 2014; Fleming & Nellis, 2000; Lewis, 2012; United Nations Population Division, 2007). The study sources two secondary and cross-sectional datasets; the 10% samples of the 2001 and 2011 South Africa censuses (Statistics South Africa, 2003, 2012).

The hypothesis of the study is that there is a positive relationship between the vulnerability and fertility of the Eastern Cape's households (Boserup, 1965; Malthus, 1798; Ragin & Amoroso, 2011). Hence, the main research question of the study is, the relationship between the vulnerability and fertility of the Eastern Cape's households (Dixon, Singleton, & Straits, 2016) The study population and area are the households of the Eastern Cape Province of South Africa, which is located on the east coast of South Africa. The province is surrounded by those of the Free State, Kwa-Zulu Natal,

the Northern Cape as well as the Kingdom of Lesotho. The Eastern Cape is one of South Africa's provinces which contain both urban and rural parts, this because it is an amalgamation of a part of the former Cape Province and the former homelands of the Ciskei and Transkei (Heyns, Boekstein, & Spencer, 2000; Main, 2017; McCrea, Reid, Velton, & Pinchuck, 2015; Nirmala, Edison, & Suni, 2011) (Appendix A).

Demographic data in countries of the Global South, and particularly Sub-Saharan Africa, is argued to be of be incomplete and inaccurate quality (Moultrie et al., 2013). This could be a threat to the internal validity of the study. Further, because the study uses comprehensive data and does its operationalisations at a household level rather than at a large aggregate level it is argued to be a base for inductive qualitative studies that will explore the households' of the Eastern Cape's vulnerability and fertility dynamics, hence, being argued to generate a robust study with a high external validity (McCaig, 2010; Mitchell & Jolley, 2009). The numerical and graphical summaries enable the study to descriptively study the relationship between the vulnerability and fertility of the Eastern Cape's households. The numerical summaries and graphical summaries for the quantitative, continuous, ratio operationalisations of the vulnerability and fertility variables are mainly used for the study of the centre and spread of the variables which can contribute significantly to the study; while those of the qualitative, ordinal operationalisations of the vulnerability and fertility variables are of significance to the exploration of the frequencies of the categories of the variables. The graphical summaries extend on the aforesaid features, hence, reveal hidden features of the variables which the numerical summaries are unable to unpack. The correlation analyses enable the study to inferentially study the relationship between the vulnerability and fertility of the Eastern Cape's households and enable the study to make inferences on the magnitude and strength of the relationship. The regression analyses enable the study to inferentially study the relationship between the vulnerability and fertility of the Eastern Cape's households and the effect of the fertility on the vulnerability.

# CHAPTER 4: ANALYSIS

The analysis of the study is by means of a Frequentist (i.e. Classical) statistical paradigm. The previously mentioned statistical school of thought informs the epistemology of the study, which then apprises the ontology of the study. All inferences are at 5% statistical level of significance, hence, 95% level of confidence (Efron & Hastie, 2016; Friedl & Hörmann, 2008; Pruzan, 2016; Stauffer, 2008).

Numerical and graphical summaries of the vulnerability and fertility variables are employed for the description of the centre and kurtosis of the vulnerability and fertility. From the means, medians, frequency distributions and relative frequency distributions of the vulnerability and fertility it is concluded that; the centre of the vulnerability has shifted in a positive direction between 2001 and 2011 while that of fertility has remained constant, hence, vulnerability has increased while fertility has remained constant. Secondly, from the lower quartiles, upper quartiles, variances and standard deviations it is concluded that; the kurtosis of the vulnerability and fertility is high. Hence, the numerical summaries indicate that there is no relationship between the vulnerability and fertility (Table 4.1; Table 4.2).

Table 4.1 Numerical summaries of the quantitative, continuous, ratio operationalisations of the vulnerability and fertility variables, 2001 and 2011.

| **Numerical summary** | **2001** | | **2011** | |
|---|---|---|---|---|
| | **Vulnerability** | **Fertility** | **Vulnerability** | **Fertility** |
| Mean | 0.1 | 0.0 | 0.2 | 0.0 |
| Median | 0.1 | 0.0 | 0.1 | 0.0 |
| Lower quartile | 0.0 | 0.0 | 0.0 | 0.0 |
| Upper quartile | 0.1 | 0.0 | 0.3 | 0.0 |
| Variance | 0.0 | 0.0 | 0.0 | 0.0 |
| Standard deviation | 0.1 | 0.2 | 0.1 | 0.2 |

Table 4.2 Frequency and relative frequency distributions of the qualitative ordinal operationalisations of the vulnerability variables, 2001 and 2011.

| **Vulnerability** | **Frequency** | | **Relative frequency** | |
|---|---|---|---|---|
| | **2001** | **2011** | **2001** | **2011** |

| | | | | |
|---|---|---|---|---|
| Invulnerable | 112845 | 79583 | 0.9 | 0.5 |
| Vulnerable | 18283 | 65783 | 0.1 | 0.5 |
| **Total** | **131128** | **145366** | **1.0** | **1.0** |

Table 4.3 Frequency and relative frequency distributions of the qualitative ordinal operationalisations of the fertility variables, 2001 and 2011.

| **Fertility** | **Frequency** | | **Relative frequency** | |
|---|---|---|---|---|
| | **2001** | **2011** | **2001** | **2011** |
| Below replacement fertility | 131128 | 0 | 1.0 | 1.0 |
| Above replacement | 0 | 0 | 0.0 | 0.0 |
| **Total** | **131128** | **145366** | **1.0** | **1.0** |

From the histograms and kernel density plots of the vulnerability and fertility, which are adopted for the display of the distributions of the vulnerability and fertility, the former for the display of the unsmoothed distributions and the latter for the smoothed distributions; it is concluded that the vulnerability is bimodal and that the fertility is unimodal. Secondly, the distribution of the vulnerability has changed between 2001 and 2011, with the kurtosis decreasing between the period. Thirdly, vulnerability has also undergone a temporal shift a feature which is also observed in the numerical summaries above. Hence, the graphical summaries of the vulnerability and fertility reach the same conclusion as the numerical summaries, of no relationship between the vulnerability and fertility (Figure 4.1; Figure 4.2; Figure 4.3; Figure 4.4; Figure 4.5; Figure 4.6; Figure 4.7; Figure 4.8).

