MACRO-ECONOMIC POLICY AND PERSONAL FINANCE INFLUENCES ON WEALTH INEQUALITY IN SOUTH AFRICA

by

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i Declaration

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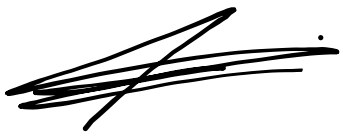

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22 October 2021

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iii Dedication

This thesis is firstly dedicated to each and every South African. While I was never born in poverty, I have seen enough people suffer in this country of ours to know that it is a problem that I cannot ignore. This dissertation I wrote for you. It is our responsibility to ensure we create a society where every person has enough to eat, has a roof over their head and are able to make a meaningful and positive contribution to our country. May the sun always shine brightly on Africa. May her future be even brighter!

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Abstract

In South Africa, high levels of wealth inequality have persisted since 1994, to the extent that 1% of the population owns 50% of the wealth. Many South Africans lead marginalised lives as consequence of wealth inequality. This study employed a quantitative behavioural life-cycle model to investigate how macroeconomic policies and personal financial choices influenced wealth inequality in South Africa over the period 2010 to 2019. Results show that there was a negligible decrease in wealth inequality. Most South Africans do not possess enough wealth for personal financial management to influence wealth inequality negatively. Policies to redistribute wealth are unable to meet wealth redistributive targets. To reduce wealth inequality through personal financial management, household resource allocation should prioritise education in labour sectors that possess a critical shortage of skills. This will provide a mechanism for wealth accumulation through stable and higher future income levels. Government redistributive policies should change from predominantly lump sum transfers to the targeting of high labour market absorption. An open labour market would support private and foreign direct investment, strengthening economic growth and providing the marginalised upliftment through increased income and the opportunity to accumulate wealth.

Keywords: wealth inequality, wealth redistribution, wealth accumulation, quality of life, macroeconomic policy, behavioural life cycle model, South Africa

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CHAPTER 1: INTRODUCTION

1.1 Background

Wealth inequality continues to increase at a faster rate globally in spite of increased levels of skill and knowledge, productivity from employees, strong financial performance from corporates and continued growth in global gross domestic product (GDP) (Bivens and Mishel, 2015; Frick, 2016; Goda, 2016; Barkai and Benzell, 2018; Zucman, 2019; World Bank, 2020).

In South Africa, high levels of wealth inequality have persisted since the abolishment of Apartheid in 1994, an institutional system of political, social and economic exclusion of the non-white majority population, to the extent that 1% of the population owns 50% of the wealth. Wealth represents the total sum of all assets of an individual or household, and includes financial assets such as equity, bonds, property and private pension rights. Income earned by individuals in the labour market provides a natural mechanism to procure and accumulate wealth over the long-term. Income as a source of wealth generation and consequent wealth accumulation may include the purchase of property; investing in the stock or bond markets through investment vehicles, such as unit trusts, exchange-traded funds and exchange-traded notes; accumulating long-term savings through notice deposit accounts, retirement annuities and employer or private pension fund schemes (Von Fintel and Orthofer, 2020).

Wealth also provides the capability to affect both standard of living (SoL) and quality of life (QoL) indicators, such as protection against income shocks, increased access to healthcare and education and increased life expectancy. SoL refers to the material well-being of the average person in a given population (Birčiaková, Stávková and Antošová, 2015). QoL is defined as the degree to which impartial human needs are fulfilled in relation to individual and communal perceptions of subjective well-being. These needs comprise of basic human needs, such as subsistence, reproductive and security needs, and subjective well-being, such as affection, identity, leisure and creative expression (Costanza, Fisher, Ali, Beer, Bond, Boumans, Danigelis, Dickinson, Elliott, Farley, Elliott Gayer, MacDonald Glenn, Hudpseth, Mahoney,

McCahill, McIntosh, Reed, Rivzi, Rizzo, Simpatico and Snapp, 2007). Wealth and QoL accordingly share a positive correlation. Regarding QoL, many South Africans lead marginalised lives as consequence of wealth inequality due to economic marginalisation, so much so that President Thabo Mbeki described in 2003 that the country is comprised of two distinct economies. The first economy is described as modern, owns and produces the majority of the wealth in South Africa and is integrated within the global economy. The second economy is structurally disconnected from the first economy and the global economy, produces little wealth and economic growth, contains the majority of the population and incorporates the poorest of the rural and urban population (Senik, 2014; Adebajo and Virk, 2018; Eurostat, 2019).

Since individuals who earn higher incomes tend to accumulate more wealth over time (Sullivan and Wolla, 2017), income inequality is an important factor to consider regarding wealth inequality. The Gini coefficient is the most widely used income inequality measure (Gastwirth, 2017). According to Lechthaler, Pauly and Mucklich (2020), the Gini coefficient is a statistical measure that condenses the entire income distribution of a population into a single number, where a value of 0 represents perfect equality and a value of 1 represents maximum inequality.

Globally, income inequality has increased over the past three decades. Across emerging economies, the Gini coefficient has also increased more than in developed economies and the global market (Alvaredo, Chancel, Piketty, Saez and Zucman, 2018; Derviş and Qureshi, 2016). Changes in income inequality across selected emerging markets, however, show a large variance (Peters and Volwahsen, 2016). Table 1 below, illustrates the Gini coefficients for Argentina, Brazil, China, Indonesia, Mexico and South Africa. South Africa's income Gini coefficient appears much higher in relation to these emerging market peers.

Table 1: Gini coefficient, GDP per capita and population size for select emerging markets in 2014.

Country	Gini coefficient	GDP per capita (2020 US$)	Population size	Average annual population growth (1996-2014) (%)
Argentina	41.7	12 334.798	42 669 500	1.06
Brazil	52.1	12 112.588	202 763 735	1.18
China	39.2	7 678.599	1 364 270 000	0.66
Indonesia	40.8	3 491.625	255 129 004	1.36
Mexico	48.7	10 922.376	120 355 128	1.43
South Africa	63.0	6 433.187	57 779 662	1.46

Source: World Bank (2020)

The Gini coefficient is primarily driven by changes in GDP per capita over time. Luan and Zhou (2017) show that as GDP per capita increases, the Gini coefficient should decrease. Figure 1 illustrates that South Africa's GDP per capita has increased over time, yet the Gini coefficient has remained relatively unchanged.

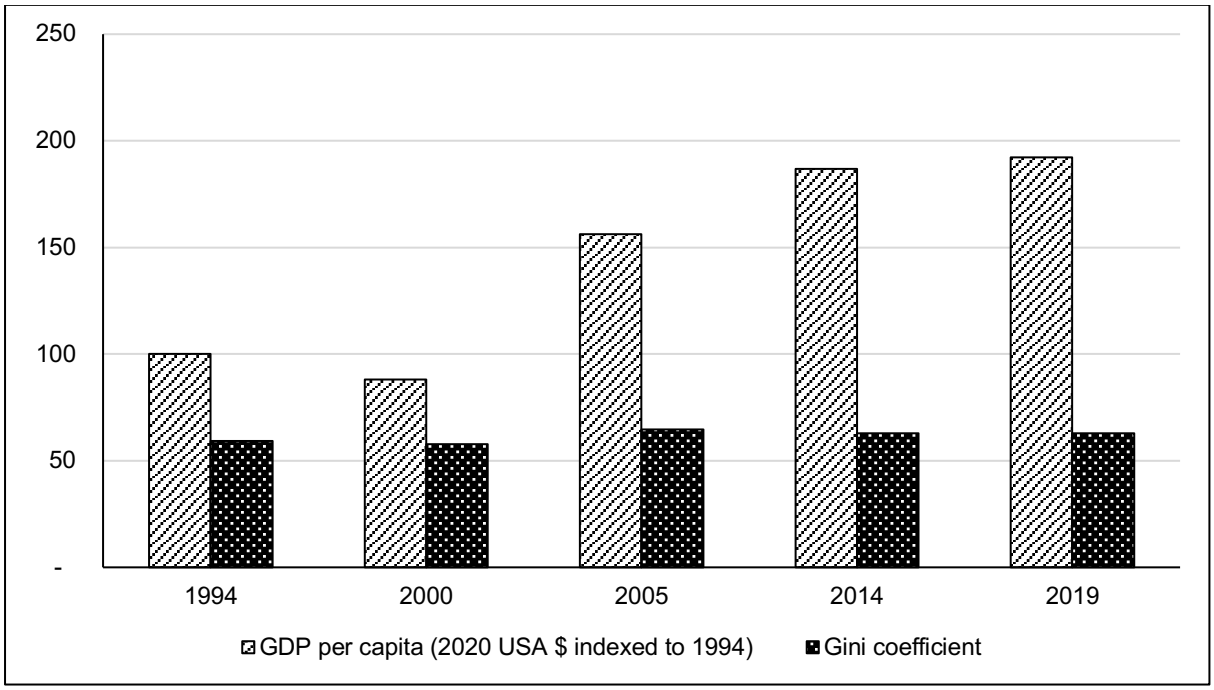

Figure 1: GDP per capita and Gini coefficient for South Africa.
Source: World Bank (2020).

In relation to the other countries in table 1, South Africa ranks low regarding GDP per capita, which is determined by the growth rates of both the economy and the

population (OECD, 2019). Wesley and Peterson (2017) show that in low-income countries, high population growth is detrimental to GDP per capita in the short to medium term owing to the increase in the number of dependents. Table 1 illustrates that South Africa has the highest average annual population growth over the period. Higher population growth is also associated with inheritance, which is then divided amongst more dependents, contributing to greater inequality since inherited wealth is an important aspect in growing future wealth as a form of capital (Piketty, 2014).

Income inequality and wealth inequality share a positive correlation. The median net worth of black and white South Africans in 2010 was R92,213 and R1,791,054. In 2015 black South Africans median net worth increased to R236,486 whilst white South Africans' decreased slightly to R1,771,403 in 2015 (Mbewe and Woolard, 2016). The correlation is higher in low-income countries as opposed to middle and high-income countries. Changes in labour markets, trade globalisation, technological change, financial globalisation, redistributive policies and education are factors that drive higher income inequality (Berman, Ben-Jacob and Shapira, 2016; Dabla-Norris, Kochhar, Suphaphiphat, Ricka and Tsounta, 2015). Less affluent households must also allocate a larger share of income to meet basic needs. A large proportion of South African households, predominantly black, spend a larger share of income on basic needs than the more affluent, white minority (Bureau for Food and Agricultural Policy, 2020; Statistics South Africa [Stats SA], 2017). SoL, QoL and access to liquid assets and wealth are found to be strong and robust predictors of life satisfaction (Berlin and Kaunitz, 2015; Jantsch and Veenhoven, 2019; Yu, Lee, Sirgy and Bosnjak, 2020). Liquid assets and wealth provide access to consume goods and services that have a direct effect on and QoL (Luburić and Fabris, 2017), which can be described by eight dimensions (Eurostat, 2019). Table 2 describes these QoL indicators.

Table 2: QoL indicators.

Dimension	Description
Material living conditions	Household income and housing conditions.
Productive or main activity	Quality of employment.
Health	Access to healthcare and healthy lifestyles.
Education	Access to basic and higher education and digital skills.
Leisure and social interactions	Participation in cultural, sport and voluntary activities.
Economic security and physical safety	Economic security, management of debt and safety in community.
Governance and basic rights	Voter participation and equal rights.
Natural and living environment	Exposure to pollution, grime and other environmental problems.

Source: Eurostat (2019)

Since individuals allocate resources to meet various needs based on the different dimensions of table 2, choices on how financial resources are consumed have an impact on individual wealth in the long-term. Although South Africa has experienced a large increase in financial inclusion from an access perspective, the manner in which South Africans use financial products suggest that financial literacy is low (Abrahams, 2017; Deloitte, 2019). Financial literacy is defined as possessing knowledge of financial concepts, skill in making financial decisions, having an ability in managing personal finances and confidence in future financial planning (Kimiyaghalam and Safari, 2015). The participation rate of different savings' schemes by South Africans for 2014 and 2019 is illustrated in Table 3.

Table 3: Participation of South Africans' savings by channel allocation.

Channel	2014 (%)	2019 (%)
Banked cash savings	35	35
Bonds	1	1
Investments	8	9
Retirement annuities	24	26
Informal Savings	49	60

Source: Old Mutual (2019)

Table 3 above illustrates how the participation rate of informal savings is higher than formal savings and has increased in recent years (Old Mutual, 2019). Informal savings vehicles are predominantly comprised of stokvels, burial societies and unbanked cash savings, which yield low investment returns. Formal savings vehicles constitute banked cash savings, bonds, investments and retirement annuities, which are able to generate investment returns exceeding inflation. Table 3 illustrates that the participation rate of formal savings has remained relatively unchanged between 2014 and 2019. The effects of lower income and financial literacy are found to be determinants of poor households' disposition to save informally as opposed to formal savings vehicles (Klapper and Singer, 2015). High transaction costs and physical barriers, such as distance and documentation requirements, are some factors that prevent poorer individuals from accessing formal savings vehicles (Klapper and Singer, 2015). Choices on how to manage investment and savings also affects wealth accumulation through investment returns over time. Wealthier, high-income households tend to assume riskier investment profiles than less affluent, low-income households. These riskier investment profiles are typically comprised of investments and bonds as opposed to informal savings (Murendo and Mutsonziwa, 2016; Beckmann, 2019; Kochaniak, 2020).

The factor of investment choice is guided both by the level of financial literacy and the risk perception of an investor (Aren and Zengin, 2016). Baker and Filbeck (2015) describe several types of investment risks that investors consider. These include market, credit, liquidity, country, governance and inflation risks. Investors are highly sensitive to government's position on budget deficits, external debt and sovereign debt-to-GDP (Mugobo and Mutize, 2016). South Africa's debt service cost has increased steadily since 2007/2008, whilst the budget deficit has increased sharply in the midst of the economic impact of the 2020 covid-19 global pandemic. The impact and risk that state-owned enterprises (SOEs) pose to the fiscus present further challenges and negative investor sentiment towards South Africa (National Treasury, 2020a).

In order to reduce wealth inequality in South Africa, it is advised that the government should devote attention towards promoting good governance conducive to economic growth, implement a restructure in the labour market, expand the revenue base,

increase investment in education and physical infrastructure, reduce debt and the public wage bill and privatise unproductive SOEs (Omilola and Akanbi, 2014; Mdluli, Mcyai and Mc Camel, 2019). Personal finance factors, such as financial literacy and allocation of resources are key determinants in reducing wealth inequality and improving SoL and QoL (Struwig and Plaatjes, 2007; Gathergood, 2012; Lusardi, Michaud and Mitchell, 2017).

The aim of this study will be to propose a model on how socio-economic policy and personal finance factors can affect wealth inequality collectively, with the objective being to decrease wealth inequality in South Africa.

1.2 Problem statement

High wealth inequality presents several negative effects to society. These include suppressed economic growth and a decrease in standard of living (SoL) and quality of life (QoL) factors, such as healthcare, education, employment and living conditions (Birčiaková, Stávková and Antošová, 2015). Retirement savings rates tend to be lower in less affluent households than wealthier households, further increasing wealth inequality. Negative effects on democratic political systems includes reduced regulation, decreased public investment in infrastructure and economic distortions that benefit the more affluent at the expense those at the lower tranches of the wealth distribution (Nowatzki, 2012; Rufrancos, Power, Pickett and Wilkinson, 2013; Bagchi and Svenjar, 2015; Lusardi, Michaud and Mitchell, 2017; Tyler and Felix, 2020). Wealthier countries also tend to possess a higher QoL than poorer countries (Mpofu, 2013).

During the Apartheid era, the majority non-white population were economically excluded in South Africa. The policies enacted by the government during this period prevented this population group from wealth generation and accumulation activity. The legacy of these laws and policies has left a lasting impact post-Apartheid. Since 1994, the South African government has implemented several policies aiming to address the imbalances. However, even though expenditure on economic development, education, social development and wealth redistribution per capita has increased in

line with inflation since the global financial crisis of 2007-2008, inequality has remained unchanged across the same period (Michie, 2020; National Treasury, 2020b). Improvements in racial and gender based equality in the labour market has also mitigated inequality, but the collective impact of these policies have had little effect on overall inequality and QoL regarding the majority non-white population: the typical black household owns less than 5% of the wealth of the typical white household (Leibbrandt, Wegner and Finn, 2011; Mbewe and Woolard, 2016; Weybright, Caldwell, Xie, Wegner and Smith, 2017; Stats SA, 2018; Leibbrandt and Shipp, 2019; Tshishonga, 2019; Burger and Christian, 2020; Chatterjee, Czajka and Gethin, 2020).

The degree of financial literacy, which is strongly correlated with the ability to accumulate wealth, is markedly lower in the non-white population compared to the white population (Nanziri and Leibbrandt, 2018). QoL factors display a positive relationship with financial literacy. The non-white, lesser educated, unemployed population is the most marginalised and at risk of experiencing the negative effects of wealth inequality. A key determinant for individuals to achieve economic stability in South Africa is access to stable labour market income, where the personal savings fraction of income is highly influential on decreasing wealth inequality (Van Rooij, Lusardi and Alessie, 2012; Berman, Ben-Jacob and Shapira, 2016; Schotte, Zizzamia and Leibbrandt, 2017; Nanziri and Olckers, 2019).

The South African economy is expected to contract between 4% and 16% during 2020 as consequence of the onset of the covid-19 pandemic in March 2020 (Arndt, Davies, Gabriel, Harris, Makrelov, Modise, Robinson, Simbanegavi, Van Seventer and Anderson, 2020). Since inequality widens post-recessions, the non-white, lesser educated and unemployed South African population face further economic and social exclusion as effected by increased wealth inequality. Macro-economic policies that focus on increased economic inclusion, wealth redistribution and personal financial management must support each other to decrease wealth inequality. The personal finance choices that South Africans make will be a crucial contributor to economic and social upliftment, in conjunction with policies that are implemented (Heathcote, Violante and Perri, 2010; Heo, Grable and O'Neill, 2017; South Africa: Department of Health, 2020).

1.3 Research Objectives

Through investigating wealth inequality, this research aimed to understand macro-economic policy and personal finance influences on wealth inequality in South Africa. This research will aim to achieve the following objectives:

1. To investigate how policies focused on addressing wealth inequality by the South African government affect wealth inequality.
2. To assess how South Africans' personal finance choices affect wealth inequality.
3. To ascertain the degree of wealth most South Africans are able to access a meaningful quality of life (QoL).
4. To propose a model that can be utilised to decrease wealth inequality in South Africa to an extent where most South Africans are able to access a meaningful quality of life (QoL).

1.4 Research Questions

From the aforementioned research objectives, the following research questions emanate:

1. How do policies focused on addressing wealth inequality by the South African government affect wealth inequality?
2. How do South Africans' personal finance choices affect wealth inequality?
3. How much wealth do most South Africans require to able to access a meaningful quality of life (QoL)?
4. What model can be utilised to decrease wealth inequality in South Africa to an extent where most South Africans are able to access a meaningful quality of life (QoL)?

1.5 Significance of the Study

This study will contribute to the body of knowledge by explaining the manner in which wealth inequality in South Africa is affected by policies that target wealth redistribution and how personal financial management affects wealth accumulation. In addition, the

study will be significant in that it aims to clarify the relationship between the degree of wealth inequality and the according impact on QoL. Literature does not disseminate wealth requirements into tangible, practical factors concerning living requirements. Generally, the literature also reviews wealth inequality either reviewed from a macroeconomic perspective or from an individual or household perspective. These two factors, however, are two different aspects of one reality and this study adds this perspective to the body of knowledge. It is intended that the findings of this study will make a meaningful contribution to the South African government's policy formulation and implementation insofar as attaining wealth redistribution and eliminating wealth inequality is concerned.

1.6 Scope of The Study

This study is limited to South Africa. The time period under analysis spans the period 2010 to 2019. The time period is limited to the particular period so as not to include the 2007-2008 global financial crisis and the economic impact of the 2020 covid-19 pandemic in the analysis, as this would impart increased factors that would require special considerations. Policies that were included in this study were those related to reducing wealth inequality and increasing QoL, including social development and wealth redistribution.

1.7 Limitations of The Study

This study is limited by assuming an average South African as proxy for the model. The distribution of the underlying population is not encapsulated in the model, therefore the assumption of a single solution to address wealth inequality may be inadequate to solve for all cases in the population.

This study is also limited by assuming that the relationship between SoL and QoL are positive, and that a higher QoL implies a higher SoL and a lower QoL implies a lower SoL.

The study is further constrained by the inability of the model to account for household consumption preferences. Instead, the model simply assumes that all households behave rationally in the sense of maximising the ability to increase wealth across the lifetime at each income level.

The model does not allow for dynamism in government expenditure, where there could exist reforms that can accelerate or allocate greater spend to initiatives related to wealth inequality.

Lastly, the findings of this study may have limited generalisability to other developing economies, who may pursue different policy measures from those of South Africa.

1.8 Chapter Outline

This study is structured as follows:

Chapter 1: Introduction
This chapter discussed the background of the study, articulated the problem statement, presented the overall aim of the research, and aligned the research objectives and research questions. The significance of the study was also outlined herein.

Chapter 2: Literature review
This chapter presents the preliminary literature review of the study, which includes the identification and definitions of the key concepts, development of hypotheses and to show what weaknesses exist in the literature.

Chapter 3: Research methodology
This chapter discusses the research methodology that was adopted for the study. The chapter describes the research design, population and sample, data variables and sources, reliability and validity of the study. The model specification, data analysis and interpretation thereof is presented. Ethical considerations are also addressed.