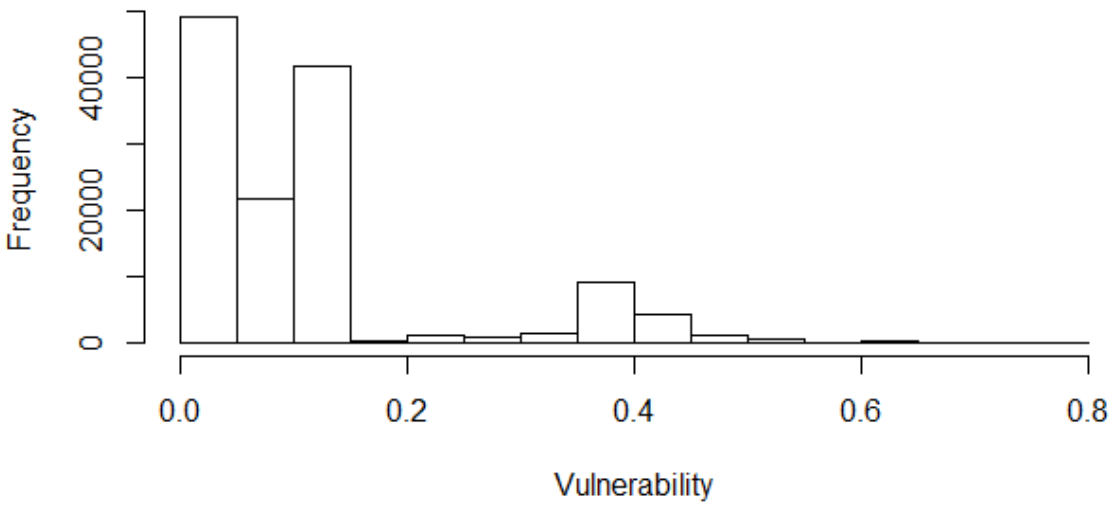


Figure 4.1 Histogram of the quantitative, continuous, ratio operationalisation of the vulnerability variable, 2001.

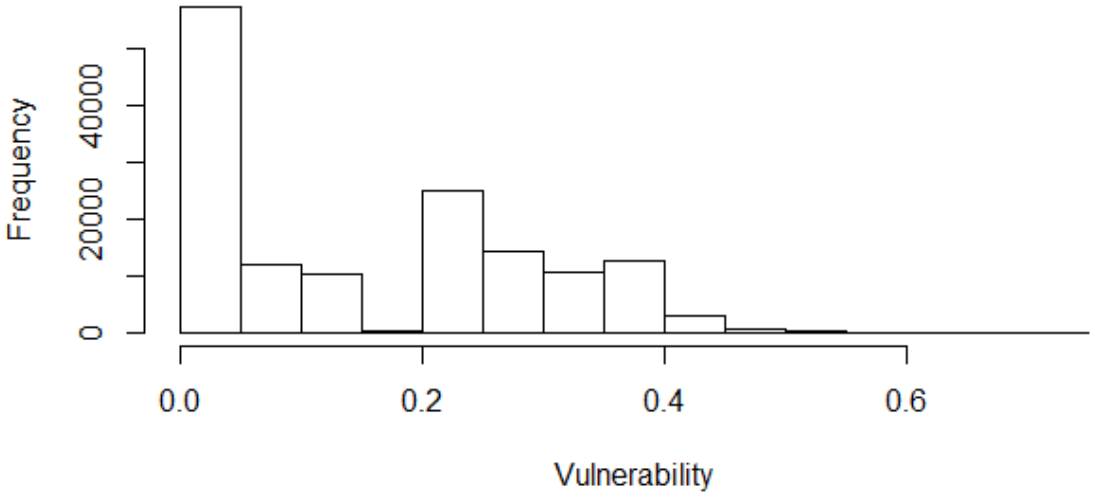


Figure 4.2 Histogram of the quantitative, continuous, ratio operationalisation of the vulnerability variable, 2011.

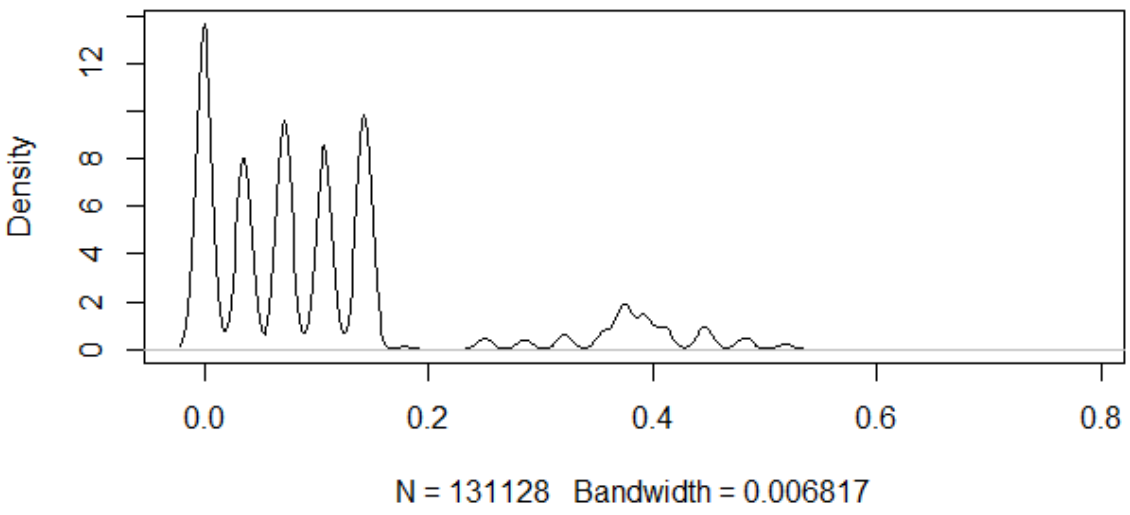


Figure 4.3 Kernel density plot of the quantitative, continuous, ratio operationalisation of the vulnerability variable, 2001.

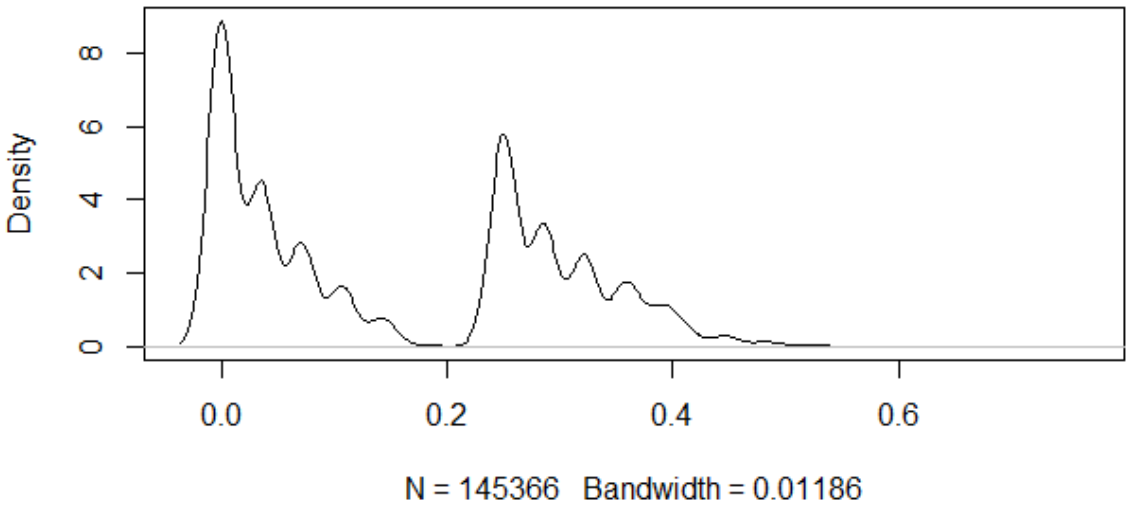


Figure 4.4 Kernel density plot of the quantitative, continuous, ratio operationalisation of the vulnerability variable, 2011.

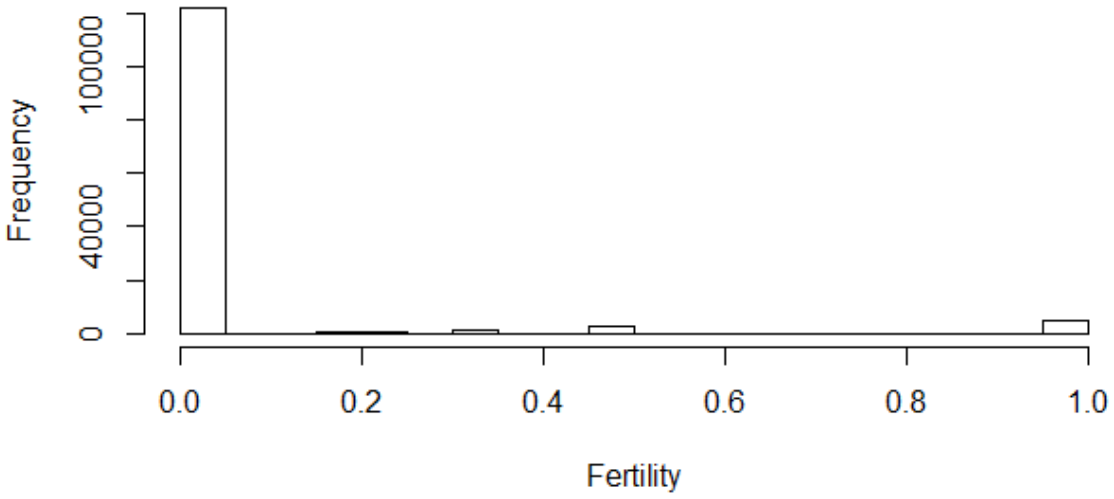


Figure 4.5 Histogram of the quantitative, continuous, ratio operationalisation of the fertility variable, 2001.