Chapter 4: Data analysis, findings and discussion

This chapter presents the data analysis and discusses the results obtained in the context of the research questions.

Chapter 5: Conclusion and recommendations

The conclusion of the study in the context of the findings from Chapter 4, and the research objectives and questions as outlined in Chapter 1, are presented and discussed. Recommendations and suggestions for further study are also presented.

2 CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter focuses on the literature related to wealth inequality and how this inequality is influenced by macroeconomic and personal financial management factors. The chapter starts with a definition of terms. This is followed by the theoretical framework and the empirical literature. The chapter closes off with a conclusion.

2.2 Definition of key concepts

This section introduces definitions of key concepts central to this study. Wealth inequality, macroeconomics, personal financial management and quality of life are defined in the context of the study.

2.2.1 Wealth inequality

Inequality and poverty have been referenced and defined in interchangeable fashion in global literature (Beteille, 2003). Inequality and poverty are related, but are two distinct concepts (Peterson, 2017). Poverty is generally defined as possessing insufficient resources to maintain a socially acceptable lifestyle (Wagle, 2019). Inequality is the quantification of the position of individuals or groups relative to others in a society (Peterson, 2017). Wealth inequality in the South African context is defined as an unequal distribution of household assets in the population (Chatterjee, 2019), which corresponds with the global definition as the the measurement of the wealth position of individuals or groups relative to others in a society (Killewald, Pfeffer and Schachner, 2017). Globally, wealth is defined as the current market value of all assets owned by an individual or group net of all liabilities and future government transfers and social security grants. These assets would include all financial and non-financial assets (Jakobsen, Jakobsen, Kleven and Zucman, 2020). In Sub-Saharan Africa and South Africa, rural livelihoods means that some forms of wealth are governed by non-market institutions. The definition of wealth can be expanded to include other stores

of wealth, such as cattle, fertile farmland, equipment, knowledge, skills and social capital (Stroebel, Swanepoel, Nthakheni, Nesamvuni and Taylor, 2008; Chowa and Masa, 2012).

2.2.2 Macroeconomics

In the South African context, macroeconomics is defined as the evaluation of variables indicative of macroeconomic conditions. These include taxation, inflation, the size of the economy and GDP growth (Lemma and Negash, 2013). Globally, macroeconomics is defined as the evaluation and interpretation of the structure and performance of national economies and of the policies adopted by governments to affect and influence economic performance (Tsai, 2019). Economic structure in the South African context is defined as a set of mechanisms and institutions for decision making, the implementation of these decisions concerning monetary policy, trade policy, income, unemployment, production and consumption (Rodrik, 2008). These mechanisms and institutions consist of property rights, mechanisms of coordination and information and decision-making structures (Kim, 2012).

2.2.3 Personal financial management

Globally there exists no universally accepted definition of financial literacy (Fatoki and Oni, 2014). Authors in the literature propose serval different definitions. Lai and Tan (2009) propose that in an emerging market context, personal financial management is the process of asset management to achieve personal economic satisfaction. Zamfir, Manea and Ionescu (2016) propose that asset management in the Western school of economics context is the active process of managing assets in such a manner that maximum growth in the value of the assets will be achieved. Investment risk and investor sentiment towards risk is described by the Von Neuman-Morgenstern utility theorem (Mayfield, Perdue and Wooten, 2008). The theorem shows that rational investors faced with risky outcomes of different decisions will behave in a manner to maximise their expected utility (Von Neumann and Morgenstern, 1947). The global literature has developed into two schools of thought on investment choices regarding

risk (Mayfield, Perdue and Wooten, 2008). One school of thought focuses on demographics to explain investor sentiment to risk, such as gender, ethnicity, education, income and wealth (Bajtelsmit and Bernasek, 1996; Barber and Odean, 2001). The alternative school of thought bases theory on the foundations of psychology and how personality and psychological traits guide investor behaviour (Carducci and Wong, 1998; Filbeck, Hatfield and Horvath, 2005; Gambetti and Giusberti, 2019).

Education in the form of financial literacy shares a positive relationship with savings behaviour, retirement planning and investment decision making in the global literature (Oseifuah, 2010; Meghana and Sarala, 2020). Financial literacy in the South African context is defined as possessing basic numeracy and comprehension skills regarding simple financial products, the nature of money and the consequences of decision-making (Oseifuah, 2010). Financial literacy levels, personal financial management skills and the impact of these factors on personal satisfaction varies significantly by different types of occupation and regions globally (Bhargava, Mittal and Kushwaha, 2017).

2.2.4 Quality of life

Quality of life (QoL) in the global literature refers to the level of satisfaction or happiness derived from financial and material living conditions, employment, health, education, leisure and social activities, economic and physical safety, human rights and freedoms, protection of the environment and overall life satisfaction (Luburić and Fabris, 2017).

In the South African context, several authors include the population's basic needs, geography and human development as measures of QoL (Rossouw and Naudé, 2008; Naudé, Rossouw and Krugell, 2009). Several other studies also define quality of life through the context of South Africa's Apartheid history and the ongoing legacy thereof, comparing aspects of QoL amongst different racial groups in South Africa (Higgs, 2007; Posel and Casale, 2011; Møller, 2013).

The concept of QoL is closely related to standard of living in global literature. Happiness, through use of the happiness index, is used as proxy for QoL estimates despite happiness being a subjective factor that depends on an individual's outlook on a meaningful life philosophy, the importance they place on their personal financial situation and an understanding of their place in the hierarchy of society (Musikanski, Cloutier, Bejarano, Briggs, Colbert, Strasser and Russell, 2017; Susniene and Jurkauskas, 2009).

2.3 Theoretical literature

This section discusses the theoretical literature on the relationships between wealth inequality and macroeconomics and wealth inequality and personal financial management in both the global and South African global contexts.

2.3.1 Wealth inequality and macroeconomics

2.3.1.1 Global context

Kuznets (1955) investigates the relationship between inequality and economic growth, more specifically whether inequality increases or decreases as economic growth increases over time. The study proposes that inequality tends to rise in the early stages of economic development due to two different factors. Firstly, as an economy transforms from an agricultural-based economy to an industrialised economy (Kuznets, 1961), rural populations earn less than income than the urban population, leading to an increase in inequality initially before decreasing as capital matures. Secondly, wealthier individuals save proportionally at higher rates than poor individuals. Inequality thus takes on the form of an inverted U-shaped curve over time, termed as the Kuznets curve in literature (Glomm, 1997; Desbordes and Verardi, 2012).

The theory proposed by Kuznets (1955) fails to account for economic factors that equalise wealth inequality in the long run. Stiglitz (1969) proposes a model of wealth accumulation that considers how the population's consumption function changes, heterogeneity of labour skills and income and how the production economy changes to different levels of income. Under the assumption of a linear savings function, homogenous labour and stable economic growth, Stiglitz (1969) shows that if economic growth remains stable over time, the wealth distribution reverts to an equalitarian distribution. In the case where there two economic growth paths exist, the lower economic growth path is unstable and leads to an increase in wealth inequality over time, since individuals with initial wealth at less than the stable path have a lower rate of growth of wealth.

The assumption of a linear savings function is challenged by Schlicht (1975), who proposes a convex savings function in conjunction with a strictly increasing income function to account for of monopolistic pricing factors. The rate of interest in the model is a decreasing function that is greater than the marginal productivity of capital and that the wealth distribution consists of distinct groups where members of the same group possess the same amount of wealth. All members in the population earn the same labour income and possess the same savings function. The theory indicates that under a two-class system, where there are capitalists and labourers, increasing wealth inequality increases the rate of savings, leading to a higher capitalist proportion in the wealth distribution as economic growth increases.

Under the theory proposed by Schlicht (1975), markets must remain efficient, which is not always the case. Okun (1975) expands on this theory by proposing that there exists a trade-off between equality and market efficiency in society. The theory implies that a government must make a choice regarding economic and social policies, and that taking a biased position towards social and economic equality may weaken economic growth and disincentivise the population to work and save. In prioritising a completely free economic market, allowing the financial market to remain unchecked could worsen inequality by widening income and wealth gaps.

Banerjee and Newman (1993) expanded on the model proposed by Okun (1975), where due to the relationship between economic agents' labour decisions and the distribution of wealth and capital market imperfections, poor individuals choose wage employment over self-employment. Wealthy individuals in this model are those who are self-employed entrepreneurs. The model shows that only under sufficient inequality will employment opportunities exist. The labour force structure thus depends on the wealth distribution. Under the assumption of an initial wealth distribution, the economy evolves either to wide-spread self-employment or a worker labour market, with an economic outcome of either prosperity or stagnation.

The growth path of the economy alone however does not lead to an increase or a decrease in inequality. Instead, Fields (2001) expands on the theories proposed by Okun (1975) supports the operation of capital markets as a factor, whilst Banerjee and Newman (1993) by suggests that the change in inequality depends on which macroeconomic factors economic growth is influenced by. Fields (2001) further includes land ownership as an additional factor.

Lupu and Pontusson (2011) proposes a diametric theory to the theory proposed by Fields (2001). Lupu and Pontusson (2011) posits that the structure of inequality determines the redistributive policies required, not the level of inequality or the path of economic growth. Assuming that middle-income voter support is necessary to the implementation of redistributive policies, middle-income voters will empathise with the poor and support redistributive policies when the income distance, termed as the social distance, between the middle and the poor is relatively small compared to the income distance between the middle and the affluent. The theoretical framework shows that greater spread in the lower half of the income distribution is consistent with less redistribution. Higher voter participation, increased unionisation and female labour force participation are associated with increased redistribution. The rate of unemployment and the rate of students engaged in vocational training have little effect on redistribution.

Lupu and Pontusson (2011) are unable however to account for factors that may skew wealth inequality through political means, including economic, social, cultural, political,

or knowledge capital (Khan, 2012). Piketty (2014) expands on this in two different ways. Firstly, through acknowledging political-capitalist agents' power in wealth and tax regulation, Piketty (2014) suggests that to decrease wealth inequality, a global wealth tax system must be implemented. By taxing assets globally, individuals will be restricted in the ability to evade taxation through shifting assets from one jurisdiction to another. Secondly, Piketty (2014) proposes through the wealth to income ratio, the rate of return on capital and the growth rate of GDP as proxy for the growth rate of labour income, that if the rate of return on capital exceeds the growth rate of GDP, wealth inequality increases. The wealth to income ratio is represented by the value of all financial assets owned by its citizens against the country's GDP. Increased wealth inequality will subsequently lead to a new class of social elites, where wealth will be less readily created by individuals, but instead inherited and becoming increasingly concentrated.

2.3.1.2 South African context

The theoretical literature on the relationship between wealth inequality and macroeconomics in the South African context is dominated by the effect of Apartheid as well as the legacy it has left. Terreblanche (2002) and Von Holdt (2003) proposes that the Apartheid economic structure promoted the occupational and economic segregation of the white and non-white populations. The non-white population possessed no ability to uplift themselves out of poverty. This ensured that a very large degree of wealth inequality was maintained actively during this period.

Several studies expand on how wealth inequality is affected by the legacy of Apartheid during the democratic era (Webster and Von Holdt, 2005; Barchiesi, 2007; Clark, 2014; Francis and Webster, 2019). These studies propose that several changes in market policies, such as increased labour market flexibility, deregulation and expanded social policies increased inequality. Despite the upward mobility in the labour market of non-whites to higher quality and income jobs, white workers have continued to be promoted above them. Increased market flexibility and labour market deregulation shifted the labour market to a higher proportion of informal employment

and more social welfare provided to most of the population in the form of basic income grants. Both these factors influenced wealth inequality negative in the long run.

Education as a determining factor in the outcome of wealth accumulation is strongly proposed as a leading cause during and after Apartheid (McKeever, 2017; Francis and Webster, 2019). The poor quality of education afforded to the non-white population under Apartheid directly impacted the legacy of future generations in that black families generally did not own any wealth post-Apartheid. The expansion of the education budget largely allocated previously to the non-white minority now had to provide uplift for a much larger population, which it since been able to do with mixed results.

2.3.2 Wealth inequality and personal financial management

2.3.2.1 Global context

The life-cycle theory was developed by Modigliani, Brumberg and Ando during the 1950s (Baranzini, 2005), based on the concept that individuals make choices regarding their consumption and behaviour over their lifetime. Individuals choose to accumulate savings when earnings are positive and dis-save when they are retired. The model makes several assumptions regarding decision-making, including stable consumption and income levels over the lifetime and interest rates and bequests that are fixed at zero. The theory infers that savings rate of an economy is independent of per capita income, that wealth inequality is a decreasing function of economic growth and that the most important variable determining the wealth-ration is the length of retirement, or the number of years of active employment (positive income).

The life-cycle theory is constrained by the inability to include inter-generational transfers of wealth, that the wealthy continue to save more than the poor and that younger families in certain regions tend to save an increasing portion of their income.

Friedman (1957) disagrees with several aspects of the life-cycle model proposed by Modigliani, Brumberg and Ando. Income and consumption are not fixed at constant

rates but vary across the individual's lifetime. Consequently, the savings rate of an individual varies over time and is determined as the rate at which their current income exceeds their permanent income, which is defined as their expected long-term average income. The permanent income hypothesis however does not account for variability in decision-making, especially concerning risk regarding the savings mechanism. Kahneman and Tversky (1979) expands on the permanent income hypothesis through introducing prospect theory, the analysis of decision making under risk.

Kahneman and Tversky (1979) assumes that individuals exhibit risk aversion and risk loving behaviour depending on the nature of the gain or loss. Losses cause a greater emotional impact on an individual than equivalent gain, so given a choice between two outcomes where both offer the same result, an individual will choose the option offering perceived gains. The failure of prospect theory to account for how framing effects present in complex decision environments influence decision-making. Bronfrenbrenner (1979) accounts for this effect in the human ecological model. Individuals are dynamic agents that both influence and are influenced through interactions with and within larger, interdependent systems.

Shefrin and Thaler (1988) use the expanded theory developed by Bronfrenbrenner (1979) as a theoretical basis to further expand the goal-directed behaviour of individuals. They propose the behavioural life-cycle hypothesis. Individuals practise mental accounting across several different systems or accounts, suggesting that individuals have different propensities to save in different categories. Individuals are thus either long-or short-term planners and that money in different accounts are used for different purposes. Wealth is assumed to consist of three types of accounts. These are current income, current assets and future income. The theory implies that the propensity to spend is highest in the current income account, and lowest in the future income account. The theory further implies that the greater the level of permanent income, the higher the savings rate, since present needs will comprise a larger share of a smaller income as opposed to a larger income; the more a bequest represents salary income rather than wealth, the greater the likelihood of immediate consumption of the bequest; at constant levels of wealth, consumption tracks income and at constant income levels, homeownership increases retirement wealth. Thaler (1999)

further expands on mental accounting by suggesting that biases and systematic departures from rational, value-maximising behaviour can occur. Mental accounting theory provides a framework for how an individual forms some budget, however the theory does not explicate what those budgets are intended for. Individuals also form mental budgets not by the way they intend to spend money, but also in the way they receive it (O'Curry and Strahilevitz, 2001). Levav and McGraw (2009) further propose that individuals' budget choices are based on emotional reasoning.

Quisumbing (2010) develops the proposal of Levav and McGraw (2009) further by developing a conceptual framework to describe the relationship between intergenerational transfers and emotional reasoning and how this affects poverty. Quisumbing (2010) assumes that parents care about the well-being of children. Parents consider investment returns as a factor into their decision-making when choosing to invest in their children and that their ability to undertake investment is constrained by resources, time and money, and their ability to trade off present versus future resources. The theory predicts that parents may disagree about which child to invest resources into and that the differences in the type and amount of wealth transferred by gender could result in differences in lifetime incomes of dependents.

2.3.2.2 South African context

The theoretical literature on personal financial management and wealth inequality is largely centred on the aspects of how Apartheid affected wealth inequality in a broader, macroeconomic sense. This literature was covered briefly in section 2.3.1.2. Studies by Adato, Carter and May (2006) and Carter and Barrett (2006) propose that due to the nature of the economy being polarised to such a large extent, that upward mobility will remain impeded and that the wealth distribution will remain unchanged unless the poverty trap is eliminated by promoting the distribution of a base load of assets to the impoverished.

Rousseau and Venter (2016) focus on the relationship between the underlying socio-demographic variables within the marginalised population and how financial insight

and behaviour influences household choices on asset allocation. The theory proposes that demographic variable, such as age, gender, occupation and marital status share a strong positive relationship with financial insight and consequently financial behaviour that promotes wealth accumulation.

Chatterjee (2019) suggests that given the unique nature of South Africa's economy given its economic history, wealth inequality theories need to go beyond standard savings and distribution models. Hereditary modes of wealth transmission must be accounted for and intergenerational mobility regarding the impact of wealth regarding future employability, income, job duration and labour market progression must be considered. In this manner, wealth inequality in South Africa can be described and analysed more accurately. This in turn allows for households to make more informed decisions on education and which labour market segments to target regarding higher income levels to assist in wealth accumulation.

2.4 Empirical literature

This section discusses the empirical literature on the relationships between wealth inequality and macroeconomics and wealth inequality and personal financial management in both the global and South African context.

2.4.1 Wealth inequality and macroeconomics

2.4.1.1 Global context

Several studies focus on the relationship between inflation and the wealth distribution in an economy. Bach and Stephenson (1974) study the relationship between the redistribution effects of inflation on the wealth holdings of households. The results of the study show that an increase in inflation shifts current income from shareholders to employee wages. The relationship between inflation and wealth distribution is found to be positive, and increased inflation transfers purchasing power from the rich and the poor to the middle and upper middle groups. A study by Doepke and Schneider

(2006), focused on the effects of inflation on the wealth distribution of the USA for the period 1952 to 2004, supports the positive relationship between inflation and increases in wealth redistribution. Doepke and Schneider (2006) show that across households, wealth is transferred from rich, old households to young, middle-class households with mortgages. The studies by Bach and Stephenson (1974) and Doepke and Schneider (2006) do not however expand on how high economic growth can offset inflation and how this may affect how wealth inequality evolves.

Economic growth as a factor affecting inequality is well-researched in empirical literature. Deininger and Squire (1998) analysed the interactions between economic growth and inequality, and how these in turn affect poverty reduction during economic development. The results of the study show that there exists a strong negative relationship between initial inequality in the asset distribution and long-term economic growth. Inequality decreases income growth for the poor but increases income growth for wealthier individuals. Macroeconomic policies that increase investment and asset acquisition capability for the poor increases economic growth and decreases wealth inequality. The accumulation of new assets is also more likely to positively affect poverty reduction than simply redistributing existing assets.

Bagchi and Svejnar (2015) expands on the analysis of Deininger and Squire (1998) by investigating how billionaires' wealth and the relationship between billionaire wealth and cronyism affects wealth inequality. The results show that wealth inequality has a negative effect on economic growth, supporting the empirical findings of Deininger and Squire (1998). Politically connected wealth inequality has a much larger negative effect on economic growth, as opposed to politically unconnected wealth inequality, which has a statistically insignificant relationship with economic growth. Both these studies however fail to account what the determinants of income for the various income groups are in the population.

Causa, Vindics and Akgun (2018) focuses on this aspect through analysing the drivers of tax and income redistribution for the period 1990 to 2014 in Organisation for Economic Co-operation and Development countries. Their results showed that social spend on income support to the working-age population has the greatest redistributive effect, decreasing inequality. An increase in 1% of GDP yields an increase of 4% in

redistribution. Tax revenue raised from personal income yields a 3% increase in redistribution for an increase in 1% of GDP spend. Increased global economic integration decreases the effect of tax redistribution to reduce inequality. DeScioli, Shaw and Delton (2018) studied the impact of redistribution on individual investment decisions. They concluded that there exists a positive relationship between investment and profit and redistribution across the population. When an economy where non-investors are allowed to exploit investors, there exists a negative relationship between investment and redistribution.

A different empirical approach to investigate wealth inequality focuses on the relationship between macroeconomic policies and the distribution of wealth. Hibbs (1977) investigates the adopted macroeconomic policies and outcomes associated with liberal and conservative governments in capitalist democracies. The results show that economic objectives for less wealthy, lower income and lower occupational groups are best served by a low unemployment, high inflation macroeconomic environment. A high unemployment-low inflation macroeconomic environment tends to support the economic objectives of more wealthy, higher income and higher occupational groups. Time-series analysis of unemployment data for the UK and the USA shows that the unemployment rate is driven downward by liberal, labour-aligned administrations, and driven higher by conservative administrations. Governments tend to pursue macroeconomic policies broadly aligned to the economic interests and subjective preferences of their class-defined core political constituencies. A population with high wealth inequality will lean to elect a redistributive administration, whilst a low wealth inequality population will support a more conservative administration.

Saiki and Frost (2014) examined the effect of unconventional monetary policy on inequality in Japan for the period 2008 to 2014. The results indicate that monetary policy interventions undertaken by Japan after the global financial crisis of 2007-2008 widened inequality via the portfolio channel. Asset prices rose disproportionally compared to economic fundamentals, which benefit wealthier households that own a larger share of savings in equities. This empirical result supports the outcome obtained by Hibbs (1977) in that the increase in the unemployment rate in Japan across this period coupled with a low inflation environment led to a higher wealth inequality outcome.