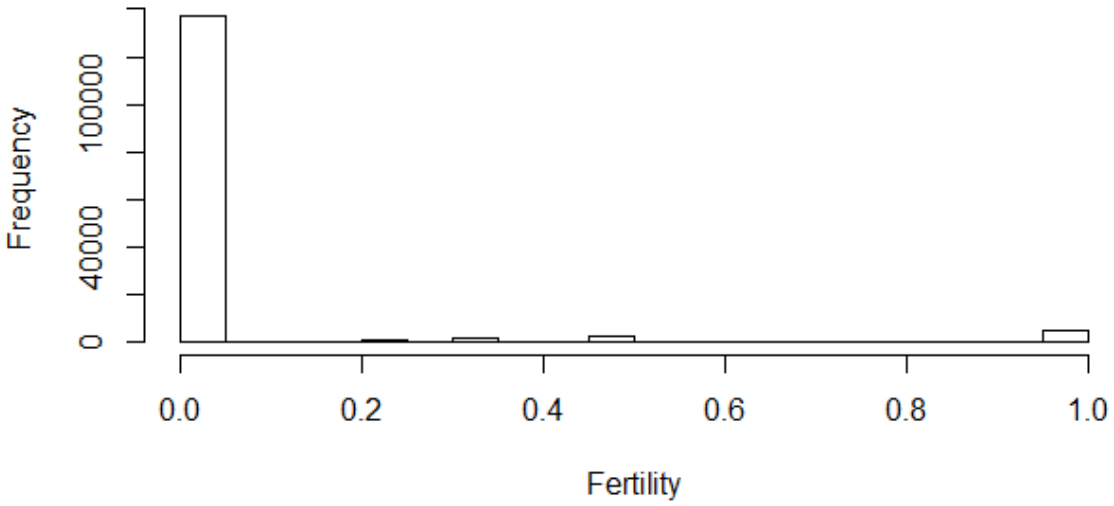


Figure 4.6 Histogram of the quantitative, continuous, ratio operationalisation of the fertility variable, 2011.

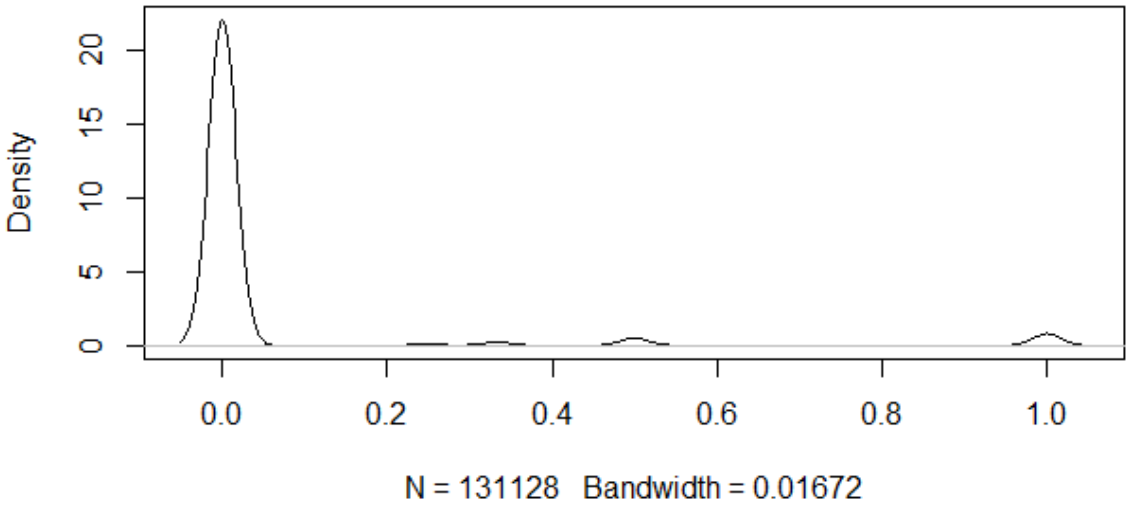


Figure 4.7 Kernel density plot of the quantitative, continuous, ratio operationalisation of the fertility variable, 2001.

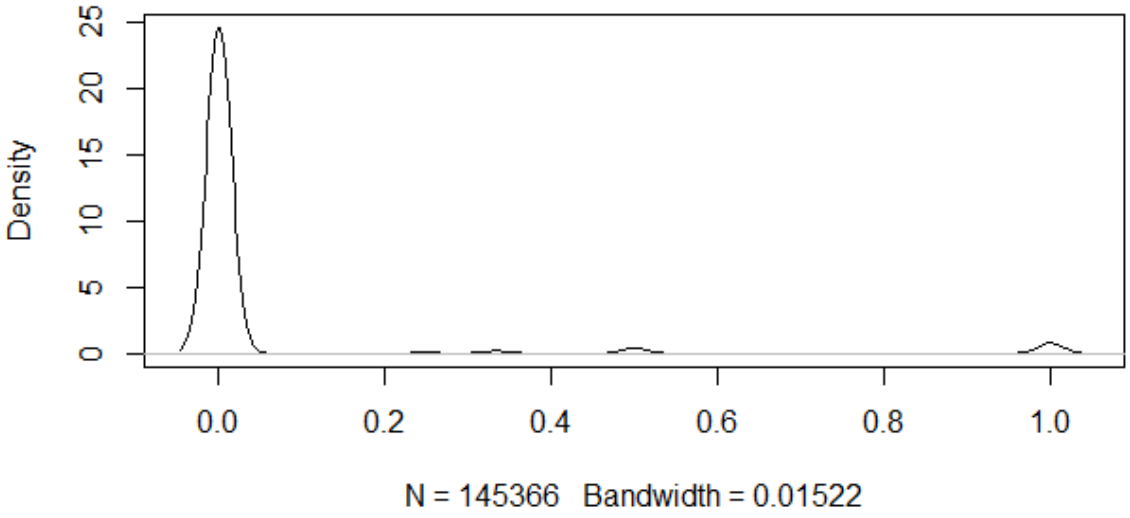


Figure 4.8 Kernel density plot of the quantitative, continuous, ratio operationalisation of the fertility variable, 2011.