O'Farrell and Rawdanowicz (2017) further extend the analysis of monetary policy on wealth inequality. Through analysing the business cycle via investment returns, debt-cost servicing and asset prices, they show that monetary policy has ambiguous effects on wealth inequality, with increased property prices decreasing wealth inequality, and increasing stock and bond prices increasing wealth inequality. Progressive taxation, social welfare and equitable access to education decreases wealth inequality. Minimising the probability of financial crises and the associated deep recessions further decreases wealth inequality. Mumtaz and Theophilopoulou (2020) support this finding. They found that expansionary monetary policy shocks lead to an increase in wealth inequality. The effect is heterogenous across the wealth distribution, with the monetary shock affecting the lower wealth median household by a larger amount than the right tail. The results suggest that the shock is transmitted through changes in net property and financial wealth.

2.4.1.2 South African context

Little empirical literature on wealth inequality in the South African exists (Polus, Kopiński and Tycholiz, 2021). Several studies indicate that high unemployment, high income inequalities and the legacy of Apartheid drives persistently high wealth inequality (Leibbrandt, Bhorat and Woolard, 1999; Van der Berg, 2010; Leibbrandt, Finn and Woolard, 2012). The division of labour income and the segmentation of the labour market along racial lines post-Apartheid determines human capital development and the economic growth trajectory of the country (Van der Berg, 2010). Increasingly, the division of wealth in the post-Apartheid economy has become based more on social class than race (Polus, Kopiński and Tycholiz, 2021). Von Holdt (2013) maintains that political elites and factionalism in national government has led to a wider class divide between political capitalist agents and the economically marginalised population.

Empirical literature on government corruption and the effect thereof on macroeconomic factors, economic growth and inequality supports that the political elite compromises economic growth in pursuit of personal wealth gains, impeding and

negating the effect that macroeconomic policies should have on reducing wealth inequality (Lannegran and Ito, 2017). Padayachee (2019) promotes several different policy measures to reduce wealth inequality despite the economy being characterised by low growth, persistently high unemployment, rampant corruption and governance failures. The analysis by Padayachee (2019) shows that monetary policy should prioritise full employment while retaining price stability in the market as a secondary objective. This objective can be achieved through increased public capital investment to promote economic growth and increase employment. Padayachee (2019) further promotes the separation of the budget into two accounts: a current budget and a capital budget.

Expansion through increased capital investment alone is not a solution, especially considering South Africa's public debt trajectory. Bond and Malikane (2019) show that excess public debt coupled with monetary policies adopted by the democratic government has widened inequality and left the marginalised population with a higher proportion of future tax recoveries. Increased expenditure through increased taxation would also be unlikely to achieve the required level of additional revenue to finance such expenditure (Arendse and Stack, 2018).

2.4.2 Wealth inequality and personal financial management

2.4.2.1 Global context

Several different empirical approaches are applied to investigate the relationship between wealth inequality and personal financial management. Menchik (1980) uses an intergenerational life-cycle model to describe wealth inequality through the mechanism of intergenerational transfers. The model assumes that parents bestow wealth to their children based on different factors, such as sex, birth order, family size, estate size and asset composition of the household wealth. The results presented by Menchik (1980) is preference-dependent and that households tend to share wealth equally between different sexes regardless of birth order. The model supports equalisation in the wealth distribution. A study by Laitner (2001) supports this evidence. Laitner (2001) shows that intergenerational transfers may represent a

mixture of altruistic and non-altruistic behaviour, although this study is unable to fully encapsulate the behaviour of very wealthy households. Charles and Hurst (2003) expand on this by investigating the probability of wealthy individuals' children also being wealthy. Their results show that income, human capital and the ownership of particular assets are highly correlated between parents and their children. Income as variable accounts for half of the parent-child wealth relationship. Factors, such as education, large financial gifts and expected future bequests explain none of the intergenerational wealth elasticity after controlling for income.

Hallahan, Faff and McKenzie (2004) provides evidence that disagrees with the result obtained by Charles and Hurst (2003). Through introducing risk tolerance as an additional factor, their results show that gender, income and net assets are significantly correlated with financial risk tolerance, and that a negative non-linear relationship exists between age and risk tolerance. Marital status and risk tolerance also showcases a negative relationship. Since an investor's risk profile is a highly influential factor in the construction of an appropriate investment portfolio, the aging of the baby boomer cohort leads to investment flows from more risky growth asset classes to less risky income asset classes. The greater life expectancy of women generally leads to a risk tolerance shift to less risky assets. The implication of these two factors leads to a decrease in wealth inequality. Studies by Benton and Keister (2017) and Toft and Friedman (2020) expand on this by demonstrating that children from higher-income households enjoy an increased probability to ascend faster towards the higher end of the income distribution. Education, marriage and delayed child-bearing foster resources that can be used to accumulate wealth from inheritances and gifts. Divorce and having children at younger ages affect wealth accumulation negatively.

The relationship between financial literacy, personal financial management and wealth inequality is researched in several different aspects. Empirical results show a strong positive correlation between the effect of financial literacy on increased skill of personal financial management and a subsequent decrease in wealth inequality. Maina (2010) show that the financially literate population in Kenya saves in larger magnitude than the non-financially literate population. Van Rooij, Lusardi and Alessie (2012) find support for this in that after controlling for other wealth-determinant factors,

such as age, income, education, risk tolerance, savings behaviour and family composition, individuals with a high degree of financial knowledge are found to be more likely to invest in riskier and higher-yield investments, such as stocks. Financial literacy is also shown to be positively associated with retirement planning behaviour. In an empirical study undertaken by Johan, Rowlingson and Appleyard (2020), they find that despite personal financial education having a positive and statistically significant effect on financial knowledge, the relationship between personal financial education and financial behaviour shared no statistically significant relationship. A study by Lusardi and Mitchell (2011) supports this conclusion. Family financial socialisation, income and work experience were found to be much stronger indicators of more efficient financial behaviour regarding personal financial management. These studies are limited in that different cultures perceive and manage money differently (Cohen, Shin and Liu, 2019).

2.4.2.2 South African context

Carter and May (2001) investigate the dynamics of the wealth distribution post-Apartheid in the majority non-white population in Kwa-Zulu Natal. The initial base of assets owned at the onset of a democratic South Africa was found to be a strong predictor of whether an individual would be able to move up in the wealth distribution or remain in structural poverty. Most of these individuals also did not earn enough income or own enough assets to move out of poverty. The South African population possesses a predominantly weak propensity to save (Grawitzky, 2003). Kotzé and Smit (2008) provides empirical evidence to support that individual debt levels have increased to such an extent that most do not have enough income left to save. On average South Africans save between 1% and 2% of their disposable income, which is very low in relation to the required provisions for pension savings. This result indicates that individual debt levels and consumption is too high relative to income, supporting the findings of Carter and May (2001). This implies that the average level of income is simply too low to meet savings and consumption requirements.

Fomum and Jesse (2017) expand on the consumption and savings analysis performed by Kotzé and Smit (2008) by considering financial inclusion in the population as a factor affecting the ability to accumulate wealth. Financial inclusion is captured by

monthly savings and insurance whereas asset ownership is measured by a composite assets index. Quantile regressions are used to examine how financial inclusion influences asset ownership across the wealth distribution. The study shows that the relationship between financial inclusion and asset ownership is positive and statistically significant. Through increased financial literacy and inclusion, poor individuals can improve their ability to increase their wealth, decreasing wealth inequality.

Karambakuwa and Ncwadi (2021) broadens the study performed by Fomum and Jesse (2017) on the relationship between household debt, financial literacy and wealth inequality. Households are found to be over-indebted due to several different factors. Firstly, low rates of financial management skills mean that individuals are unable to practice responsible spending and saving. Secondly, high rates of credit consumption, often at high interest rates, lead to increased long-term household debt. Thirdly, no- or low-income households reliant on social welfare are most at risk. This sub-population forms the majority of the population.

2.5 Chapter conclusion

This chapter provided a discussion on key concepts related to this study. These include wealth inequality, macroeconomics, personal financial management and quality of life. Theoretical and empirical literature related to the relationships between wealth inequality and macroeconomics and personal financial management was discussed. Both the global and South African contexts were discussed. As the literature review indicates, the South African aspect is unique from the global aspect considering the political, social and economic history of the country. The impact that the legacy of Apartheid has on macroeconomic policy requirements continue to challenge government in its mandate to decrease wealth inequality. Financial exclusion and consequent inability to accumulate wealth for the majority non-white population is largely driven by factors related to education, full market employment and access to higher income employment opportunities in relation to the white, affluent minority.

The theoretical and empirical literature, both in the global and South African context, fails to consider wealth inequality from a more grounded perspective. There is a failure to disseminate wealth requirements into tangible, practical factors concerning living requirements. Such factors consist of healthcare, education, bequest and labour income requirements within a household setting. There is also a failure within the literature on what wealth inequality means in the context of what constitutes an adequate standard of living and quality of life. Generally, the literature also indicates that wealth inequality is either reviewed from a macroeconomic perspective or from an individual or household perspective. These two factors, however, are two different sides of the same coin, since individuals' ability to generate wealth is determined by the macroeconomic policies implemented through virtue of the democratic election process and are subsequently affected by which policies are implemented. The behavioural-life cycle model proposed by Shefrin and Thaler (1988) was discussed and shown to be supported strongly in the literature in both the macro- and micro-economic spheres. The next chapter presents the methodology adopted to address the research objectives of this study.

3 CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter aims to present the data and methodology adopted for this study. This chapter will discuss the research design, population and sample, data variables and sources, reliability and validity of the study, model specification, data analysis and interpretations. Ethical considerations to the study will also be discussed.

3.2 Research design

Research design is a plan that provides the foundational structure that integrates all the elements of a quantitative study to ensure that the results obtained are credible and unbiased (Dannels, 2018). The research design includes the framework of the study, starting with the formulation of the hypothesis, when and how frequently to collect data, what data to gather from which sources, how to collect the data and how to analyse the data (Abutabenjeh and Jaradat, 2018). The research design ensures that the study fulfils a particular purpose and that the research can be completed with the available resources (Durrheim, 2006).

To investigate the relationship between wealth inequality, macroeconomic policy and personal finance, this study uses as foundation the behavioural life-cycle theory proposed by Shefrin and Thaler (1988). This study incorporates policy effects into the behavioural life-cycle model through inclusion of macro-policy variables across the life cycle. The adoption of this approach culminates from the fact that even though policy and personal finance effects may influence each other reciprocally, controlling for external economic and political factors, the population in general selects the macro policies adopted by the government by virtue of the democratic election process, during which politicians advocate to support certain initiatives should they be elected to office. The behavioural life-cycle theory has been proved to provide an adequate approximation to financial decision-making of individuals in numerous studies (Levin, 1998; Browning and Crossley, 2001; Schooley and Worden, 2008). This study is an explanatory one that uses quantitative methods. The proposed model assumes that

an individual follows the life cycle as described in figure 2, where the individual is born at T_0, attains education, enters the labour market and buys property at T_1, has children at T_2, retires at T_3 and passes away and bequethes their estate to the next generation at time T_4.

Time	T_0	T_1	T_2	T_3	T_4
Events	• Individual is born	• Individual attains education • Individual enters labour market • Individual buys property	• Individual has children	• Individual retires	• Individual dies • Estate bequeathed to next generation

Figure 2: Life cycle model and events during the individual's life cycle.

To investigate research question 1, the researcher uses the method proposed by Chatterjee, Czajka and Gethin (2020) to estimate the distribution of household wealth in South Africa. This result is used in conjunction with the behavioural life-cycle theory and data from National Treasury regarding social development and redistribution policies to determine the policy impact on wealth redistribution over time.

To address research question 2, the researcher determines an average QoL, represented as cost of living, per quintile of wealth distribution and constructs a consumption distribution using South African General Household Survey data. Using the result of research question 1, the researcher determines the areas where there exists a non-equilibrium between QoL and the level of wealth inequality.

For research question 3, the researcher uses the outcomes of research questions 1 and 2 to construct a matrix distribution of QoL and wealth inequality that is used to determine the level at which wealth inequality will maximise access to higher levels of QoL. This is done within the constraints of social development and redistributive spend and allocation as dictated by policies.

The results of research questions 1, 2 and 3 provides the solution for research question 4. The behavioural life-cycle model is supported in the literature (Levin, 1998; Graham and Isaac, 2002; Schooley and Worden, 2008; Griesdorn, Lown, Devaney, Cho and Evans, 2014). The life-cycle model further is the standard model that economists use to describe the intertemporal decision-making process of time, effort and money (Browning and Crossley, 2001).

3.3 Population and sample

The population of a study is a subset of the target population from which the sample is to be selected (Hu, 2014). In this study, the population consists of all South Africans of working age (15 to 64 years old) and post-retirement age (65 years and older). The sample of South Africans used for this study is obtained through using secondary data from Statistics South Africa for all purposes of this study. This data is supplemented with data from the Human Sciences Research Council. Data sample size and technique is as represented by the secondary data sources. Stratified sampling is applied to all data used where applicable. Stratified sampling is a probability sampling method where the population is divided into distinct strata. Within each stratum, the elements are similar to another with respect to the characteristics important to the survey (Elfil and Negida, 2017). Stratified sampling is used as sampling method in the collection of the secondary data in the study.

3.4 Data variables and sources

Data is collected from several different sources. These data sources are available in the public domain and can be accessed through the websites of the relevant organisations. These sources are listed in table 4.

Table 4: Data and sources.

Data	Variable proxy	Source	Similar studies
Income	Macro-economic policy; Personal financial management	Statistics South Africa South African Revenue Service World Inequality Database	Brzozowski et al.,2010; Saez and Zucman, 2016; Anghel et al., 2018
Employment	Macro-economic policy	Statistics South Africa South African Revenue Service	Carroll, Dynan and Krane, 2003; Lentz and Tranæs, 2005; Dickens, Triest and Sederberg, 2017.
Government expenditure (budget)	Macro-economic policy	Statistics South Africa National Treasury	Rudra, 2004; Wolff and Zacharias, 2007; Mehmood and Sadiq, 2010.
Consumption	Personal financial management	Statistics South Africa Department of Higher Education National Student Foundation Aid Scheme Council of Medical Schemes	Tan and Voss, 2003; Dreger and Reimers, 2012; Subramanian and Jayaraj, 2013.
Healthcare	Personal financial management	Statistics South Africa Council of Medical Schemes	Boyetey, 2016; Dickman, Himmelstein and Woolhandler, 2017; Pinilla and López-Valcárcel, 2020.
Education	Personal financial management	Statistics South Africa Department of Higher Education National Student Foundation Aid Scheme	Rauscher and Elliott, 2014; Pfeffer, 2018; Kim, 2021.
Household assets	Personal financial management	Statistics South Africa South African Reserve Bank Department of Agriculture, Land Reform and Rural Development	Chiteji and Stafford, 1999; Keister, 2000; Krivo and Kaufman, 2004.
Savings	Personal financial management	Statistics South Africa Financial Sector Conduct Authority	Díaz, Pijoan-Mas and Ríos-Bull, 2003; Campanale, 2007; Gu and Tam, 2013.

3.4.1 Income

Brzozowski, Gervais, Klein and Suzuki (2010) study the relationship between income, consumption and wealth inequality in Canada. The results show that income inequality has increased greatly over the last 30 years, and despite an offset by tax and social transfers, wealth inequality has failed to decrease over the same period of time. Saez and Zucman (2016) show that the increase in wealth inequality in the USA since 1913 can be attributed to the large increases of top incomes coupled with an increase in the savings rate inequality. Anghel, Basso, Bover, Casado, Hospido, Izquierdo, Kataryniuk, Lacuesta, Montero and Vozmediano (2018) show that the increase in inequality of income per capita in Spain as a consequence of economic recession directly contributed to increased wealth inequality.

3.4.2 Employment

Carroll, Dynan and Krane (2003) analyse household job-loss risk to household net worth in the USA over the period 1983 to 1992. The study concludes that there exists no precautionary behaviour in low-income households, but that there exists strong relationships between the two variables in the middle- and high income household groups. Lentz and Tranæs (2005) study the optimal savings' behaviour as an individual moves between employment and unemployment in the USA. They show that unemployment periods have a negative effect on wealth inequality, due to precautionary savings built up during employment being consumed during periods of unemployment due to cumulative wealth being drawn down to smooth consumption over the full employment period. Dickens, Triest and Sederberg (2017) show that over the period 1984 to 2011 in the USA, the ability of households to use wealth, unemployment insurance and other transfers to cover lost income during periods of unemployment is very limited and has declined since the 1980s. Most households do not own enough wealth to smooth their consumption for more than a short period of unemployment.

3.4.3 Government expenditure

Rudra (2004) studies the relationship between government social expenditure and income distribution for 35 less developed countries for the period 1972 to 1996, and compares these results to redistributive social spending effects in 11 advanced countries. The results show that while all government social expenditure improved the income distribution and decreased wealth inequality in advanced countries, the effects in less developed countries were much lower. Wolff and Zacharia (2007) investigates government expenditure and taxation effects on household financial well-being in the USA between 1989 and 2000. The results show that overall inequality is significantly reduced by net government expenditure and that the inequality-reducing effect of net government expenditures is attributed to expenditure more so than taxation. Mehmood and Sadiq (2010) studies the long- and short-run relationships between fiscal deficits and poverty in Pakistan. The results show a negative relationship between government expenditure and poverty between 1976 and 2010 for both the long- and short-run.

3.4.4 Consumption

Tan and Voss (2003) investigate the relationship between consumption and wealth in Australia for the period 1988 to 1999. The results of the study show that changes in financial and non-financial assets have significant, but different short- and long-term effects on wealth inequality. Changes in non-financial wealth have larger effects than changes in financial wealth over the long-term. Dreger and Reimers (2012) examine the long-term relationship between consumption, income and wealth for 15 industrialised countries for the period 1991 to 2010. Property price increases are shown to exceed the effects of increased equity wealth. Risk sharing activities between agents in the population dictate how wealth effects arise from consumption behaviour, and without sufficient integration within financial markets, consumption expenditure decreases, and the savings rate increases, decreasing wealth inequality. Subramanian and Jayaraj (2013) investigate trends in wealth inequality and the distribution of household wealth and consumption in India over the period 1970 to

2010. The results show that there exists a positive relationship between consumption of wealthier household as opposed to less wealthy households, and wealth inequality.

3.4.5 Healthcare

Boyetey (2016) examines the relationship between wealth inequality and healthcare utilisation in households in Ghana from survey data collected for 2014. The results show that access to healthcare varies according to the distribution of household wealth. The middle class is shown to have the lowest access to healthcare. Dickman, Himmelstein and Woolhandler (2017) investigate inequality and health-care system outcomes in USA households from 1963 to 2014. The study shows that poor individuals have less and worse access to healthcare than wealthier individuals. Rising healthcare premiums and cost sharings have also diminished income gains over the same period, driving more individuals into poverty and bankruptcy. The proportion of health-care resources apportioned to the wealth has also increased over time. Pinilla and López-Valcárcel (2020) examine how the financial behaviour of households across the wealth distribution in Spain influences their probability of buying voluntary private healthcare insurance for the period 2008 to 2014. The results show that wealth influences households' decisions to purchase private healthcare insurance. For poor households, there exists no significant tendency to obtain such insurance, whereas as wealth increases, the probability to purchase private healthcare insurance increases.

3.4.6 Education

Rauscher and Elliott (2014) examine the factors that lead to decreased higher education completion rates in the USA, and introduce how a legacy of wealth provides an advantage for wealth students as opposed to poorer students. Adequate access to financial aid, as well as long-term education savings mechanisms are shown to increase the likelihood of increased rates of higher education completion for poorer students. Pfeffer (2018) investigates the relationship between educational attainment and family wealth levels for the period 1999 to 2015 in the USA. The results show that despite an increase in educational attainment coupled with a moderate decrease in wealth distribution in high school attainment and higher education access, there exists

a large and increasing inequality in wealth in higher education attainment. This increase is derived from wealthier children possessing greater access to pursue and complete higher education, due to family wealth. Kim (2021) examines how heterogeneity in education contributes to wealth inequality and life-cycle savings in the USA for the period 1968 to 2011. The results show that wage dispersion is linked to the skills acquired through the choice of higher education and the resultant occupation, and that this wage-dispersion ultimately leads to increased wealth inequality between skilled and unskilled households.

3.4.7 Household assets

Chiteji and Stafford (1999) investigate the relationship between parents' and children household portfolio asset composition between 1984 and 1994 in the USA. The results show that parents that held stocks are more likely to have children that hold stocks as well. Household portfolio choices thus implicitly influences children's portfolio choices in adulthood, with the net effect that wealthier households tend to generate more wealth across generations than poorer household, widening wealth inequality. Keister (2000) investigates racial differences impacts household asset ownership and the distribution of household wealth in the USA for the period 1983 and 1986. The study results show that white households are more likely to buy riskier, higher-return assets than black households. Removing racial differences from factors that determine wealth inequality reduces wealth inequality only marginally. Krivo and Kaufman (2004) investigate how differences in property ownership between different races in the USA affects wealth inequality. The results show that decreased rates of homeownership in the non-white races lead to a disparity in wealth over time. The barriers faced by black Americans to own property severely impedes their ability to generate wealth as opposed to white Americans.

3.4.8 Savings

Díaz, Pijoan-Mas and Ríos-Bull (2003) investigates households' savings habit formation in the USA using several different heterogenous models. The study concludes that positive habit formation increases households' savings rates and

decreases wealth inequality. The results hold for both persistent and non-persistent habits, with the effect much more pronounced in the former as opposed to the latter. Campanale (2007) examines the relationship between wealth accumulation and household savings behaviour in the USA, using household survey data from 1998. The results show that households' portfolios differ significantly as the level of wealth increases, with a trend to a higher concentration of high-yield assets as wealth increases. The savings return rate between less wealthy and more wealthy households lead to a substantial increase in wealth inequality over time. Gu and Tam (2013) study the dynamics between savings, economic growth and wealth inequality in China for the period 1978 to 2009. The results show that economic growth has a limited effect on the savings rate, whilst decreased wealth inequality has a positive and larger effect on increasing the savings rate.

3.5 Reliability and validity of the study

Reliability describes how well the study evaluates what was intended to be measured (Heale and Twycross, 2015). Reliability can be achieved by conducting the study again to confirm if the same results are obtained. The data used for this study is sourced from secondary sources. Using the research methodology as outlined in this study, conducting the study again should yield the same result.

Validity describes how well the study accurately measures the concepts under investigation (Heale and Twycross, 2015). The data used for this study is sourced from secondary sources. Appropriate measurement and sampling methods are used in the compilation of this data by the relevant sources.

The researcher subjects the data variables to a correlation analysis for the purpose of validating and establishing the nature of the relationship between the data variables used in the study. The correlation coefficient measures the strength of the relationship between two continuous, numeral variables. The correlation coefficient can assume a value between -1 and +1 (Bujang and Baharum, 2016), with a negative coefficient implying an inverse relationship and a positive coefficient implying a positive relationship. An absolute coefficient value between 0.1 and 0.3 implies weak association, indicating that model interpretations are erroneous. An absolute

coefficient value between 0.3 and 0.5 implies a moderate correlation and that model interpretations are plausible. Absolute coefficient values exceeding 0.5 implies a strong correlation, indicating that model interpretations are definite (Mabandla, 2018).

3.6 Model specification

The model consists of three different components, with the first model component related to personal finance, wealth inequality and QoL. The second model component is the wealth inequality ratio. The third model component is related to macroeconomics and wealth inequality. The model uses as foundation the behavioural life-cycle theory proposed by Shefrin and Thaler (1988). Their model is extended to answer the research questions that this study is focused on by defining wealth inequality as possessing a QoL below the level at which a meaningful QoL can be maintained for the duration of a lifetime, coupled with assets that can be bequeathed to the next generation as generational wealth.

3.6.1 Personal finance wealth inequality model

A meaningful QoL can be approximated as the average monetary lifetime requirements the average South African may face with respect to specific QoL indicators, as given in table 2 in chapter 1. The level of wealth W, at which a meaningful QoL can be attained by the average South African, is described by equations 1 and 2:

$$W_{QoL}(T) = (1 + q_5) \times (\sum_{i=1}^{3} q_i) + q_4 + \alpha \quad (1)$$

$$W'_{QOL}(T) = (1 + q_5) \times (\sum_{i=1}^{3} q_i) \quad (2)$$

where $W_{QoL}(T)$ is the quality of life wealth variable, $W'_{QOL}(T)$ is the 0th generation quality of life wealth. q_1 refers to material living conditions, q_2 refers to healthcare requirements, q_3 refers to educational requirements, q_4 refers to bequeathed estate passed onto the next generation, T refers to the life expectancy of the average South African, q_5 refers to quality of employment and α is the bequeathed estate received from the previous generation. Each variable q_i can be approximated to a specific

monetary value required. q_1 is determined by income levels and can be approximated as the lifetime subsistence requirements, retirement savings contribution, retirement withdrawals and household savings of an average South African, represented as consumption, accounting for the period where there are child dependents in the household. q_2 is determined as the lifetime cost of healthcare associated with the individual, accounting for periods of excess cost across the life cycle, associated with periods where the individual bears responsibility for their children's healthcare needs, defined as T_2 in figure 2. q_3 is calculated as the expected cost of education requirements for further development and growth in the labour market regarding career growth and costs associated with education requirements regarding children, determined across the time period T_2 to T_3. q_4 is determined as the bequeathed estate, approximated as the real-return value of the average transferred property plus the remaining real-return pension asset at the cessation of the individual at time T_4 in figure 2. q_5 is the opportunity cost of unemployment. This cost of unemployment is calculated using the average rate of unemployment as a measure of lost income between the period T_3 and T_1, as given by figure 2. The model aims to determine the quality of life wealth $W_{QoL}(T)$ and the 0th generation quality of life wealth $W'_{QOL}(T)$ for each year for the period 2010 to 2019, by fixing each year in the period as a separate state, and then extending each state by the respective period T for all independent variables as determined by each state's underlying data. The dependent variables $W_{QoL}(T)$ and $W'_{QOL}(T)$ can then be plotted as time-series over the period 2010 to 2019 to compare model results with actual income data to determine how the level of wealth W at which a meaningful QoL can be attained has changed over the period.

The personal finance wealth inequality model compares the results obtained from $W'_{QOL}(T)$ with the result of equation 3:

$$W(T) = \frac{1}{N_{RT}} \sum_{23}^{60} \frac{t_{PI}}{r_{ET}} - t_{PI} \tag{3}$$

where $W(T)$ is the lifetime level of wealth accumulated over the period $T = 60 - 23$. T is fixed at 38 since this corresponds to the same employment period for $W'_{QOL}(T)$. N_{RT} represents the number of registered personal income taxpayers. The total amount of tax collected on personal income is the variable t_{PI}. The effective tax rate on personal

income is represented by r_{ET}. $W(T)$ is thus the average total lifetime after-tax personal income of an individual. $W(T)$ is also determined for the different percentile income groups: the 0 percentile income group PI_0; the 0-50th percentile income group PI_{0-50} and the 50-90th percentile income group PI_{50-90}; the 90-100th percentile income group PI_{90-100}. Table 5 shows that the percentile income groups 0-50 (PI_{0-50}), 50-90 (PI_{50-90}) and 90-100 (PI_{90-100}) are deteremined from the number of employed individuals registered for pay-as-you-earn (PAYE) income tax. The 0th percentile income group is defined as either unemployed, discouraged work seekers or employed individuals not registered for PAYE income tax. The individuals in the latter case earn below the income threshold for PAYE income tax. Individuals in this group may be employed in the informal sector or as seasonal employees. The model assumes that the population in this income group earn zero income, since the population is so large relative to the income generated.

Table 5: classification of population income groups in determining W(T) in the personal finance wealth inequality model.

<table>
<tr><th colspan="2">Population of working age</th><th colspan="3">Population income group</th></tr>
<tr><td>Employed</td><td>Registered for PAYE</td><td>$W(T)$: PI_{0-50}</td><td>$W(T)$: PI_{50-90}</td><td>$W(T)$: PI_{90-100}</td></tr>
<tr><td>Employed</td><td>Not registered for PAYE</td><td colspan="3" rowspan="3">$W(T)$: PI_0</td></tr>
<tr><td colspan="2">Unemployed</td></tr>
<tr><td colspan="2">Discouraged work seekers</td></tr>
</table>

3.6.1.1 Independent variable equations

Each component q_i of equation 1

$$W_{QoL}(T) = (1 + q_5) \times (\sum_{i=1}^{3} q_i) + q_4 + \alpha \quad (1)$$

is determined using each of the respective sub-equations, that are in turn determined by other variables. These sub-equations for each component q_i are discussed in this section.

Consumption (q1)

$$q_1 = H_P \sum_{T_1}^{T_3} \frac{S_R}{P} + \sum_{T_1}^{T_1+6} P_{C,i_P} + \sum_{T_1}^{T_1+20} P_{P,i_P} + 2 \sum_{T_1}^{T_3} \frac{S_H}{N_P} + 2 \sum_{T_1}^{T_3} C_A + 2 \sum_{T_3}^{T_4} B_P \quad (4)$$

The consumption per individual is given by equation 4 as the sum of the annual retail trade sales S_R divided by the number of individuals in the population P multiplied by the number of people in the household H_P per year over the period T_1 and T_3. P_{C,i_P} represents the sum of the annual instalments payable on a small family car over a period of 6 years, and P_{P,i_P} represents the sum of the annual instalments of the purchase price of an average property for a period of 20 years, both priced at the average prime interest rate of i_P per year with zero deposit. Household savings is represented by the value of household savings contributed by both adults in the households over the period T_1 to T_3, with annual savings contributions determined by the household savings rate S_H divided by the average number of parents per household N_P; Term 5 represents the value of the average retirement contributions C_A, contributed by both adults in the household over the period T_1 to T_3. Term 6 represents the average retirement withdrawals between T_3 to T_4 for both adults in the household, at the average withdrawal B_P.

Healthcare (q2)

$$q_2 = 2 \times \sum_{T_1}^{T_4} C_{MR,T_i} + N_C \times \sum_{T_{MA}}^{18+T_{EG}} C_{MR,T_i} \quad (5)$$

The cost of healthcare is given by equation 5 as the sum of two terms; term 1 representing cost of healthcare for adults (2) in the household as the sum of all average risk contributions C_{MR,T_i} to a medical scheme per age T_i between T_1 and T_4; term 2 representing the cost of healthcare for children in the household as the average number of children N_C multiplied by the sum of all average risk contributions C_{MR,T_i} to a medical scheme from age 0 (the mother conceives children at time T_{MA}, the median age of conception) to $18 + T_{EG}$, where T_{EG} is the average period of time in years until > 50% of higher education students have graduated.

Education (q3)

$$q_3 = N_C \sum_{18+T_{MA}}^{18+T_{MA}+T_{EG}} C_{HE} \quad (6)$$

The cost of higher education is described by equation 6, in relation to the number children in the household, is given by the product of the number of children N_C, and the sum of the average cost of higher education per student per year, for a time period beginning at $18 + T_{MA}$ (the age of the parents when the children enter higher education) and ending at $18+ T_{MA} + T_{EG}$ (the age of the parents when the children graduate from higher education and enter the labour market).

Bequeathed estate (q4)

$$q_4 = \frac{1}{N_C} * [\, V_{P,T_1} \left(1 + \frac{r_P}{T_4 - T_1}\right)^{T_4 - T_1} + 2C_A \times \frac{(1+r_R)^{T_3 - T_1 + 1} - 1}{r_R} \times (1 + r_R) - 2 \sum_{T_3}^{T_4} B_P \,] \quad (7)$$

The value of the bequeathed estate is given equation 7 through three separate terms; term 1 represents the value of the property V_P acquired at time T_1, increasing at an annual real return rate of r_P (equal to 2%) over the period T_1 to T_4. Term 2 represents the value of the average retirement contributions C_A, contributed by both adults in the household, increasing at an annual real return rate of r_R (equal to 5%) over the period T_1 to T_3. Term 3 represents the retirement withdrawals between T_3 to T_4 for both adults in the household, at the average withdrawal B_P. The bequeathed estate is then shared equally by the number of children in the household N_C.

Cost of unemployment (q5)

$$q_5 = \left(1 - \frac{P_E}{P_{WA}}\right) \times \left(\frac{T_3 - T_1}{T_4 - T_1}\right) \quad (8)$$

The cost of unemployment per individual is given by equation 8 as the complement of the percentage of the number of employed individuals in the population P_E divided by

the number of individuals of working age in the population P_{WA}. This variable is then scaled to account for the period of employment.

Alpha term (α)

$$\alpha_i = \begin{cases} 0 & when\ i = 1 \\ q_{4,i-1} & when\ i > 1 \end{cases} \quad (9)$$

The bequeathed estate α_i received from the previous generation $i - 1$, is given by the piecewise function equation 9, where α_i is zero when the generation i is the first generation, and q_{4i} when i is greater than 1.

3.6.2 Wealth inequality ratio

Equation 10 describes wealth inequality as given by the ratio:

$$WI = \frac{W(T)}{W'_{QOL}(T)}, W'_{QOL}(T) > 0 \quad (10)$$

where WI is the wealth inequality ratio and $W(T)$ is the average wealth owned by an average South African. $W(T)$ is analogous to $W'_{QOL}(T)$, in that $W(T)$ is the sum of all income over the average lifetime T of the average South African, as given by equation 11

$$W(T) = \sum_{i=1}^{T} y_i \cong \sum_{T_1}^{T_3} y_i \quad (11)$$

where y_i is the total income and bequests at each point T_i. For comparative purposes, equation 5 is approximated as the lifetime income of the average South African over the same period T_1 to T_3 as per equations 1 and 2 for each year tranche between 2010 and 2019. When the wealth inequality ratio is greater than 1, this implies that the average South African owns more wealth than what is required for a meaningful QoL, implying that there exists an excess capacity for redistributive policies to transfer wealth to those below the threshold $W'_{QOL}(T)$. When the ratio is less than 1, this implies that the income level $W(T)$ owns less wealth than what is required for a meaningful

QoL, implying that wealth inequality is exceedingly high and that current redistributive policies may not adequately raise enough individuals in the population to the threshold $W'_{QOL}(T)$. Wealth inequality trends can be revealed by plotting WI over time. Different population income groups, classified according to the income distribution in the population, can also be used to determine their relationship to the meaningful QoL as given by $W'_{QOL}(T)$. These groups are classified in table 5. The wealth inequality ratio can be expanded to determine which variables contribute the greatest to wealth inequality component-wise and from either a macro-economic policy or personal finance factor.

3.6.3 Macro-economic wealth inequality model

Government's ability to address wealth inequality is constrained by government expenditure related to wealth transfers and expenditure on factors related to reducing wealth inequality in the long-term. Such expenditure on social welfare, education and economic development is constrained by how the total budget is allocated. Equation 12 describes the composition of the annual budget with respect to source revenue

$$B = R_t + R_{nt} + \varepsilon \tag{12}$$

where B is the total budget, R_t is the budget attributed to tax revenue, R_{nt} is the budget attributed to non-tax revenue, ε is other revenue contributors. Since the total budget is determined by both tax revenue, non-tax revenue and other revenue sources, government is constrained by the degree of wealth redistribution that can be allocated through reasonable tax revenue on the population. Equations 13 and 14 describe how the budget allocated to wealth redistribution is related to the total budget

$$B = B' + B_{WI} \tag{13}$$

$$B_{WI} = k\,B = k\,(R_t + R_{nt} + \varepsilon) \approx k\,(R_t + R_{nt}), 0 \leq k \leq 1 \tag{14}$$

where B_{WI} is government expenditure related to healthcare, social welfare, education and economic development, B' is the budget remainder and k representing a factor

whereby B_{WI} can be levered up or down. Equation 15 describes B_{WI} in relation to the budget allocations for healthcare, social welfare, education and economic development

$$B_{WI} = B_H + B_{SW} + B_E + B_{ED} \tag{15}$$

where B_H is expenditure related to healthcare, B_{SW} is expenditure related to social welfare and development, B_E is expenditure related to education and B_{ED} is expenditure related to economic development. Since wealth redistributive transfers are targeted to the lower end of the wealth and income distributions, irrespective of employment status, the population targeted by these policies are those belonging to the 0th and 0-50th percentile income groups, PI_0 and PI_{0-50}. Equation 15 is thus adjusted to equation 16 to describe the average government expenditure related to healthcare, social welfare, education and economic development expenditure related to wealth redistributive policies to each member of this population.

$$\bar{B}_{WI} = \bar{B}_H + \bar{B}_{SW} + \bar{B}_E + \bar{B}_{ED}, N = N(PI_0) + N(PI_{0-50}) \tag{16}$$

Each component function $\bar{B}_i$ of equation 16 is determined using respective equations, that are in turn determined by other variables. These are described in section 3.6.3.1. The redistributive wealth transfer distance is described by equation 17

$$W_G = W'_{QOL}(T) - \bar{B}_{WI} + W(T) \tag{17}$$

where $W(T)$ is the level of wealth accumulated over the period T as per the personal finance wealth inequality model, $W'_{QOL}(T)$ is the level of wealth W at which a meaningful QoL can be attained as per the personal finance wealth inequality model and $\bar{B}_{WI}$ is the average government expenditure related to healthcare, social welfare, education and economic development expenditure related to wealth redistributive policies to each member of the population N, where N is the population defined to be fit for the labour market, excluding the 50-90th and 90-100th percentile income groups, PI_{50-90} and PI_{90-100}.

3.6.3.1 Independent variable equations

For each independent variable equation input for equation 16, the population under consideration belongs to the 0th and 0-50th percentile income groups, PI_0 and PI_{0-50}.

Healthcare ($\bar{B}_H$)

$$\bar{B}_H = \frac{B_H}{P - P_{MB}}[N_C(18 + T_G) + 2(L_E - 23)] \quad (18)$$

The average healthcare transfer per tranche year is given by equation 18 as $\bar{B}_H$, where B_H is the total budget expenditure for healthcare for the year, P is the entire South African population, P_{MB} is the the population consisting of medical aid beneficiaries, N_C is the average number of children born per tranche year, $18 + T_G$ represents the age of childhood dependence on adults, defined as 18 plus the average number of years to higher education graduation, T_G, where at least 50% of the student population has graduated. The term $L_E - 23$ represents the time period of adult dependence on the healthcare system, equal in time-length to the personal finance wealth inequality model.

Social welfare ($\bar{B}_{SW}$)

$$\bar{B}_{SW} = \frac{B_{CS}}{N_{CS}}[N_C(18)] + \frac{B_{OG}}{N_{OG}}[2(L_E - 60)] \quad (19)$$

The average social welfare transfer per tranche year is given by equation 19, as $\bar{B}_{SW}$, where B_{CS} is the total budget expenditure for child support for the year, N_{CS} is the number of children for whom child support is being received, N_C is the average number of children born per tranche year and 18 represents the number of years for which child support grants will be received. B_{OG} is the total budget expenditure for old age grants for the year, N_{OG} is the number of recipients of old age grants and the term $2(L_E - 60)$ represents the old age grant received for both adults in the household where L_E is the average life expectancy.

Education ($\bar{B}_E$)

$$\bar{B}_E = \frac{B_E}{N_{BE}+N_{HE}}[N_C(18+T_G)] \quad (20)$$

The average education transfer per tranche year is given by equation 20, as $\bar{B}_E$, where B_E is the budget expenditure for education for the year, N_{BE} is the number of children in basic education, N_{HE} is the number of children in higher education, N_C is the average number of children born per tranche year and the term $18 + T_G$ represents the duration of time children spend in education, where T_G is the average number of years to graduation in higher education, where at least 50% of the student population has graduated.

Economic development ($\bar{B}_{ED}$)

$$\bar{B}_{ED} = (\frac{B_{HWE}+B_T}{N_P} + \frac{B_{JL}+B_{AL}}{N_P})[2(L_E - 23)] \quad (21)$$

The average economic development transfer per tranche year is given by equation 21, as $\bar{B}_{ED}$, where B_{HWE} is the budget expenditure for human settlements, water and sanitation and electrification, B_T is the budget expenditure for public transport, B_{JL} is the budget expenditure for job creation and labour affairs, B_{AL} is the budget expenditure for agriculture and land reform, N_P is the population belonging to the 0th and 0-50th percentile income groups, PI_0 and PI_{0-50}. L_E represents the average life expectancy for the respective year, where 2 represents the number of adults in the household and 23 equates the time period to the personal finance wealth inequality model.

3.7 Data analysis and interpretations

The sample of data used in the study is first described using descriptive information, such as age, gender, race, employment, education and wealth status. An average life-cycle cost of living for the average level of wealth is determined for each year as a

separate tranche, using average cost inputs as per variables described in equations 1 to 9. These inputs are also used to determine the wealth inequality ratio as described by equation 10. Equation 17 utilises the results obtained from the inputs for equations 2, 11 and 16. Equations 12 to 21 uses the budget data as given by National Treasury. Statistical software used for analysis includes R, Python and Microsoft Excel.

3.8 Ethical considerations

Ethics refers to the conduct of individuals. It is a set of principles or morals that guides the standards of behaviour of people and their relationships with others and distinguishes between acceptable and unacceptable behaviour. Ethics in the research setting is important, since researchers should protect the dignity of subjects and publish information that is researched well and under acceptable behaviour. This includes selecting the appropriate methodology used in the research, relevant data collection methods and present and interpret research findings in a logical sequence (Akaranga and Makau, 2016).

Prior to undertaking any data collection, the researcher applied for ethical clearance from the Unisa Ethics Committee. Only after permission was granted did the researcher download the required secondary data. In addition, all sources are referenced in-text and listed in detail in the references at the end of this study.

During the research period, the researcher conducted the study in accordance with the approved proposal. Research data and information was stored in accordance with the requirements as outlined in the research proposal. The researcher was committed to honesty, fairness and credibility in the judgment of research, performing of analyses and the presentation of theories, designs and interpretations of results. The researcher adhered to the Unisa Policy on Research Ethics.

3.9 Chapter conclusion

This chapter presented the research design and methodology used for the study. This study uses as foundation the behavioural life-cycle theory proposed by Shefrin and Thaler (1988). The model consists of three different components. The first component is the personal finance wealth inequality model, using consumption, healthcare, education, bequeathed estate and cost of unemployment as model variables. The second model component is the wealth inequality ratio, using the average lifetime income and the model result of the personal finance wealth inequality model as inputs. The third component, the macro-economic wealth inequality model, uses healthcare, social welfare, education and economic development as model variables. The population and sample, data variables and sources, reliability and validity and ethical considerations were discussed. The following chapter will present the data analysis, findings and discussion.