Graphical summaries, scatter plots, of the relationship between the vulnerability and fertility are employed for the analyses of how the vulnerability is affected by the fertility. From the scatter plots in 2001 and 2011, it is concluded that vulnerability is not affected by fertility, since the gradient of the line fitted by the method of ordinary least squares is observed to be approximately 0. Therefore,

the graphical summaries of the relationship between the vulnerability and fertility re-inforce the conclusion made above that there is no relationship between the vulnerability and fertility (Figure 4.9; Figure 4.10).

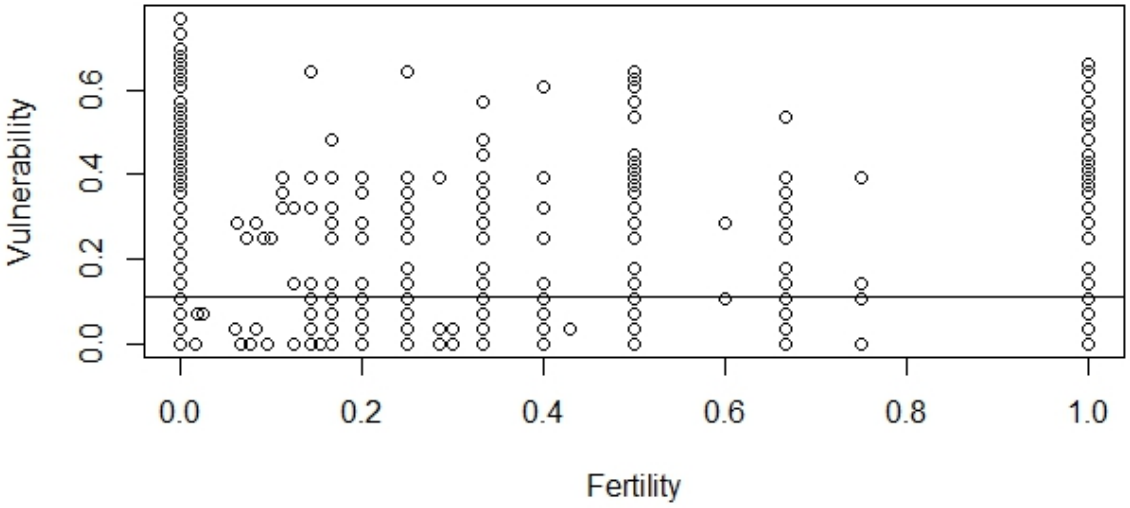


Figure 4.9 Scatter plot of the quantitative, continuous, ratio operationalisations of the vulnerability and fertility variables, 2001.

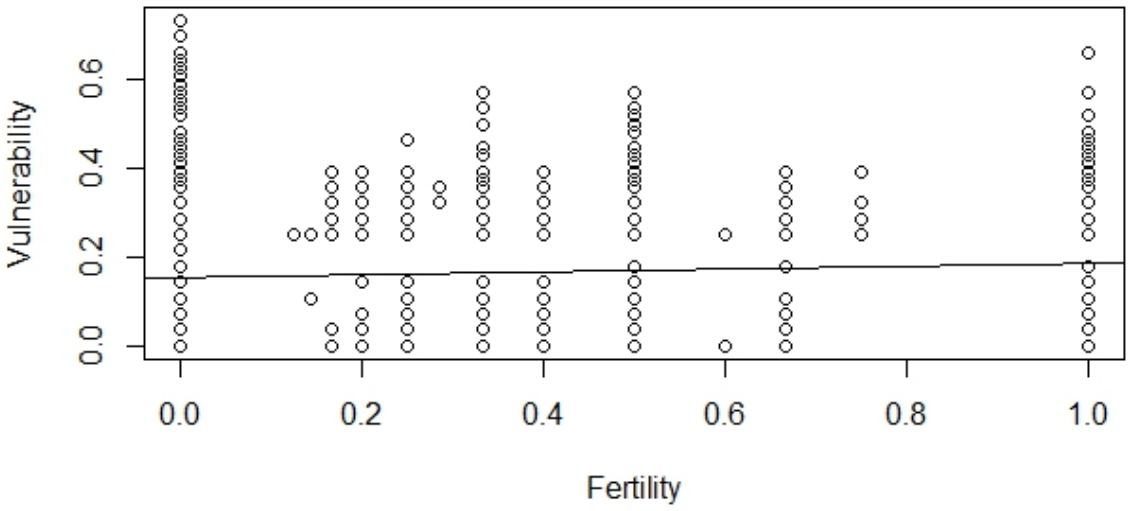


Figure 4.10 Scatter plot of the quantitative, continuous, ratio operationalisations of the vulnerability and fertility variables, 2011.

Pearson's product-moment correlation analyses of the relationship between the vulnerability and fertility are employed for the description and inference of the extent of the relationship between the vulnerability and fertility. Preceding, the antecedent are Q-Q plots to assess one of its two assumptions, that of the normality of the vulnerability and fertility variables, the other assumption, that of the linearity between the vulnerability and fertility variables, is deduced from the scatter plots above, and it is concluded that the assumption is violated. From the Q-Q plots of the vulnerability and fertility variables the assumption of normality is also violated. Hence, both assumptions of Pearson's product-moment correlation analyses are violated, therefore, the study does not progress with Pearson's product-moment correlation analyses, since its assumptions are violated, therefore, posing the threat of a dismissible deduction (Figure 4.11; Figure 4.12).