4 CHAPTER 4: DATA ANALYSIS, FINDINGS AND DISCUSSION

4.1 Introduction

The previous chapter discussed the research design and methodology utilised for this study. This chapter presents the preliminary correlation analysis, data analysis, empirical findings and the discussion of these in the context of the literature and the objectives of the study. By way of recap, the objectives that this study sought to address were:

1. To investigate how policies focused on addressing wealth inequality by the South African government affect wealth inequality.
2. To assess how South Africans' personal finance choices affect wealth inequality.
3. To ascertain the degree of wealth most South Africans are able to access a meaningful quality of life (QoL).
4. To propose a model that can be utilised to decrease wealth inequality in South Africa to an extent where most South Africans are able to access a meaningful quality of life (QoL).

The research questions the study sought to address were:

1. How do policies focused on addressing wealth inequality by the South African government affect wealth inequality?
2. How do South Africans' personal finance choices affect wealth inequality?
3. How much wealth do most South Africans require to able to access a meaningful quality of life (QoL)?
4. What model can be utilised to decrease wealth inequality in South Africa to an extent where most South Africans are able to access a meaningful quality of life (QoL)?

4.2 Data analysis

This section discusses the data analysis for the personal finance wealth inequality, wealth inequality ratio and the macro-economic wealth inequality models.

4.2.1 Personal finance wealth inequality model

4.2.1.1 Descriptive statistics of dependent and independent variables

The summary of descriptive statistics of all dependent and independent variables related to the personal finance wealth inequality model are presented in table 6. The intention of this summary is to show the number of observations, mean, standard deviation and minimum and maximum values related to each variable. Table 6 shows that the high degree of difference between mean total annual taxable income and retail trade sales indicates that the average South African allocates a large degree of income to consumption. The low number of active retirement fund members and pension fund members relative to the labour force indicates most South Africans are not able to save for retirement and possess a large estate to bequeath. Total enrolment in public higher education is low in relation to the population of working age and discouraged work seekers, indicating that most South Africans are unskilled. The standard deviation of the number of medical aid beneficiaries is relatively low in relation to the population of working age and the labour force, indicating that most South Africans cannot afford healthcare.

Table 6: descriptive statistics for variables used in the personal finance wealth inequality model.

Variable category	**Variable**	**Observations**	**Mean**	**Standard Deviation**	**Min**	**Max**
Income	Total annual taxable income	10	1 813 131 947 734	48 742 928 647	1 116 978 777 335	2 486 784 606 714
Income	Registered PAYE individuals	10	16 268 497	5 090 981	5 920 612	22 170 546
Income	Effective income tax rate	10	18.56%	0.61%	18.02%	19.79%
Employment	Population of working age	10	35 335 600	2 298 177	31 946 000	38 433 000
Employment	Labour force	10	20 263 300	2 041 659	17 462 000	22 968 000
Employment	Employed	10	14 932 200	1 293 852	13 061 000	16 313 000
Employment	Unemployed	10	5 331 100	784 037	4 401 000	6 655 000
Employment	Discouraged work seekers	10	15 072 300	313 268	14 484 000	15 465 000
Education	Total enrolment in public higher education	10	989 588	60 271	892 936	1 085 568
Education	Years to higher education completion (at graduation rate exceeds 50% of intake)	10	6	1	5	8

Education	Total grants and tuition in higher education	10	61 907 500 000	16 055 448 547	40 958 000 000	88 428 000 000
Consumption, Bequeathed estate	Number of property transfers	10	338 954	56 819	212 068	387 760
Consumption, Bequeathed estate	Purchase price	10	461 946 426 192	79 149 684 725	341 279 677 256	639 739 663 483
Consumption, Bequeathed estate	Prime interest rate	10	9,57%	0,70%	8,50%	10,41%
Consumption	Gross household savings	10	41 472 888 175	7 156 582 370	30 280 900 000	49 636 765 750
Consumption, Savings	Number of households	10	15 227 400	1 217 786	13 456 000	17 163 000
Consumption, Savings	Number of active members (retirement funds)	10	10 745 803	752 056	9 439 895	11 698 294
Consumption, Savings	Number of pension members (retirement funds)	10	5 065 200	1 063 987	2 858 483	6 608 390
Consumption, Savings	Total retirement contributions	10	201 164 579 947	48 899 147 018	129 006 000 000	274 216 799 470

Consumption, Savings	Total benefits paid	10	255 952 266 032	93 009 918 102	141 404 000 000	397 302 660 318
Savings	Total assets	10	3 606 958 547 187	915 606 776 552	2 198 384 000 000	4 869 037 471 869
All	Average births per woman	10	2,41	0,09	2,32	2,58
All	Average life expectancy	10	68,0	1,0	66,6	69,2
All	Median age of mother by birth	10	27,0	0,6	26,3	27,9
Healthcare	Total risk contributions (medical schemes)	10	134 482 000 000	33 202 801 020	87 700 000 000	186 660 000 000
Healthcare	Total claims (medical schemes)	10	119 992 000 000	31 442 251 757	76 600 000 000	169 070 000 000
Healthcare	Number of beneficiaries (medical schemes)	10	8 756 142	201 738	8 315 718	8 990 160
Consumption	Retail trade sales	10	823 876 300 000	187 114 778 046	565 605 000 000	1 091 504 000 000
Consumption	Population	10	54 454 400	2 549 086	50 850 000	58 429 000
Consumption	Vehicle price	10	177 112	24 854	145 610	213 800

Source: author’s own calculation

4.2.1.2 Correlation analysis

The correlation analysis is performed for each variable category described in table 6. The results for these correlations are provided in tables A-1 and A-2 appendix A.

Table 7 provides a summary on the frequency of correlations observed for all variables used in the personal finance wealth inequality model.

Table 7: summary of correlations observed for the personal finance wealth inequality model variables.

Correlation interval	**Description**	**Frequency observed**
0,5 < corr =< 1	Strong positive	325
0,3 < corr <= 0,5	Moderate positive	10
-0,3 <= corr <=0,3	Weak	43
-0,5 <= corr < -0,3	Moderate inverse	34
-1 <= corr < -0,5	Strong inverse	53

Table 7 shows that majority of correlations between variables observed share a strong relationship. 91% of the correlations are either moderate or strong positive and moderate or strong inverse. This result indicates that interpretations made from the model are reliable and valid.

4.2.1.3 Determination of quality of life wealth and 0th generation quality of life wealth for the period 2010 to 2019

Quality of life wealth $W_{QoL}(T)$ and 0th generation quality of life wealth $W'_{QOL}(T)$ is determined for each year for the period 2010 to 2019. The interest rate i_P, used in determining consumption (q1), is determined as the average prime interest rate for the respective tranche year. The results for the independent variables for each equation 4 to 8 can be found in tables A-3 to A-7 in appendix A for the different tranches 2010 to 2019. The results for each year in each tranche for each year series 2010 to 2019 is shown in appendix A, in tables A-8 to A-17. The summarised results for the model's dependent and independent variables are shown in table 8.

Table 8: results for the personal finance wealth inequality model (W QOL (T) and W QOL' (T)).

Year	q1 (ZAR)	q2 (ZAR)	q3 (ZAR)	q4 (ZAR)	q5 (%)	W_{QOL} (ZAR)	W'_{QOL} (ZAR)
2010	8 108 224	2 816 900	946 734	2 644 016	49.7	20 417 454	17 773 438
2011	6 480 462	2 922 634	837 898	2 299 716	50.1	17 667 666	15 367 950
2012	5 894 897	2 982 316	752 682	2 110 880	49.7	16 529 157	14 418 277
2013	6 433 143	3 335 832	783 642	2 374 146	47.4	17 930 953	15 556 807
2014	6 948 248	3 661 267	861 002	2 515 992	47.1	19 388 721	16 872 728
2015	7 800 180	4 141 359	879 790	2 718 180	45.4	21 362 409	18 664 229
2016	8 374 092	4 335 774	814 602	2 829 587	46.3	22 610 957	19 781 370
2017	8 193 179	4 752 234	832 123	2 724 402	44.7	22 656 063	19 931 661
2018	10 714 026	4 985 666	890 485	3 913 170	44.8	27 940 762	24 027 591
2019	9 509 116	5 256 561	954 278	3 375 730	45.3	26 218 242	22 842 512

The results in table 8 show that quality of life wealth $W_{QoL}(T)$ and 0th generation quality of life wealth $W'_{QOL}(T)$ is largest for the 2018 year tranche, and lowest for the 2012 year tranche. The large magnitude of the 2018 year tranche can be attributed to the results obtained for q1 and q4, which are markedly higher in this tranche as opposed to other tranches. This indicates an increased cost of consumption and cumulative prevalence related to the purchase of more expensive property and increased retirement contributions. The 2012 tranche shows the same variable sensitivity as the 2018 tranche, in reverse fashion. The consumption variable q1 is largest in 2018 and the smallest in 2012. Healthcare variable q2 has a strong linear increasing trend across the year tranches in the series. q2 is largest in the 2019 tranche and smallest in the 2010 tranche. The education variable q3 is largest in the 2019 tranche, and smallest in the 2012 tranche. This result is obtained, despite the trend that the average graduation rate decreased from 8 years in the 2010 tranche to 5 years in the 2019 tranche. The education variable q3 showcases a parabolic trend over the tranche series. The bequeathed estate variable q4 has the same maximum and minimum values as variable q3. Variable q5, cost of unemployment, is largest in the 2011 tranche and smallest in the 2017 tranche, with a negative linear trend across the tranche range. This indicates that there has been a general increase in employment across the different tranches. This difference is highly marginal between tranches. Figure 3 shows a plot of the dependent variable results for each tranche year across the time period.

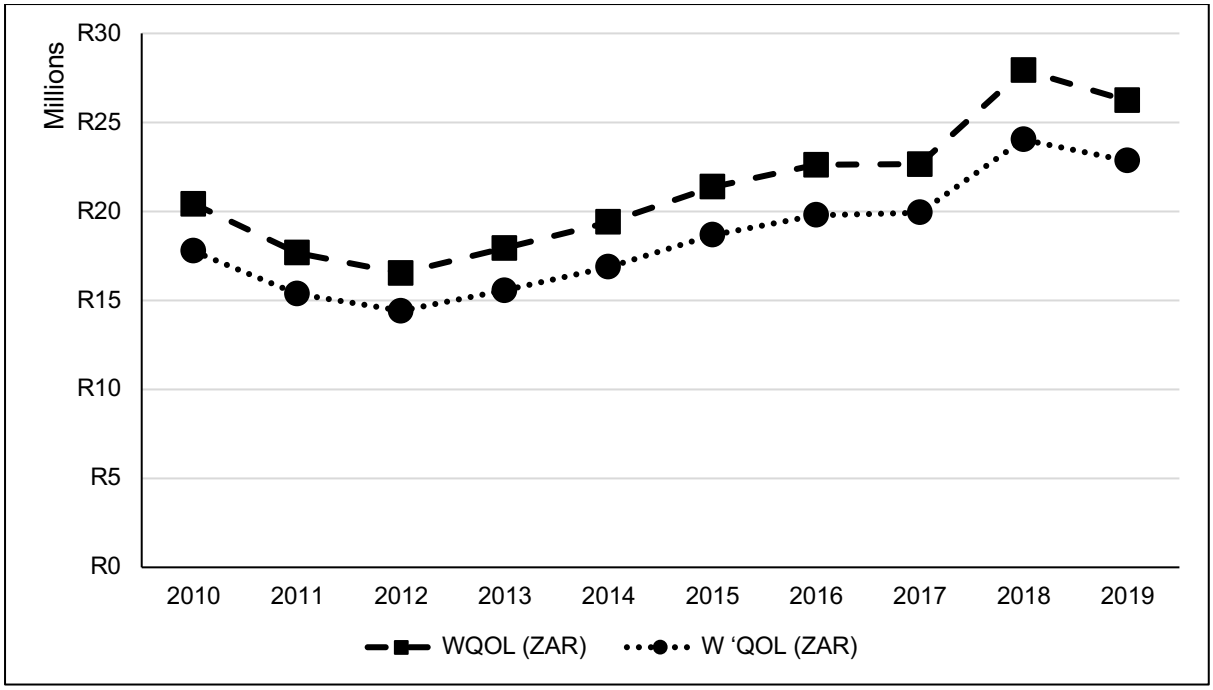

Figure 3: quality of life wealth (W QoL (T)) and 0th generation quality of life wealth (W QOL' (T)) for each tranche year over the period 2010 to 2019.

Source: author's own computations.

Figure 3 shows that quality of life wealth $W_{QoL}(T)$ and 0th generation quality of life wealth $W'_{QOL}(T)$ both initially decrease between the 2010 and 2012 tranches, and then shows a steady increase from the 2012 tranche to the 2018 tranche. Both variables decrease from the 2018 tranche to the 2019 tranche.

4.2.1.4 Determination of lifetime level of wealth for the period 2010 to 2019

Lifetime level of wealth $W(T)$ is determined for each tranche for the period 2010 to 2019. Lifetime level of wealth ($W(T)$) is also determined for the different percentile income groups: the 0 percentile income group PI_0; the 0-50th percentile income group PI_{0-50} and the 50-90th percentile income group PI_{50-90}; the 90-100th percentile income group PI_{90-100}. These results are shown in table 9.

Table 9: results for the lifetime level of wealth (W(T)).

Year	$W(T)$: PI_0 (ZAR)	$W(T)$: PI_{0-50} (ZAR)	$W(T)$: PI_{50-90} (ZAR)	$W(T)$: PI_{90-100} (ZAR)	$W(T)$ (ZAR)
2010	0	923 506	4 488 777	35 951 182	1 084 633
2011	0	552 126	2 832 832	23 416 578	1 196 454
2012	0	370 246	2 248 147	20 532 971	1 306 807
2013	0	362 556	2 221 121	20 237 569	1 374 112
2014	0	365 749	2 269 376	20 623 813	1 497 411
2015	0	383 790	2 381 316	21 641 105	1 673 409
2016	0	399 391	2 478 120	22 520 854	1 794 887
2017	0	399 318	2 477 662	22 516 689	1 848 064
2018	0	400 219	2 483 258	22 567 546	1 924 657
2019	0	396 591	2 460 746	22 362 961	1 972 229

The results in table 9 show that $W(T)$ varies widely between the different percentile income groups. $W(T)$ is on average 53 times smaller for the 0-50th percentile income group as opposed to the 90-100th percentile income group. $W(T)$ is on average 9 times smaller for the 50-90th percentile income group as opposed to the 90-100th percentile income group. $W(T)$ is on average 6 times smaller for the 0-50th percentile income group as opposed to the 50-90th percentile income group. All income groups show a negative linear trend across the different tranche years, except for the 0th percentile income group. $W(T)$ however, increases between the 2010 and 2019 tranches, at an average rate of 7% per tranche year. $W(T)$ is largest in the 2019 tranche, and smallest in the 2010 tranche. Figure 4 shows the results obtained in table 8.

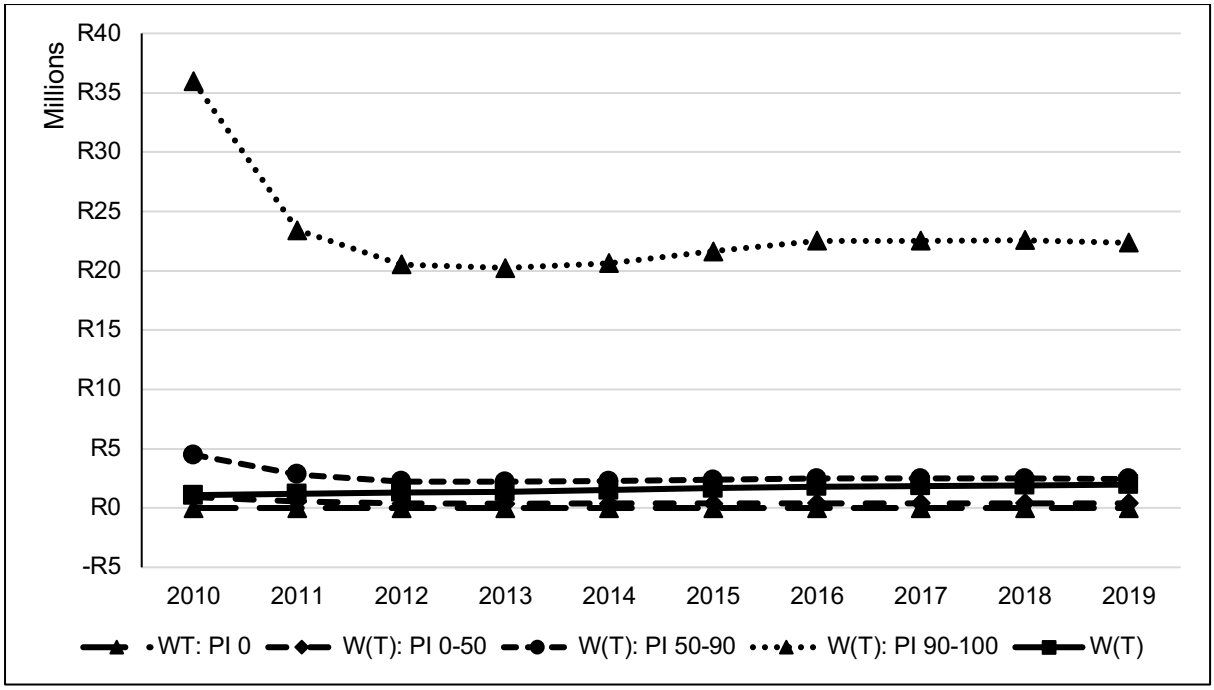

Figure 4: lifetime level of wealth (W(T)) per percentile income group for each tranche year for the period 2010 to 2019.

Source: author's own computations.

Figure 4 shows that for each percentile income group, there is a sharp decrease between the 2010 and 2012 tranches, before a marginal increase or decrease for each percentile income group series across the remaining tranche years. Figure 4 shows how much larger $W(T)$: PI_{90-100} is in relation to $W(T)$ and the other percentile income $W(T)$ series. Figure 5 plots $W(T)$: PI_0, $W(T)$: PI_{0-50}, $W(T)$: PI_{50-90} and $W(T)$ over the different tranche years.

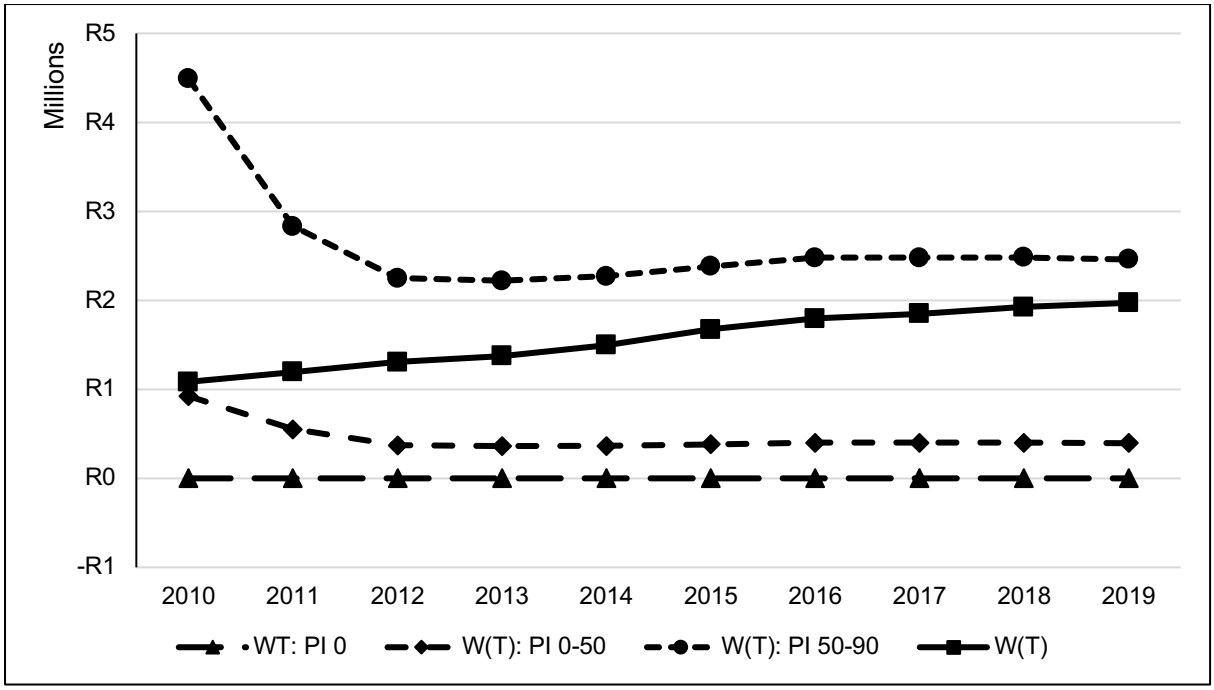

Figure 5: lifetime level of wealth (W(T)) for the 0th, 0-50th and 50-90th percentile income groups for each tranche year for the period 2010 to 2019.

Source: author's own computations.

Figure 5 shows that $W(T): PI_{0-50}$ is much lower than $W(T): PI_{50-90}$ and $W(T)$, and does not share the same magnitude increase between the 2013 and 2019 tranche years. $W(T)$ increases at a steady rate across the different tranche years. $W(T)$ is located closest to the 0-50th percentile income group initially, and then increases to be closest in magnitude to the 50-90th percentile income groups. This increase in $W(T)$ over the tranche years can be attributed to a continuous shift of population members from lower percentile income groups to higher percentile income groups. Table 10 shows the number of individuals per series $W(T): PI$ for each percentile income group.

Table 10: number of individuals per income group for each tranche year for the period 2010 to 2019.

Year	$\boldsymbol{N: PI_0}$	$\boldsymbol{N: PI_{0-50}}$	$\boldsymbol{N: PI_{50-90}}$	$\boldsymbol{N: PI_{90-100}}$	$\boldsymbol{N_{RT}}$
2010	26 025 388	2 960 306	2 368 245	592 061	31 946 000
2011	22 088 825	5 173 088	4 138 470	1 034 618	32 435 000
2012	19 199 283	6 851 859	5 481 487	1 370 372	32 903 000
2013	19 293 080	7 709 460	6 167 568	1 541 892	34 712 000
2014	18 552 289	8 389 856	6 711 884	1 677 971	35 332 000
2015	17 769 462	9 092 769	7 274 215	1 818 554	35 955 000
2016	17 515 730	9 537 635	7 630 108	1 907 527	36 591 000
2017	17 236 890	9 990 055	7 992 044	1 998 011	37 217 000
2018	16 727 625	10 552 188	8 441 750	2 110 438	37 832 000
2019	16 262 454	11 085 273	8 868 218	2 217 055	38 433 000

Table 10 shows that the number of registered personal income taxpayers N_{RT} increased at a steady rate across the entire period, with a large shift upwards to higher wealth levels between the population groups $N: PI_0$, $N: PI_{0-50}$ and $N: PI_{50-90}$. $N: PI_{0-50}$ increased by 8 124 967 registered taxpayers between the 2010 and 2019 tranches. $N: PI_{50-90}$ increased by 6 499 974 registered taxpayers between the 2010 and 2019 tranches. $N: PI_{90-100}$ increased by only 1 624 993 registered taxpayers between the 2010 and 2019 tranches in comparison. These large proportional increases indicate that there has been upward mobility in the income distribution over this period of time, increasing the wealth distribution over the same period for each tranche in succession. Figure 6 shows the results of table 10.

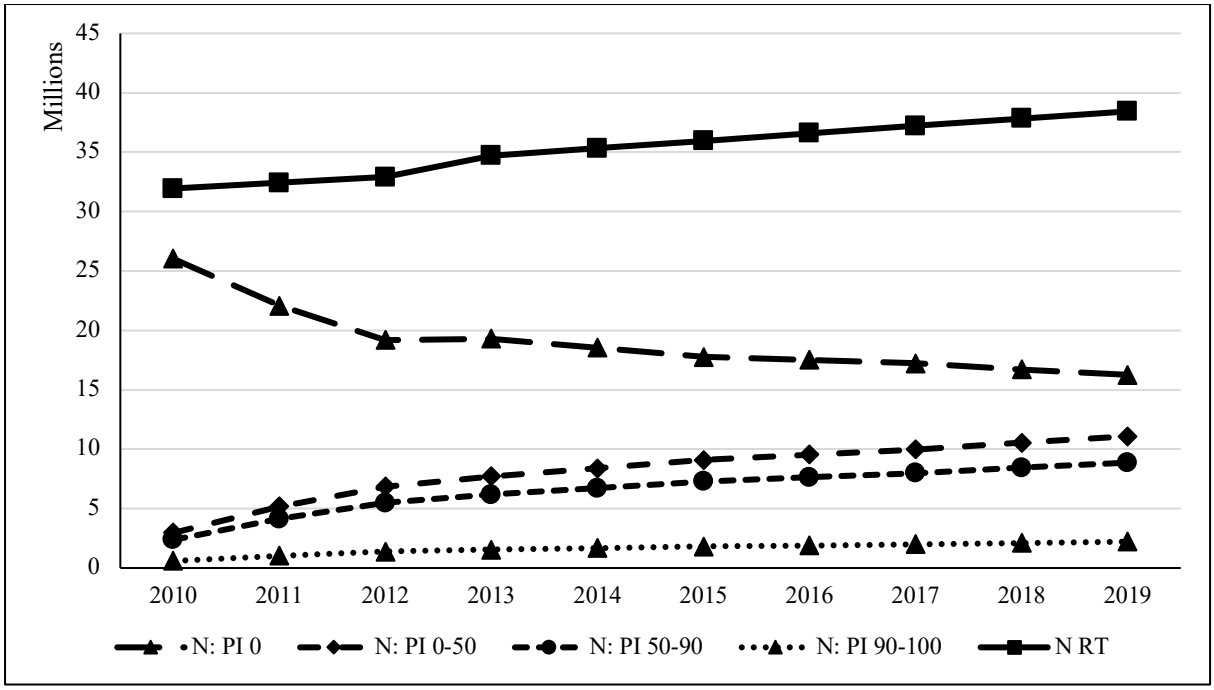

Figure 6: number of individuals per income group for each tranche year for the period 2010 to 2019. Source: author's own computations.

Figure 6 shows that the population of working age has increased steadily from 2010 to 2019, with a large decrease in the $N{:}\,PI_0$ group over this period. $N{:}\,PI_{0-50}$ and $N{:}\,PI_{50-90}$ increase at the same relative rates as $N{:}\,PI_0$ decreases, showcasing the upward mobility over the different tranche years.

4.2.1.5 Personal finance wealth inequality model summary

The result of the analysis shows that quality of life wealth $W_{QoL}(T)$ and 0th generation quality of life wealth $W'_{QOL}(T)$ increased across the period by 28%. Lifetime level of wealth $W(T)$ increased by 82% across the period, however this large increase is off a very low base and consists of a large proportion of the population shifting from the lower end of the income distribution to the middle of the distribution. $W'_{QOL}(T)$ was 16 times larger in 2010 than $W(T)$. This decreased to a factor of 12 by 2019, indicating that personal finance effects were positive, but that the wealth gap for a sufficient QoL is still very large and out of reach for the majority of the population.

4.2.2 Wealth inequality ratio

The wealth inequality ratio (WI) is determined for each percentile income group, as given in table 5, as well as the overall population of working age. The results for the wealth inequality ratio WI are shown in table 11.

Table 11: results for WI for each tranche for the period 2010 to 2019.

Year	$\boldsymbol{WI: PI\ 0}$	$\boldsymbol{WI: PI\ 0-50}$	$\boldsymbol{WI: PI\ 50-90}$	$\boldsymbol{WI: PI\ 90-100}$	$\boldsymbol{WI}$
2010	0	0.052	0.253	2.023	0.061
2011	0	0.036	0.184	1.524	0.078
2012	0	0.026	0.156	1.424	0.091
2013	0	0.023	0.143	1.301	0.088
2014	0	0.022	0.134	1.222	0.089
2015	0	0.021	0.128	1.159	0.090
2016	0	0.020	0.125	1.138	0.091
2017	0	0.020	0.124	1.130	0.093
2018	0	0.017	0.103	0.939	0.080
2019	0	0.017	0.108	0.979	0.086

The results in table 11 shows that WI has increased from the 2010 tranche to the 2019 tranche. WI is quite small in magnitude however, at an average of 0.085 over all the tranche years. $WI: PI_0$ is fixed at zero across all tranche years. $WI: PI_{0-50}$, $WI: PI_{50-90}$ and $WI: PI_{90-100}$ all decreased over the different tranche years at different rates. $WI: PI_{0-50}$ is largest in the 2010 tranche and smallest in the 2018 and 2019 tranches, decreasing by 0.035 at an average rate of -10.7% per tranche year. $WI: PI_{50-90}$ decreased by 0.145 at a rate of -8.6% per tranche year. $WI: PI_{90-100}$ decreased by 1.044 from tranche year 2010 to 2019 at a rate of -7.4% per tranche year. Figure 7 shows the results of table 11.

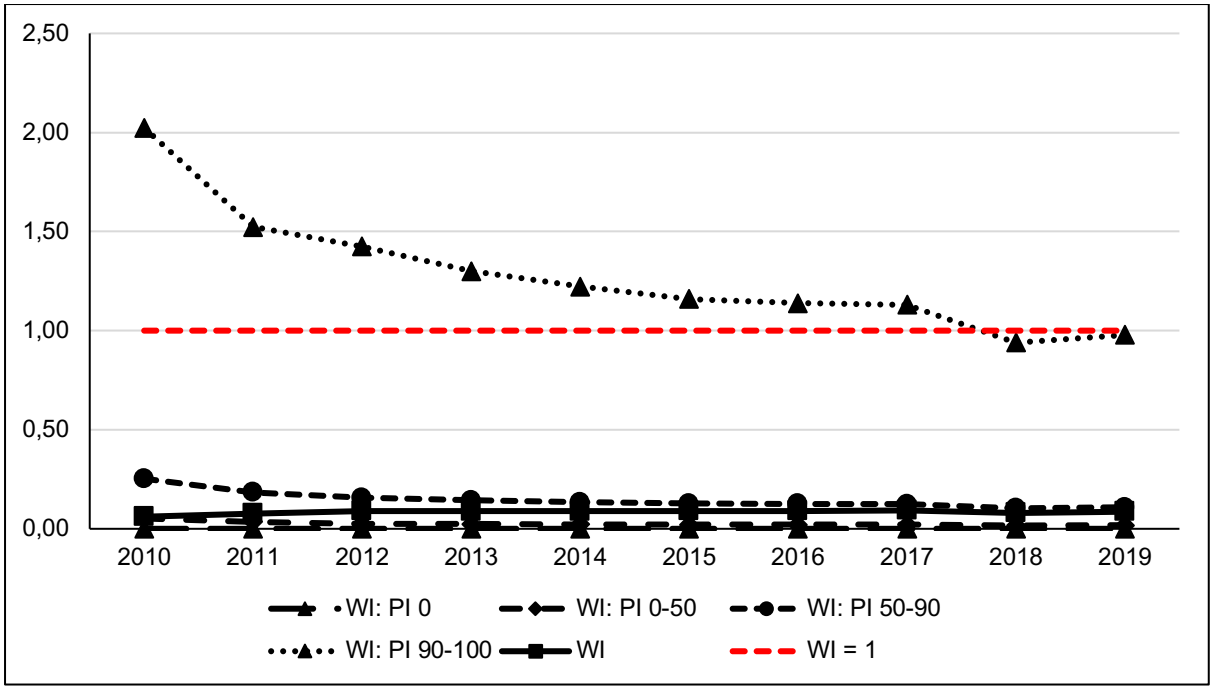

Figure 7: wealth inequality ratio (WI) per income group for each tranche year for the period 2010 to 2019.

Source: author's own computations.

Figure 7 shows the downward trend of the $WI: PI_{90-100}$ group over each tranche year. $WI: PI_{90-100}$ decreases to the threshold WI level where this population group can enjoy the required QOL as determined by $W'_{QOL}(T)$ for the 2019 tranche. Figure 8 shows WI and $WI: PI_0$, $WI: PI_{0-50}$ and $WI: PI_{50-90}$.

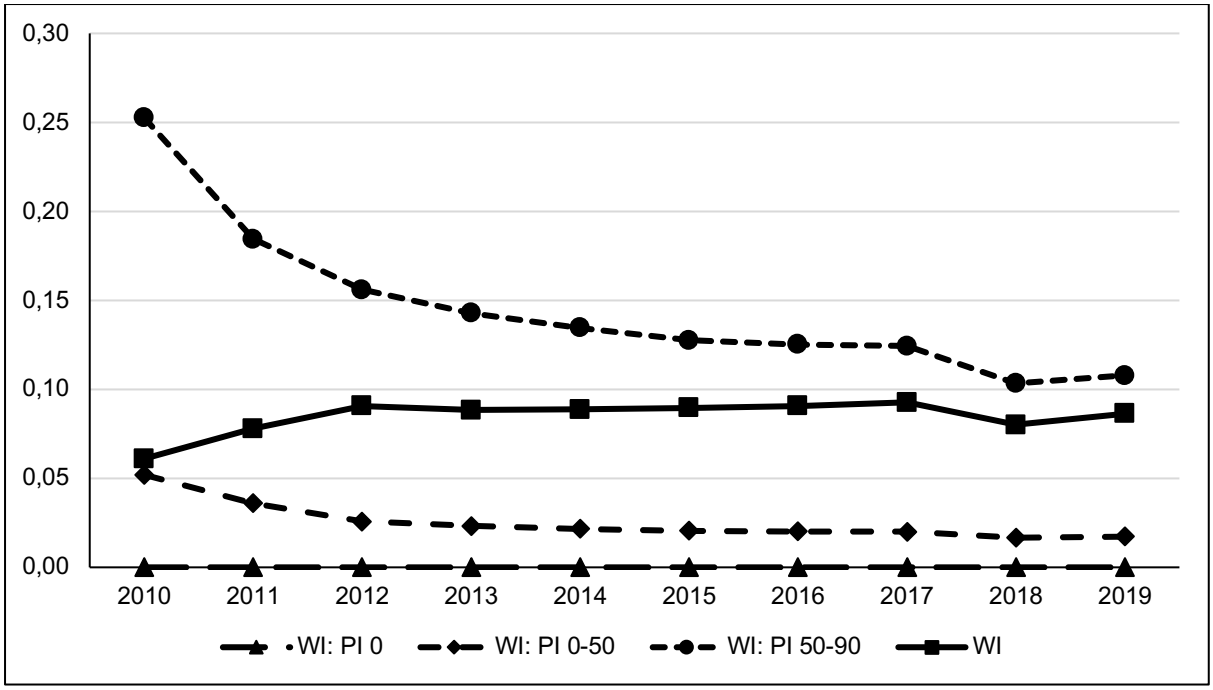

Figure 8: wealth inequality ratio (WI) for the 0th, 0-50th and 50-90th percentile income groups for each tranche year for the period 2010 to 2019.

Source: author's own computations.

Figure 8 shows the downward trend of the $WI{:}\,PI_{0-50}$ and $WI{:}\,PI_{50-90}$ variables over each tranche year. WI increases steeply between the 2010 and 2012 tranches, and remains marginally at a similar magnitude across the remaining tranche years.

4.2.2.1 Wealth inequality ratio summary

The result of the analysis shows that the wealth inequality ratio WI increased from 0.061 to 0.086 over the period. Despite this decrease in wealth inequality, all population groups except $N{:}\,PI_0$ experienced decreased wealth over the period, indicating absorption of labour in the population across the period as individuals from the zero-income population into higher income groups. WI is very small in magnitude, indicating that a large proportion of the population remains in poverty.

4.2.3 Macro-economic wealth inequality model

4.2.3.1 Descriptive statistics of dependent and independent variables

The summary of descriptive statistics of all dependent and independent variables related to the personal finance wealth inequality model are presented in table 12. The intention of this summary is to show the number of observations, mean, standard deviation and minimum and maximum values related to each variable. Table 12 shows that medical aid beneficiary population standard deviation is small relative to the population, indicating that a small segment of the population has access to higher quality, private healthcare. Average life expectancy standard deviation is small, indicating that population healthcare has remained relatively unchanged. The number of child support grants are high relative to the population, indicating that a large segment of the population is economically vulnerable. Average births per woman have a low standard deviation across the period. This indicates that despite high poverty, people are not having less children, increasing fiscal strain on government to allocate increased social welfare to the marginalised and increasing wealth inequality. This is supported by the high standard deviation in the child support grant budget as opposed to the job creation and labour affairs budget across the period. The number of children in basic education versus the number of children in higher education indicates that there is a large proportion of youth that are unable to upskill themselves in readiness to enter the labour market and further are unable to obtain higher income positions.

Table 12: descriptive statistics for variables used in the macro-economic wealth inequality model.

Variable category	**Variable**	**Observations**	**Mean**	**Standard Deviation**	**Min**	**Max**
Healthcare	Healthcare budget	10	155 960 000 000	39 888 433 300	104 600 000 000	222 600 000 000
Healthcare	Population	10	54 454 400	2 549 086	50 850 000	58 429 000
Healthcare	Medical aid beneficiary population	10	8 756 142	201 738	8 315 718	8 990 160
Healthcare, Social welfare, Education	Average births per woman	10	2,41	0,09	2,32	2,58
Healthcare, Education	Years to higher education completion (at graduation rate exceeds 50% of intake)	10	6	1	5	8
Healthcare, Economic development	Average life expectancy	10	68,0	1,0	66,6	69,2
Social welfare	Child support grant budget	10	42 898 000 000	10 967 489 969	27 273 000 000	60 603 000 000
Social welfare	Old age grant budget	10	48 215 400 000	13 381 114 579	29 991 000 000	70 453 000 000

Social welfare	Number of child support grants	10	11 364 600	957 480	9 424 000	12 508 000
Social welfare	Number of old age grants	10	3 016 300	333 229	2 534 000	3 538 000
Education	Education budget	10	264 970 000 000	72 650 992 958	165 100 000 000	386 400 000 000
Education	Number of children in basic education	10	14 095 300	219 785	13 883 000	14 630 000
Education	Number of children in higher education	10	455 511	152 007	210 592	740 245
Economic development	Human settlements, water and sanitation and electrification budget	10	60 090 000 000	9 612 081 518	49 100 000 000	82 400 000 000
Economic development	Public transport budget	10	57 240 000 000	17 041 074 562	38 600 000 000	81 600 000 000
Economic development	Population in the 0^{th} and $0\text{-}50^{th}$ percentile income groups	10	27 201 351	728 955	26 051 142	28 985 694
Economic development	Job creation and labour affairs budget	10	26 750 300 000	4 342 050 874	22 300 000 000	33 236 000 000
Economic development	Agriculture and land reform budget	10	24 706 300 000	4 482 987 993	17 100 000 000	30 700 000 000

Source: author's own calculations.

4.2.3.2 Correlation analysis

The correlation analysis is performed for each variable category described in table 12. The results for these correlations are provided in tables A-20 and A-23 appendix A.

Table 13 provides a summary on the frequency of correlations observed for all variables used in the personal finance wealth inequality model.

Table 13: summary of correlations observed for the macroeconomic wealth inequality model variables.

Correlation interval	**Description**	**Frequency observed**
0,5 < corr =< 1	Strong positive	86
0,3 < corr <= 0,5	Moderate positive	3
-0,3 <= corr <=0,3	Weak	37
-0,5 <= corr < -0,3	Moderate inverse	9
-1 <= corr < -0,5	Strong inverse	36

Table 13 shows that majority of correlations between variables observed either share a strong positive or strong negative relationship. 78% of the correlations are either moderate or strong positive and moderate or strong inverse. This result indicates that interpretations made from the model are reliable and valid.

4.2.3.3 Determination of the redistributive wealth transfer distance for the period 2010 to 2019

The redistributive wealth transfer distance (W_G) is determined for each tranche year for the period 2010 to 2019. The input results for the independent variables for each equation 18 to 21 can be found in tables A-20 to A-23 in appendix A for the different tranches 2010 to 2019. The summarised results for the model's dependent and independent variables are shown in table 14.

Table 14: results for the macro-economic wealth inequality model (WG).

Year	$\bar{B}_H$	$\bar{B}_{SW}$	$\bar{B}_E$	$\bar{B}_{ED}$	$\bar{B}_{WI}$	W_G
2010	379 437	290 783	777 482	498 866	1 946 568	14 742 237
2011	393 851	310 205	823 132	572 443	2 099 632	12 071 864
2012	410 648	329 887	855 758	633 635	2 229 927	10 881 543
2013	443 251	358 822	900 865	594 472	2 297 410	11 885 285
2014	473 336	386 352	975 671	634 131	2 469 490	12 905 827
2015	504 686	425 221	1 038 699	592 512	2 561 117	14 429 703
2016	524 920	458 921	1 117 020	508 492	2 609 354	15 377 129
2017	574 990	505 071	1 189 139	529 321	2 798 522	15 285 076
2018	617 643	540 150	1 260 058	502 851	2 920 703	19 182 231
2019	656 616	570 184	1 341 443	520 392	3 088 635	17 781 648

Table 14 shows that the variable $\bar{B}_H$ is smallest in the 2010 year tranche, and largest in the 2019 year tranche. $\bar{B}_H$ increases positively at a strong positive linear rate across all the tranche years. $\bar{B}_{SW}$ is smallest in the 2010 year tranche, and largest in the 2019 year tranche, with a strong positive linear trend across all the tranche years. $\bar{B}_E$ is smallest in the 2010 year tranche, and largest in the 2019 year tranche. The $\bar{B}_E$ variable increases positively at a strong positive linear rate across all the tranche years. $\bar{B}_{ED}$ is smallest in the 2010 tranche year, and largest in the 2014 tranche year. $\bar{B}_{WI}$ is smallest in the 2010 tranche year, and largest in the 2019 tranche year with a strong positive linear trend over all the tranche years. W_G is the smallest in the 2012 year tranche, and largest in the 2018 year tranche. W_G decreases between the 2010 and 2012 tranche years, and then increases between successive tranche years between 2012 and 2019. Figure 9 shows W_G for each tranche year.