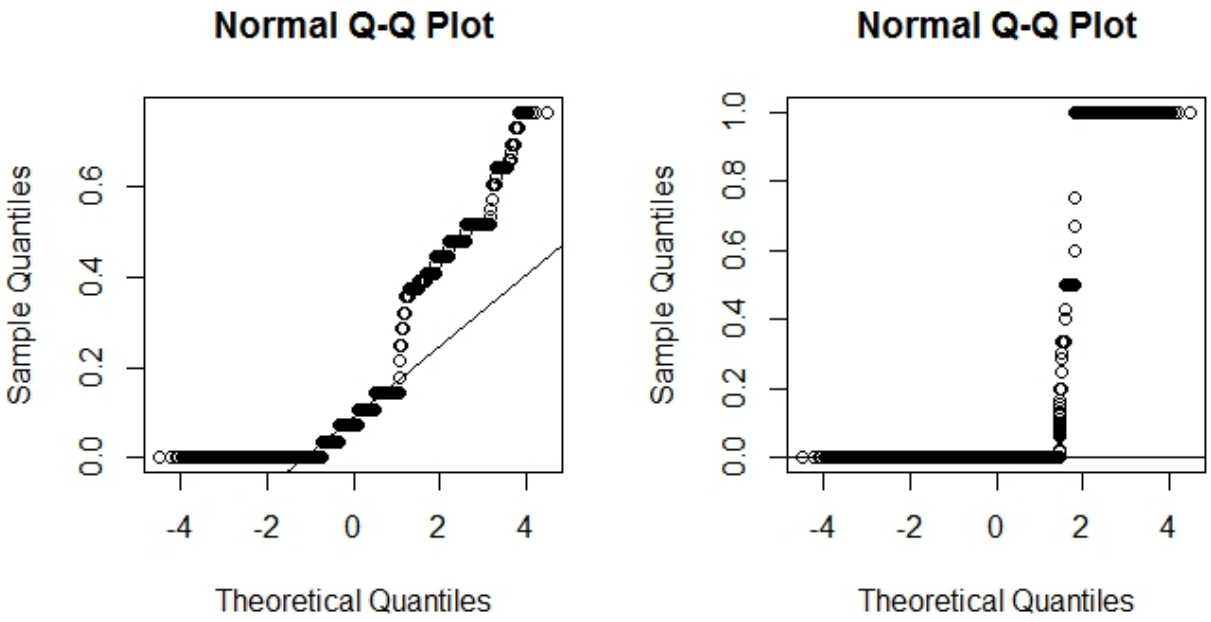


Figure 4.11 Q-Q plot of the quantitative, continuous, ratio operationalisations of the vulnerability and fertility variables, 2001.

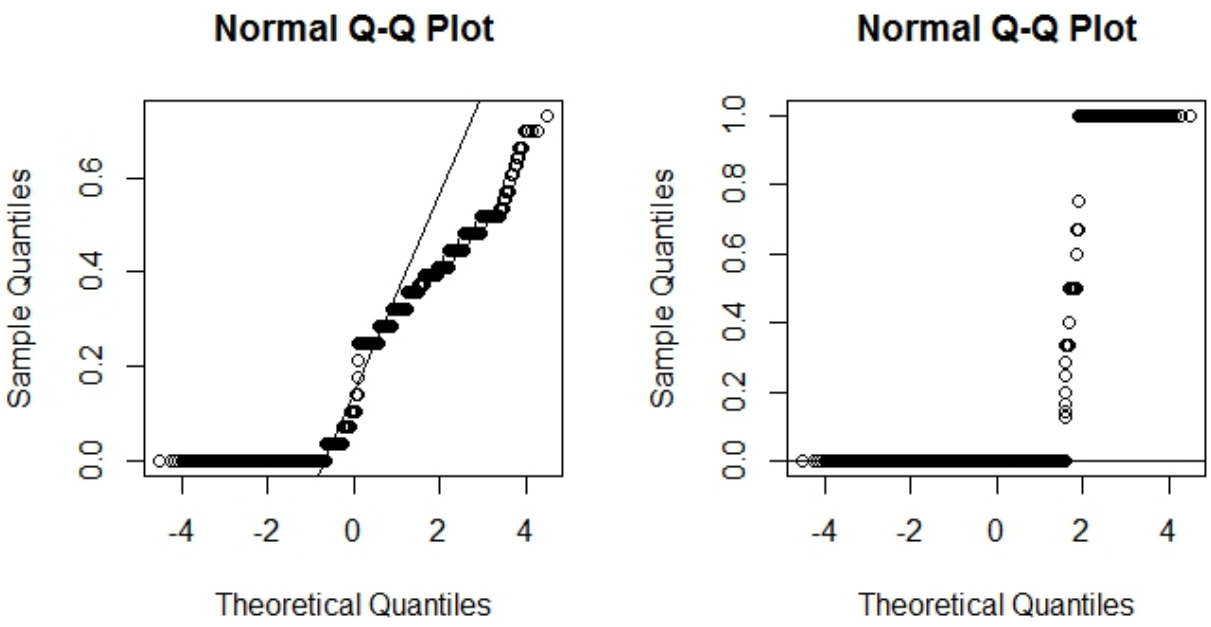


Figure 4.12 Q-Q plot of the quantitative, continuous, ratio operationalisations of the vulnerability and fertility variables, 2011.