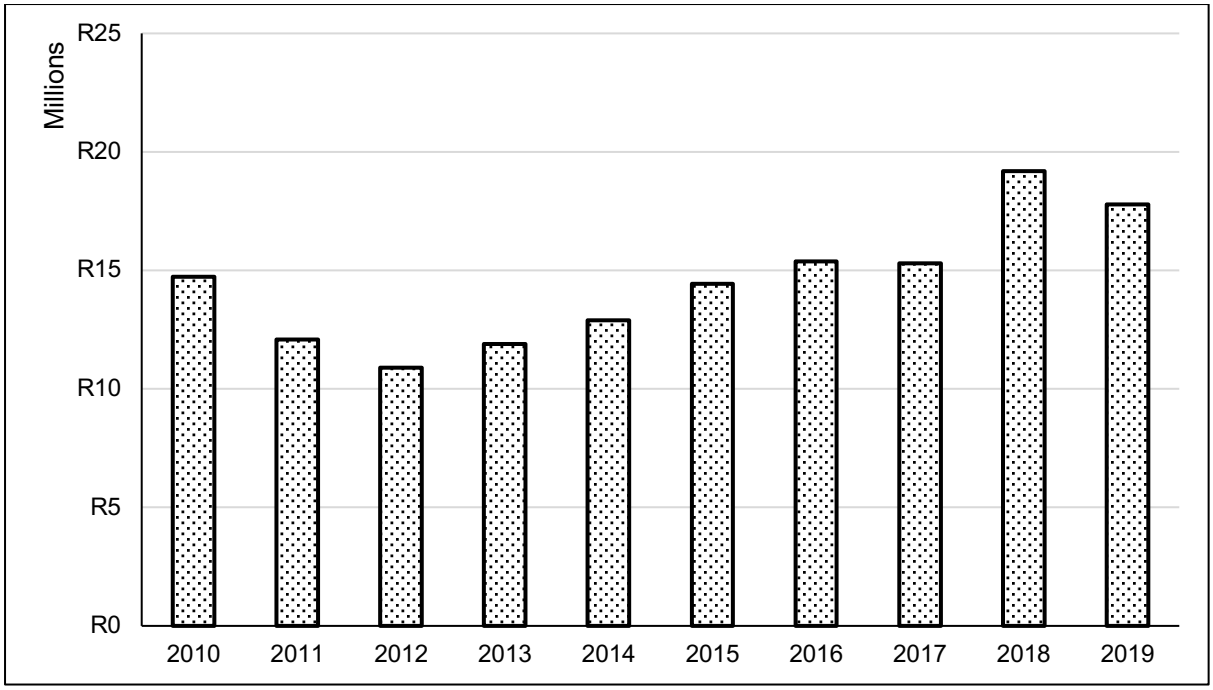

Figure 9: redistributive wealth transfer distance (WG) for each tranche year for the period 2010 to 2019.

Source: author's own computations.

Figure 9 shows W_G decreased between the 2010 and 2012 tranche years, and then increased between the 2012 and 2018 tranche years, before decreasing in the 2019 tranche year. The difference in the 2010 and 2019 tranche years in W_G is marginal at 20.6%.

4.2.3.4 Macro-economic wealth inequality model summary

The result of the analysis shows that the redistributive wealth transfer distance W_G increased across the period from R14,742,237 in 2010 to R17,781,648 in 2019. This result indicates that government is under increasing pressure to provide more social relief and that redistributive policies have not achieved the desired outcome across the period to reduce wealth inequality.

4.3 Findings

This section presents the findings for the personal finance wealth inequality, wealth inequality ratio and macro-economic wealth inequality models.

4.3.1 Personal finance wealth inequality model

$W_{QoL}(T)$ and $W'_{QOL}(T)$ have both increased over the tranche years 2010 to 2019. Both variables decreased between the 2010 and 2012 year tranches, at an average rate of 10% and 9.9% respectively. Between the 2012 and 2018 year tranches, both variables increased at an average rate of 9.4% and 9% respectively. Between the 2018 and 2019 year tranches, both variables decreased by 6.2% and 4.9% respectively. $W_{QoL}(T)$ increased from the 2010 tranche year to the 2019 tranche year by R5,800,788, an 28.4% increase. $W'_{QOL}(T)$ increased by R5,069,074 over the same period, which is an increase of 28.5%. This result implies that the level of wealth required to sustain an average QoL increased over time by 28.5%. The input variables used to determine $W_{QoL}(T)$ and $W'_{QOL}(T)$ increased and decreased over the same period at different rates.

The consumption variable q_1 decreased in four out of the nine tranche years when compared to the previous tranche year. These decreases occurred in the 2011, 2012, 2017 and 2019 tranche years. q_1 increased at an average rate of 2.1% per tranche year. q_1 increased by 17.3% from the 2010 to the 2019 tranche year. Consumption has thus contributed positively to increasing the amount of wealth required for a sufficient QoL.

The healthcare variable q_2 increased across all tranche years at an average rate of 7.2% per tranche year. q_2 increased by 86.6% from the 2010 to the 2019 tranche year. q_2 shares a strong positive relationship with the increase of $W_{QoL}(T)$ and $W'_{QOL}(T)$ over the period.

The education variable q_3 decreased between the tranche year periods 2010 to 2012 and 2015 to 2016. The variable increased at an average rate of 0.4% per tranche year. The variable increased by 0.8% over the 2010 to 2019 period. The contribution to $W_{QoL}(T)$ and $W'_{QOL}(T)$ is positive and raises the amount of wealth required marginally.

The bequeathed estate variable q_4 decreased in four out of the nine tranche years when compared to the previous tranche year. These decreases occurred in the

tranche years 2011, 2012, 2017 and 2019. The variable increased at an average rate of 3.9% per tranche year. The variable increased by 27.7% from the 2010 to the 2019 tranche year. Bequeathed estate is thus a strong contributor to an increased amount of wealth required to sustain the average QoL.

The cost of unemployment variable q_5 decreased between two periods the tranche years from 2011 to 2015 and 2016 to 2017. The variable decreased at an average rate of 1% per tranche year. From the 2010 to the 2019 tranche year, the variable decreased by 8.9%. The variable has a negative relationship with the level of wealth required, determined as $W_{QoL}(T)$ and $W'_{QOL}(T)$ and has decreased the amount of wealth required by the average South African.

The results show that $W_{QoL}(T)$ and $W'_{QOL}(T)$ has largely increased, having a negative impact on the distribution of wealth and wealth inequality across the time period 2010 to 2019. The result implies that the average South African, when assumed to receive a bequeathed estate of zero, requires a higher income in 2019 relative to 2010 to generate the required wealth level to sustain a credible QoL when compared to the average South African.

$W(T)$ increased between each tranche year between 2010 and 2019, at an average rate of 6.9%. The variable increased by 81.8% from the 2010 to the 2019 tranche year. When partitioning the population into the different income percentile groups, the changes in $W(T)$ for these sub-populations differ. For the 0th percentile income group, $WI: PI_0$ is fixed at zero for all the different tranche years. For the 0-50th percentile income group, $WI: PI_{0-50}$ decreased at an average rate of 7.3% per tranche year. $WI: PI_{0-50}$ decreased in five tranche years from the previous year. These tranche years are 2011 to 2013, 2017 and 2019. $WI: PI_{0-50}$ decreased by 57.1% from the 2010 to the 2019 tranche years. This result shows that for the 0-50th percentile income group that their wealth has decreased dramatically over the period.

For the 50-90th percentile income group, $WI: PI_{50-90}$ decreased in the same tranche years as for the 0-50th percentile income groups, at a lower average rate per tranche year of 5.4%. $WI: PI_{50-90}$ decreased by 45.2% between the 2010 and 2019 tranche

years. This decrease, although substantial, is 26.2% smaller than $WI{:}\,PI_{0-50}$. The effect of wealth inequality is thus smaller for the 50-90th percentile income group compared to the 0-50th percentile income group.

For the 90-100th percentile income group, $WI{:}\,PI_{90-100}$ decreased in the same tranche years as the 0-50th and 50-90th percentile income groups. $WI{:}\,PI_{90-100}$ decreased by an average rate of 4.3% per tranche year. Between the 2010 and 2019 tranche years, $WI{:}\,PI_{90-100}$ decreased by 37.8%. The results show that as wealth increases, the effect of decreases in lifetime wealth $W(T)$ is diminished at higher lifetime income levels, despite $W(T)$ increasing marginally for the entire population over the same period. This skewed result can be explained through the effect of the large decrease in the population of the 0th percentile income group $N{:}\,PI_0$. The results show that between the 2010 and 2019 tranche years, during each tranche year there was a shift in the population from lower percentile incomes to higher percentile incomes. Table 15 shows that the increase between successive tranche years for each percentile income group is larger than the increase in the population N_{RT}, except for the 0th percentile income population $N{:}\,PI_0$.

Table 15: shift in population counts per tranche year for different income groups.

Year	$\boldsymbol{N{:}\,PI_0}$	$\boldsymbol{N{:}\,PI_{0-50}}$	$\boldsymbol{N{:}\,PI_{50-90}}$	$\boldsymbol{N{:}\,PI_{90-100}}$	$\boldsymbol{N_{RT}}$
2010	0.0%	0.0%	0.0%	0.0%	0.0%
2011	-15.1%	74.7%	74.7%	74.7%	1.5%
2012	-13.1%	32.5%	32.5%	32.5%	1.4%
2013	0.5%	12.5%	12.5%	12.5%	5.5%
2014	-3.8%	8.8%	8.8%	8.8%	1.8%
2015	-4.2%	8.4%	8.4%	84%	1.8%
2016	-1.4%	4.9%	4.9%	4.9%	1.8%
2017	-1.6%	4.7%	4.7%	4.7%	1.7%
2018	-3.0%	5.6%	5.6%	5.6%	1.7%
2019	-2.8%	5.1%	5.1%	5.1%	1.6%

Table 15 shows that the change in $N{:}\,PI_0$ is negative for each tranche year, except for the 2013 tranche year. $N{:}\,PI_{0-50}$, $N{:}\,PI_{50-90}$ and $N{:}\,PI_{90-100}$ are positive and change at the same rate for all tranche years, since the distribution remains the same for these population groups. N_{RT} is positive in each tranche year. This result shows upward

mobility in the population to higher wealth levels over time. The effect is thus positive on reducing wealth inequality over this period.

WI increased across all tranche years, except for between 2012 to 2013 and 2017 to 2018. WI increased at an average rate of 4.5% for each tranche year, and increased by 41% between 2010 and 2019. For the different percentile income groups, $WI: PI_0$ is fixed at zero for all tranche years, $WI: PI_{0-50}$ decreased at an average rate of 11, $WI: PI_{50-90}$ decreased at an average rate of 8.5% and $WI: PI_{90-100}$ decreased at an average rate of 7.4% for each tranche year. Between the 2010 and 2019 tranche years, $WI: PI_{0-50}$ decreased by 67.3%, $WI: PI_{50-90}$ decreased by 57.3% and $WI: PI_{90-100}$ decreased by 51.6%. WI has remained largely closer to zero than one over this time period, increasing from 0.061 to 0.086. $WI: PI_{0-50}$ decreased from 0.052 to 0.017, $WI: PI_{50-90}$ decreased from 0.253 to 0.108 and $WI: PI_{90-100}$ decreased from 2.023 to 0.979. These results for the wealth inequality ratio show that wealth inequality has decreased across the time period, however this decrease has only been marginal. Despite the marginal increase in WI, the wealth inequality ratio has decreased for all percentile income groups except for the 0th percentile income group, which is fixed at zero. This indicates that collectively, the average employed South African has become poorer over the time period, and the average South African of employable age has increased in wealth. This suggests that largest share of wealth distribution has taken place from the upliftment of individuals in the 0th percentile income group $WI: PI_0$ to higher wealth levels.

4.3.2 Macro-economic wealth inequality model

$\bar{B}_{WI}$ increased by 58.7% between the 2010 and 2019 tranche years, from R1,946,568 to R3,088,635. Between each successive tranche year in the period, the increase in $\bar{B}_{WI}$ was positive, increasing at an average rate of 5.3% or R126,896 per tranche year. The variables $\bar{B}_H$, $\bar{B}_{SW}$ and $\bar{B}_E$ increased in each successive tranche year across the period.

$\bar{B}_{ED}$ decreased from the previous tranche year in 2013, 2015, 2016 and 2018. The healthcare variable $\bar{B}_H$ increased by 73.1% between the 2010 and 2019 tranche years,

from R379,437 to R656,616 at an average rate of 6.3% per tranche year. The social welfare variable $\bar{B}_{SW}$ increased by 96.1% from R290,783 in the 2010 tranche year, to R570,184 in 2019. This occurred at an average rate of 7.8% per year.

The education variable $\bar{B}_{E}$ increased by 72.5% between the 2010 and 2019 tranche years, increasing from R777,482 to R1,341,443, at an average rate of 6.3% per year. The economic development variable $\bar{B}_{ED}$ increased by 4.3% over the same period, from R498,866 to R520,392. The average rate of increase per year was 0.9%.

These results show that the measure of wealth transfer provided by policies have increased the share of wealth provided to the most marginalised. The rate increases in healthcare, social welfare and education exceeded the rate increase in $\bar{B}_{WI}$ over the time period. $\bar{B}_{ED}$ contributed weakly to increasing $\bar{B}_{WI}$.

W_G increased by 20.6% between the 2010 and 2019 tranche years, from R14,742,237 to R17,781,648. The average rate of increase per tranche year was 2.9%. This result shows that the redistributive wealth transfer distance has increased evidently by a considerable margin.

4.4 Discussion

This section presents the discussions for the personal finance wealth inequality and macro-economic wealth inequality models.

4.4.1 Personal finance wealth inequality model

The results for the personal finance wealth inequality and macro-economic wealth inequality models show that despite a decrease in wealth inequality over the period 2010 to 2019, the extent of this decrease is almost negligible. The wealth inequality ratio WI increased from 0.061 in the 2010 tranche, to 0.086 in the 2019 tranche. Since a value of 1 or greater represents complete equality and capacity for more distributive measures of wealth, the very small increase in WI over this period implies that very

little wealth has been redistributed to increase the QoL meaningfully for the most marginalised, which are the majority of the population.

Individuals that generate higher levels of income, and subsequent wealth, are also shown to have experienced a lower decline in wealth over this period as opposed to lower wealth individuals that generate a taxable income. $WI{:}\,PI_{0-50}$ decreased the most, followed by $WI{:}\,PI_{50-90}$ and the least for $WI{:}\,PI_{90-100}$. This implies that despite all individuals that generate a taxable income to generate wealth, all these individuals have experienced decreased wealth over time. Lower income individuals have experienced this to a larger degree than the middle income and high-income earners.

This result of marginal decreased wealth inequality and decreased levels of wealth for income earners were driven largely by three factors. Firstly, $W_{QoL}(T)$ and $W'_{QOL}(T)$ increased at a much faster rate across the time period than $W(T)$. This creates a net negative effect on wealth inequality reduction, since the wealth inequality ratio decreases and tends closer to zero. For the different income population groups, $W(T)$ decreased at different rates. Less wealthy individuals experienced higher decrease rates than the middle and wealth class, higher income earners.

Secondly, the large population in the 0th percentile income group, who possess zero wealth, has a large net negative effect on the determination of $W(T)$, since this income group yields zero income and thus zero growth in wealth. Although there was a substantial decrease in this population over the time period, most of these individuals' upward mobility moved them simply from the 0th to the 0-50th percentile income group. The effect of this group on $W(T)$ is largely attributable to the large population of unemployed individuals in the working age population who yield very little income. The number of employed individuals increased by 25% across the time period, whilst the labour force and population of working age increased by 32% and 20% respectively. By starting off on a base of high unemployment, the increase in the number of employed individuals had little effect on increasing $W(T)$ in the context of a somewhat proportional increase in unemployed individuals.

Thirdly, the personal finance wealth inequality model shows that the average South African household allocates a much higher proportion of wealth to consumption and healthcare, and smaller contributions to education and bequeathed estate. The high allocation of wealth to consumption is due to an increased level of household expenditure on general dealers (excluding food, clothing, furniture and appliances), pharmaceuticals and cosmetics and specialist product retailers.

This suggests that most households have over this time period increased their household expenditure on more luxurious items as opposed to basic goods and products, increasing the QoL consumption requirement. The high allocation of wealth to private healthcare notable is attributable to an increasing pool of proportionally older medical aid beneficiaries, increasing the level of risk contributions required by all members in the scheme through increased claim ratios, as well as increased life expectancy over the period. The number of private medical scheme beneficiaries remained largely unchanged over this time period, further increasing the cost of healthcare and allocation of resources thereto.

The increase in bequeathed estate requirements over the time period is due to several different factors. The prime lending rate's effect on the cost of the property over the lifetime has a distinct effect on bequeathed estate requirements. The increasing escalation rate of retirement contributions also strongly raise the bequeathed estate requirement. Despite an increase in the rate at which retirement benefits are being drawn down, this effect on bequeathed estate is small, since life expectancy post-retirement increases only marginally.

Despite these household choices, the result of the model shows that most South African households do not possess enough wealth for household decision-making on wealth allocation to have a meaningful impact in reducing wealth inequality through more efficient use of assets. This is evident through consumption requirements alone exceeding $W(T)$ for every year in the period by an average factor of five.

The allocation of assets towards education could however, most likely reduce wealth inequality in the long-term amongst these different variables. This can be attributed to consumption and healthcare being necessities, and thus limited capacity exists to

minimise these two requirements to minimum levels. Shifting what assets the household owns from the future bequeathed estate to current education requirements could provide greater capacity to acquire such assets in the near future, at a relatively higher income and consequent wealth level (Yubilianto, 2020). Higher education outcomes share a positive and statistically significant relationship with increased income (Tamborini, Kim and Sakamoto, 2016), and by extension a greater probability for upliftment out of poverty into a higher position in the wealth distribution (Coady and Dizioli, 2017). This effect is however, limited to specific higher education outcomes (Arshed, Anwar, Hassan and Bukhari, 2019), where individuals who obtain a bachelor's degree maintained equilibrium with inflationary increases over time (Carlson and McChesney, 2015). Both degree type and field of study are important determinants of future income. Kim and Tamborini (2019) show that certain vocational diplomas and certificates are associated with higher lifetime earnings than bachelor's degrees in social sciences, liberal arts and education.

4.4.2 Macro-economic wealth inequality model

Government expenditure on wealth redistributive measures targeting healthcare, social welfare, education and economic development has increased at average annual rate of 6.7% over the period. Overall, such expenditure increased by 79.4% over the time period. Total government expenditure over the same period has increased by 118.7%, at an average annual rate of 9.1%. Despite continuous annual increases in wealth redistributive expenditure, this expenditure is found to be dwindling over the time period. The net result of this expenditure trend is that $\bar{B}_{WI}$ has not sufficiently increased at a high enough rate to decrease wealth inequality significantly. Despite the increase in $\bar{B}_{WI}$ by 58.7% at an average annual rate of 5.3%, W_G increased by a net R3,039,411, from R14,742,237 in 2010 to R17,781,648 in 2019. This result implies that for government expenditure to provide sufficient wealth redistribution to the population, government must provide for additional expenditure over the lifetime of each member in the population to minimise W_G to zero.

The relatively small decrease in the wealth inequality ratio WI thus seems to be at odds with the increased levels of expenditure required to minimise WI. The net cause

of this is inherently two-fold. Firstly, government expenditure is constrained in that government can only allocate greater expenditure to wealth redistributive policies by either decreasing other expenditure items through reallocation of the budget, or by increasing budget expenditure at an increasing rate to generate an increased rate of expenditure on wealth redistribution. However, government's ability to utilise the first approach, budget reallocation, would most likely have a detrimental effect on other areas of society, since close to half the budget is already being spent on wealth redistributive and social relief measures. Government is also constrained in its ability to further increase the capacity for greater expenditure at an increasing rate to facilitate greater transfers.

Such an increase can be yielded through either increasing taxes at the personal income level, corporate level, untaxed sectors in the informal economy or through levies, such as value-added tax. Government could also increase expenditure through more government debt, in the form of government bonds and loans. Government is however, highly constrained with either of these approaches. As the personal finance wealth inequality model shows, the average South African is already severely constrained in their ability to be taxed more, even at the middle and high income levels, where $WI{:}PI_{50-90}$ decreased from 0.253 in 2010 to 0.108 in 2019. $WI{:}PI_{90-100}$ decreased from 2.023 to 0.979, indicating that the middle class only possessed 10.8% of the wealth required for a meaningful QoL, and the top 10 percent's wealth level were equivalent and consistent with a meaningful QoL. Any further additional taxes would simply plunge the middle class in South Africa into poverty, and the wealthy into either the middle class or induce an exodus of wealth and capital, which could otherwise be utilised in creating local business and employment opportunities. The risk of additional taxes having these effects on the population generating the majority of personal income tax is high. Baiardi, Profeta, Puglisi and Scabrosetti (2019) show that there exists a negative and statistically significant relationship between tax rates and economic growth. Through increased taxes, the ability of the middle class to generate meaningful market demand for goods would be severely impeded, increasing the risk of economic recessions and decreased levels of investment in the economy (Diacon and Maha, 2015).

At the corporate tax level, Lawless, McCoy, Morgenroth and O'Toole (2017) show that multinational firms are sensitive to corporate taxation policy, which influences their decision-making on investing in markets that are deemed more tax friendly. The relationship between increased corporate taxes and multinational investment and presence in an economy is shown to be negative. Increased government debt as a measure to decrease W_G does not seem be a prudent policy for South African, considering that public debt is already high at the highest level it has ever been, at 81.8% of GDP (National Treasury, 2020b). The onset of the covid-19 pandemic and the effect on South Africa's fiscal position has been detrimental, and public debt-to-GDP is expected to increase in the next few years. Although capacity for increased debt may exist to increase wealth distribution $\bar{B}_{WI}$ to consequently decrease W_G, increased levels of public debt increases the risk of creating an inflationary economic environment and increased levels of taxation in the future (Orihuela and Gómez, 2016; Romero and Marín, 2017). Increasing public expenditure through debt is shown to have a positive effect up to a margin of 62-66%, after which a negative effect on economic growth is experienced in developing, resource-rich countries (Ndoricimpa, 2020). Taxation of the informal economy in turn would require significant resources to be deployed, with potentially limited upside to increased tax revenue (Joshi, Prichard and Heady, 2013). Munjeyi (2017) suggests that tax policies that either deters tax evasion or eliminates incentives for tax evasion in the informal economy does not deliver the desired results. Designing and administering an effective tax structure for the informal economy relies on increased negotiation with informal sector associations to improve and encourage increased support and compliance with such regulation (Dube and Casale, 2016).