Ordinary least squares simple linear regression analyses of the relationship between the vulnerability and fertility are employed for the modelling and analysis of the relationship between the vulnerability and fertility. However, regression is coupled with the four assumptions of linearity, homoscedasticity, independence and normality. The first assumption of linearity is that the relationship between the fertility and vulnerability is linear; which from the diagnostic plots is violated since the plots of the residuals against the fitted values display the residuals as being high. The second assumption of homoscedasticity is that the variance of the residuals of the vulnerability are constant; this assumption is upheld by the assessment of the diagnostic plots since the pattern from the scale-location plots is constant with, 2001 deviating slightly. The third assumption of independence is that observed vulnerabilities and fertilities amongst the households of the Eastern Cape in 2001 and 2011 are independent of each other, meaning that the spatial and temporal observations of the variables do not influence each other and this is argued to be violated since the data collection process of the census data which the study employs is not 100% consistent as different enumerators collect the data for the different households and this could be argued to the spatial and temporal dimensions of the data. The fourth assumption of normality is that the residuals of the regression are normally distributed and this assumption is violated, inferred from the Q-Q plot of the residuals. Hence, three of the four assumptions of ordinary least squares simple linear regression analyses of the relationship between the vulnerability and fertility are violated, therefore, the study does not progress with ordinary least

squares simple linear regression analyses of the relationship between the vulnerability and fertility, since its assumptions are violated, therefore, posing the threat to the study (Figure 4.13; Figure 4.14).

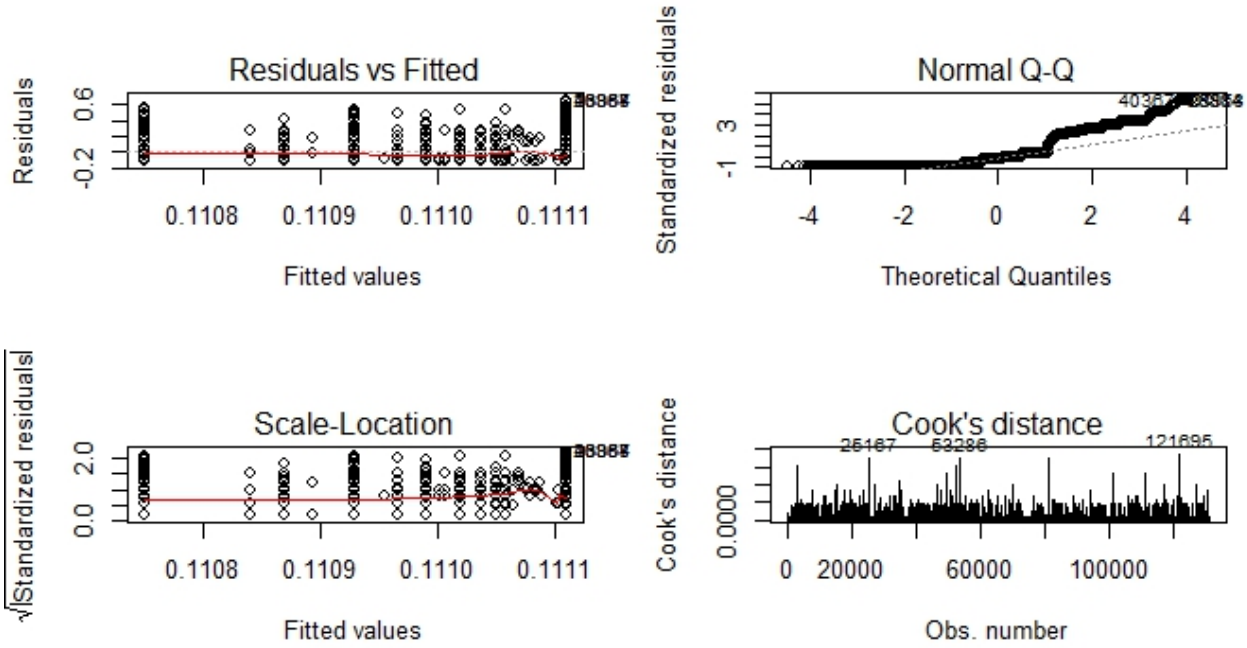


Figure 4.13 Diagnostic plots of the quantitative, continuous, ratio operationalisations of the vulnerability and fertility variables, 2001.

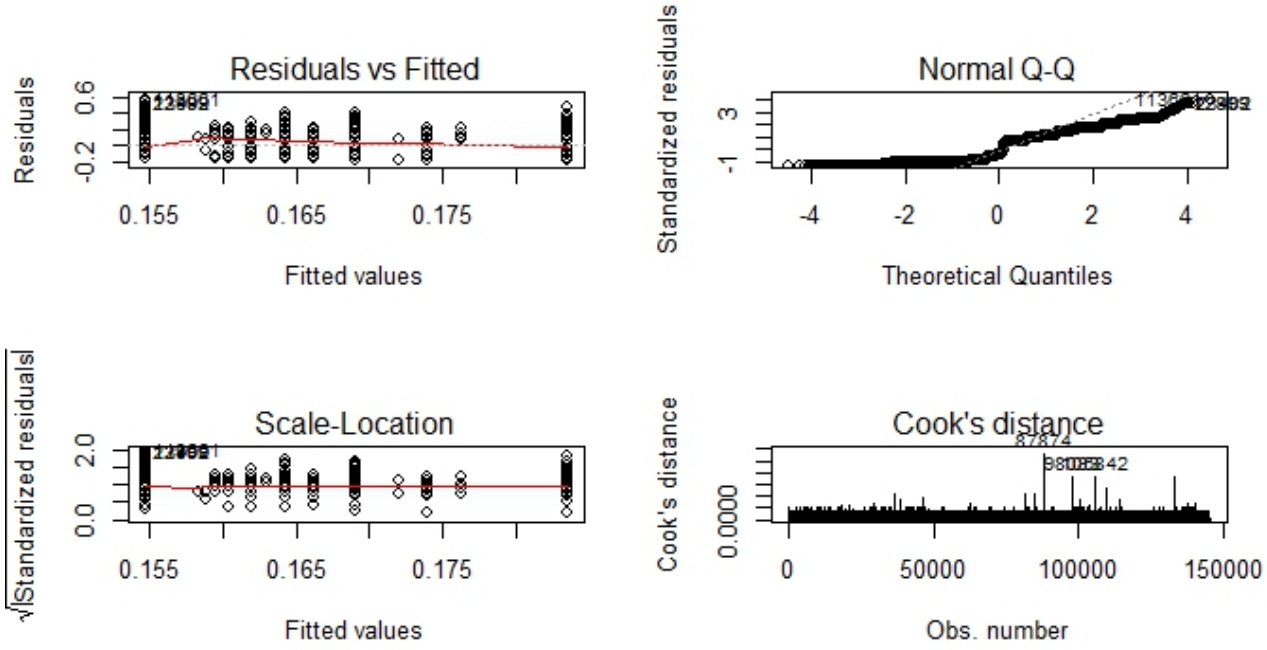


Figure 4.14 Diagnostic plots of the quantitative, continuous, ratio operationalisations of the vulnerability and fertility variables, 2011.

# CHAPTER 5: CONCLUSION

South Africa is undergoing the process of a demographic transition having its fertility decreasing. There is the consensus that the fertility of the Eastern Cape is high with its vulnerability behaving in the same trajectory. There are the trends that are becoming ubiquitous amongst the households of the Eastern Cape smaller family sizes through the adoption of family planning. The study analyses the relationship between the vulnerability and fertility of the Eastern Cape's households for the years 2001 and 2011. South Africa's 10% sample census datasets for 2001 and 2011 are structured by having their individuals (i.e. people) linked to their households and their characteristics that were recorded during the undertaking of the censuses. Vulnerability is characterised as the ex-ante assessment of the future welfare status of households because of negative idiosyncratic and covariate welfare shocks. Fertility is characterised as the total number of biological children born to the women of the households. The aim of the study is to test the validity of the anterior consensus, which emerges from Malthus, of a relationship between the vulnerability and fertility of the Eastern Cape's households in 2001 and 2011, by adopting census data for the two time periods. A Malthusian perspective, reviewed in the literature review of the study, argues that there is a relationship between the vulnerability and fertility of the Eastern Cape's households. On the contrary, a Boserupian perspective argues that there is no relationship between the vulnerability and fertility of the Eastern Cape's households.

The analysis of the study is conducted by means of numerical and graphical summaries, correlation analyses, and regression analyses, of the relationship between the vulnerability and fertility. The numerical and graphical summaries indicate that on average the households of the Eastern Cape in 2001 were at the halfway mark to the reach of poverty and in 2011 they were in poverty on average; indicating that the households had become impoverished over the ten period, which is argued to be a rapid transition into poverty for the households. Further, the vulnerability and fertility variables display skewed distributions, that of vulnerability being bimodal on the unsmoothed histograms of the vulnerability and multimodal on the smoothed kernel density plots of the vulnerability. Hence, it is argued that it is the index properties of the SAMPI that are the cause of the sharp points of the smoothed kernel density plots. A disadvantage an index measure for a continuous variable that is that it introduces the properties of discrete variable which then implies that it cannot be measured at continuous values of the fertility.

The diagnostics of the correlation and regression analyses indicate that the fertility deviates from the Gaussian distribution. This is argued to be influenced by South Africa's family planning programmes

which have given women control in terms of their childbearing and have influenced the distribution of the fertility to deviate from the Gaussian distribution. South Africa's CSG is argued not to influence nor to prevent vulnerability as there has been as positive shift, in vulnerability from 2001 to 2011, thus making elastic, while fertility has been completely inelastic. The aforesaid premises subtend the argument of a Boserupian perspective for the relationship between the vulnerability and fertility of the Eastern Cape's households in 2001 and 2011. Hence, the study concludes that there is no relationship between the vulnerability and fertility of the Eastern Cape's households in 2001 and 2011.

It is recommended that further studies control for the socio-economic and spatial dimensions of vulnerability and fertility, which could address the inconclusive results of the study in 2001 and generate results that are more robust in 2011. The former being at least at the geographical level of the urban-rural divide. However, the urban-rural divide is still broad and intersects with the socio-economic components of vulnerability; a sub-place geographical that could be argued to generate more robust results because of the spatial processes of hypersegregation and class-based segregation that are occurring in South Africa (Geyer Jr. & Mohammed, 2016). Finally, a longitudinal approach is also recommended, since vulnerability is a temporal notion, and the data from the National Income Dynamic Study (NIDS), which to date, has data following the same households from 2008 to 2014 (Chinhema et al., 2016).

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# 7. APPENDICES

**A** Study population and area

## APPENDIX A: STUDY POPULATION AND AREA


Source: Municipal Demarcation Board (2008)