From both the personal finance wealth inequality model and the macro-economic wealth inequality model, the results show that the government's policy model to redirect wealth from a very small tax base that is under increasing financial strain, is unable to meet the wealth redistributive target $\bar{B}_{WI}$ to meaningfully impact W_G sufficiently to increase QoL for most South Africans. Policies to increase wealth redistributive expenditure, such as increased taxation and increased public expenditure through debt would place the country at risk from both fiscal and monetary perspectives. The trajectories arising from such policy decisions in the long-run could

increase the likelihood of a long-term inflationary, low growth economic environment with an increase in the migration of skills and capital out of the country. The models further show that the volume of individuals in the bottom of the wealth distribution, the 0^{th} and $0\text{-}50^{th}$ percentile income groups, own virtually no wealth, however South Africa's middle class, the $50\text{-}90^{th}$ percentile income group, doesn't possess any measure of meaningful wealth for redistribution, since the middle class is under severe financial strain. The $90\text{-}100^{th}$ percentile income group have also experienced diminished levels of wealth, to the extent that current wealth levels are only just able to meet QoL requirements.

The working age population consists predominantly of unemployed and zero to low income earners with zero wealth. Xesibe and Nyasha (2020) show that for the period 1994 to 2017 in South Africa, that persistently high unemployment reduces economic growth. Through the negative relationship between unemployment and wages (Seputiene, 2011), a decrease in the unemployment rate would lead to an increase in total wages earned. This decrease in the unemployment rate would have a two-fold effect on reducing wealth inequality. Firstly, an increase in $W(T)$ would increase the wealth inequality ratio WI. Secondly, as more individuals in the working age population are absorbed into the labour market, the requirement for government expenditure related to wealth redistribution $\bar{B}_{WI}$ is reduced. Together, these two effects have a net decrease effect on W_G.

For the unemployment rate to decrease however, government needs to ensure the market economy requires sufficient demand for labour. Extensive social welfare programmes, excessive protective labour policies and decreased mobility for labour impedes labour demand (Gill, Koettl and Packard, 2013). This mechanism occurs through individuals treating social welfare and redistributive programmes as a measure of income, instead of a measure of temporary social relief and protection until employment opportunities are found (Biegert, 2017; Lehwess-Litzmann and Nicaise, 2020). Excessive protective labour policies share a negative relationship with unemployment outcomes, specifically around hiring and firing regulations and higher regulated employment costs (Bernal-Verdugo, Furceri and Guillaume, 2012). Blanchard and Galí (2010) show that inefficient employment variances arise when

labour markets are regulated by fixed-wage rigidities, pressuring a central bank to manage the trade-off between inflation and employment stability in the labour market.

4.5 Comparison of results with literature

In the context of the research objectives of this study, the results of the model is in strong agreement with previous empirical findings on the relationships between macroeconomic policy and personal financial management factors with wealth inequality.

Concerning research objective one, policy effects on wealth inequality, the result obtained are in agreement with empirical results from Leibbrandt, Finn and Woolard (2012), Lannegran and Ito (2017), Padayachee (2019) and Polus, Kopiński and Tycholiz (2021). The study results and literature agree that government policies related to redistribution has failed to minimise wealth inequality.

Regarding research objectives two and three, these being how personal finance choices' affects wealth inequality and what the required degree of wealth to access a meaningful quality of life is, the results show that achieving a meaningful QoL is much larger than the actual lifetime level of wealth. Consequently, most South Africans do not possess enough wealth for household decision-making on wealth allocation to have a meaningful impact in reducing wealth inequality through more efficient use of assets. This result is in strong agreement with empirical studies performed by Carter and May (2001), Grawitzky (2003), Krivo and Kaufman (2004), Kotzé and Smit (2008), Dickens, Triest and Sederberg (2017) and Kim (2021).

Regarding research objective four, stated as what model can be proposed to decrease wealth inequality in South Africa, results show that government should shift policy from targeting wealth redistribution largely through lump sum transfers to increasing the labour market participation rate of the working age population. An open labour market would support investment into the economy, providing economic growth and upliftment through increased income and consequent ability to accumulate wealth. These results are in agreement with studies from Rudra (2004), Mehmood and Sadiq (2010), Lentz

and Tranæs (2005), Dickens, Triest and Sederberg (2017), Arendse and Stack (2018), Padayachee (2019) and Bond and Malikane (2019).

4.6 Chapter conclusion

This chapter presented the results originating from the application of the models adopted in this study. Descriptive statistics for both the personal finance wealth inequality model and the macro-economic wealth inequality model were discussed, and both models were actualised and the findings discussed in detail. A comparison was also made between the findings of the study and empirical results of other studies in the literature.

The next chapter presents the conclusion to the study. The main findings of the study will be highlighted, and recommendations on what personal finance and policy actions can be taken to reduce wealth inequality will be presented. Suggestions for further study will also be made.

5 CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The aim of this chapter is to provide a summary of the empirical findings and a conclusion in relation to the objectives of the study. The objectives of the study were:

1. To investigate how policies focused on addressing wealth inequality by the South African government affect wealth inequality.
2. To assess how South Africans' personal finance choices affect wealth inequality.
3. To ascertain the degree of wealth most South Africans are able to access a meaningful quality of life (QoL).
4. To propose a model that can be utilised to decrease wealth inequality in South Africa to an extent where most South Africans are able to access a meaningful quality of life (QoL).

This chapter aims to provide recommendations regarding personal finance and policy decision-making to reduce wealth inequality. Suggestions for further study are also provided.

5.2 Summary of key findings

The key findings for the personal finance wealth inequality and macro-economic wealth inequality models are presented. The results obtained in this study are consistent and in agreement with empirical findings of other studies in the literature.

5.2.1 Objective one: policy effects on wealth inequality

The results of the macroeconomic wealth inequality model show that despite increases in wealth redistributive expenditure, this expenditure is found to be dwindling over the time period. Average expenditure related to wealth redistributive policies ($\bar{B}_{WI}$) has not sufficiently increased at large enough rate to decrease wealth inequality significantly over the period. This implies that for government expenditure to provide sufficient

wealth redistribution to the population, additional expenditure over the lifetime of each member in the population to minimise the redistributive wealth transfer distance (W_G) to zero is required.

Government is however constrained in the ability to increase expenditure to the required level to adequately minimise the wealth inequality ratio (WI). Expenditure is constrained in that wealth redistributive expenditure can only be increased at a higher rate through either budget reallocation, which would most likely have a detrimental effect on other areas of society, or through either increasing taxes or more government debt. Government is however, highly constrained with either of these approaches, since the average South African is already severely constrained in their ability to be taxed more. Increased government debt increases the risk of creating an inflationary economic environment and increased levels of taxation in the future.

The results show that the government's policy model to redirect wealth, through either increased taxation on a very small tax base that is under increasing financial strain, or through further increases in expenditure through government debt, is unable to meet the wealth redistributive target $\bar{B}_{WI}$ to meaningfully decrease the redistributive wealth transfer distance (W_G) sufficiently to increase QoL for most South Africans.

The current policy response that the South African government have implemented over the period 2010 to 2019 has thus been insufficient in raising the QoL of the population sufficiently.

5.2.2 Objective two: personal finance choices' effects on wealth inequality

The results of the model show that wealth inequality has decreased only marginally, and that all individuals who generate a taxable income have experienced declined wealth over the time period. The wealth inequality ratio (WI) increased only marginally, implying that very little wealth has been redistributed to increase the QoL meaningfully for the most marginalised.

The least wealthy individuals, excluding individuals in the 0th percentile income group, experienced a larger decrease in relative wealth than the middle and wealthy classes. The 0th percentile income population group, who possess zero wealth, experienced large upward mobility from the 0th to the 0-50th percentile income group.

The model also shows that the average South African household allocates a much higher proportion of wealth to consumption and healthcare, and smaller contributions to education and bequeathed estate. The allocation of wealth to education and bequeathed estate have also both decreased relatively to consumption and healthcare across the period.

The results of the personal finance wealth inequality model shows that most South African households do not possess enough wealth for household decision-making on wealth allocation to have a meaningful impact in reducing wealth inequality through more efficient use of assets. This is evident through consumption requirements alone exceeding the lifetime level of wealth ($W(T)$) for every year in the period by an average factor of five. South Africans' personal finance choices thus have a small effect on wealth inequality.

5.2.3 Objective three: the required degree of wealth to access a meaningful quality of life

The personal finance wealth inequality model determined the required level of wealth to access a sufficient QoL as the variables quality of life wealth ($W_{QoL}(T)$) and 0th generation quality of life wealth ($W'_{QOL}(T)$).

The results of the study show that on average, the required degree of wealth to access a meaningful QoL is 12 times larger than the actual lifetime level of wealth.

5.2.4 Objective four: proposed model to decrease wealth inequality in South Africa

The proposed model to decrease wealth inequality is defined through both the redistributive wealth distance (W_G) and the wealth inequality ratio (WI), as given by equations 10 and 17 in chapter 3

$$WI = \frac{W(T)}{W'_{QOL}(T)}, W'_{QOL}(T) > 0 \quad (10)$$

$$W_G = W'_{QOL}(T) - \bar{B}_{WI} + W(T) \quad (17)$$

Equation 10 can then be substituted into equation 17 by rearranging the equation to

$$W(T) = WI \times W'_{QOL}(T)$$

and then replacing the lifetime level of wealth term ($W(T)$) in equation 17 yields equation 22

$$W_G = W'_{QOL}(T)\,[1 + WI] - \bar{B}_{WI} \quad (22)$$

where the redistributive wealth distance W_G is a function of the variables 0th generation quality of life wealth ($W'_{QOL}(T)$), the wealth inequality ratio (WI) and average expenditure related to wealth redistributive policies ($\bar{B}_{WI}$). Since the model attempts to maximise wealth equality, the redistributive wealth distance W_G is minimal at zero. Applying this to equation 22 yields equation 23

$$\bar{B}_{WI} = W'_{QOL}(T)\,[1 + WI] \quad (23)$$

Applying the steady-state to equation 23 allows the variable 0th generation quality of life wealth ($W'_{QOL}(T)$) to be fixed as a constant, and the resulting wealth inequality ratio (WI) being targeted then implies the average level of expenditure related to wealth redistributive policies ($\bar{B}_{WI}$) per individual of working age in the population required to

achieve such a ratio. Since all variables of equation 23 can only be positive and zero or greater than zero, equation 23 is a linear increasing function. Figure 10 illustrates the model visually as described by equation 23.

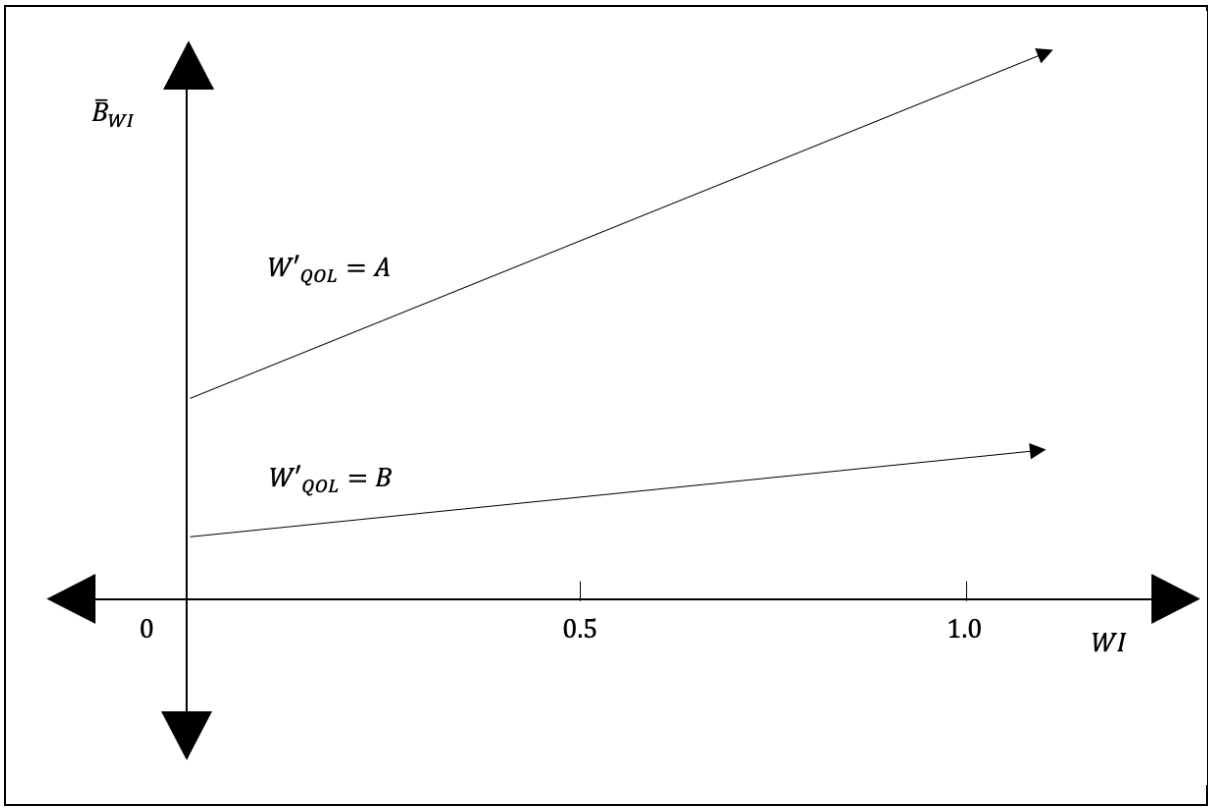

Figure 10: visual representation of proposed model to decrease wealth inequality in South Africa.

Figure 10 shows how different levels of variable 0th generation quality of life wealth ($W'_{QOL}(T)$) yield different slopes for equation 23. Through selecting a value for the wealth inequality ratio between 0 and 1 a corresponding policy response is yielded as the average level of expenditure related to wealth redistributive policies ($\bar{B}_{WI}$) per individual of working age in the population.

5.3 Implications and recommendations

The personal finance wealth inequality model shows that most households do not possess enough wealth for household decision-making on wealth allocation to have a meaningful impact in reducing wealth inequality long-term. The allocation of assets towards education are most likely though to reduce wealth inequality in the long-term.

Since consumption and healthcare are necessities, shifting asset allocation from the future bequeathed estate to current education requirements could provide greater capacity to acquire such assets in the near future, at a relatively higher income and consequent wealth level for the most marginalised. Higher education outcomes provide a greater probability for upliftment out of poverty into a higher position in the wealth distribution. Both degree type and field of study are important determinants of future income.

The macro-economic wealth inequality model shows that government policy is unable to sufficiently raise enough individuals of working age up the average QoL through current wealth redistributive policies, as well as adopting other policy options without serious fiscal, monetary and increased poverty risk in the long-term. The working age population consists predominantly of unemployed, zero to low income earners with zero wealth. A net decrease in the redistributive wealth transfer (W_G) can be achieved sustainably through aggressive policy focus on reducing the unemployment rate. A decrease in unemployment would elevate more individuals into higher wealth levels long-term, reducing wealth inequality. As more individuals in the working age population are absorbed into the labour market, the requirement for government expenditure related to wealth redistribution is also reduced.

South African individuals and household should prioritise increased allocation of resources firstly to education, especially education in labour sectors that possess and foresee a critical shortage of skills in the future. Such labour markets are characterised then by stable and higher levels of income, which then provides a mechanism for the accumulation of wealth in the form of increasing the bequeathed estate. This in turn will lead to a decrease in wealth inequality and a concurrent increase in QoL.

The South African government should continue to provide social protection and wealth redistribution, although the policy response is recommended to change. Instead of targeting wealth redistribution largely through lump sum transfers to individuals and households, the optimal use of resources necessitates a change in policy to provide a much larger focus on increasing the labour market participation rate of the working age population. The key policy focus should be to create an environment in which private enterprises are able to absorb the labour capital South Africa possess.

Government should also refrain from assuming the increasing role of absorbing more and more labour, be it through different government departments or public enterprises. Through turning public enterprises profitable, large amounts of revenue can be employed to invest in public-private ventures to increase labour market competitiveness and labour market absorption. An open labour market would also support further private and foreign direct investment into the economy, providing further economic growth and upliftment through increased income and consequent ability to accumulate wealth.

5.4 Suggestions for future research

The study did not include all forms of wealth currently owned by South Africans as part of determining the wealth distribution in the models. Including these assets in further studies could provide greater sensitivity in the models to changes in personal finance and macro-economic factors. Including population dynamics, such as age and gender, could further enhance and show differentials in wealth inequality to a more sensitive degree, especially in light of persistently high youth unemployment and wage and wealth disparities between genders.

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Appendix A

Table A-1: correlation analysis of variables for the personal finance wealth inequality model.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
A	1,00																													
B	0,95	1,00																												
C	0,79	0,62	1,00																											
D	0,99	0,96	0,74	1,00																										
E	0,98	0,94	0,75	1,00	1,00																									
F	0,96	0,95	0,67	0,99	0,99	1,00																								
G	0,97	0,89	0,86	0,97	0,97	0,93	1,00																							
H	0,84	0,89	0,55	0,84	0,79	0,79	0,76	1,00																						
I	0,92	0,90	0,83	0,92	0,91	0,88	0,91	0,80	1,00																					
J	-0,90	-0,96	-0,56	-0,90	-0,87	-0,87	-0,84	-0,88	-0,85	1,00																				
K	0,98	0,92	0,87	0,97	0,96	0,93	0,98	0,83	0,95	-0,86	1,00																			
L	-0,38	-0,26	-0,72	-0,34	-0,32	-0,26	-0,40	-0,42	-0,58	0,20	-0,52	1,00																		
M	-0,18	-0,42	-0,07	-0,19	-0,16	-0,15	-0,16	-0,39	-0,40	0,50	-0,22	0,08	1,00																	
N	0,66	0,42	0,68	0,59	0,62	0,56	0,69	0,33	0,44	-0,42	0,64	-0,24	0,45	1,00																
O	-0,31	-0,32	-0,03	-0,35	-0,34	-0,40	-0,23	-0,31	-0,06	0,14	-0,24	-0,17	-0,29	-0,20	1,00															
P	0,99	0,94	0,83	0,97	0,96	0,93	0,97	0,85	0,94	-0,90	0,99	-0,45	-0,28	0,62	-0,25	1,00														
Q	0,95	0,98	0,65	0,96	0,95	0,96	0,89	0,86	0,88	-0,92	0,92	-0,28	-0,33	0,47	-0,42	0,95	1,00													
R	0,96	0,99	0,67	0,96	0,94	0,94	0,91	0,90	0,91	-0,95	0,94	-0,32	-0,42	0,44	-0,33	0,96	0,99	1,00												
S	1,00	0,96	0,79	0,99	0,98	0,96	0,97	0,85	0,93	-0,90	0,99	-0,39	-0,22	0,62	-0,33	0,99	0,97	0,97	1,00											
T	0,99	0,92	0,80	0,98	0,97	0,95	0,96	0,84	0,88	-0,85	0,97	-0,40	-0,09	0,70	-0,39	0,98	0,93	0,93	0,99	1,00										
U	0,99	0,97	0,72	0,99	0,99	0,98	0,95	0,85	0,89	-0,90	0,96	-0,31	-0,20	0,58	-0,42	0,97	0,98	0,97	0,99	0,98	1,00									
V	-0,94	-1,00	-0,59	-0,96	-0,95	-0,96	-0,88	-0,87	-0,88	0,95	-0,90	0,21	0,39	-0,42	0,35	-0,93	-0,98	-0,99	-0,95	-0,91	-0,97	1,00								
W	0,99	0,93	0,77	0,98	0,98	0,96	0,97	0,79	0,90	-0,89	0,96	-0,33	-0,15	0,70	-0,25	0,97	0,92	0,93	0,98	0,97	0,97	-0,93	1,00							
X	0,92	0,78	0,92	0,86	0,86	0,80	0,92	0,72	0,89	-0,77	0,95	-0,60	-0,12	0,76	-0,10	0,93	0,79	0,82	0,90	0,91	0,84	-0,76	0,91	1,00						
Y	0,99	0,94	0,84	0,98	0,98	0,95	0,98	0,83	0,95	-0,89	1,00	-0,44	-0,23	0,63	-0,26	1,00	0,94	0,96	0,99	0,98	0,97	-0,93	0,98	0,93	1,00					
Z	1,00	0,94	0,83	0,98	0,98	0,95	0,98	0,84	0,93	-0,88	0,99	-0,44	-0,20	0,65	-0,29	1,00	0,95	0,96	1,00	0,99	0,98	-0,93	0,98	0,93	1,00	1,00				
AA	0,90	0,99	0,55	0,92	0,90	0,91	0,84	0,91	0,87	-0,97	0,87	-0,22	-0,50	0,31	-0,29	0,90	0,96	0,98	0,92	0,86	0,93	-0,98	0,87	0,71	0,90	0,89	1,00			
AB	1,00	0,94	0,82	0,98	0,98	0,95	0,98	0,82	0,92	-0,89	0,99	-0,40	-0,19	0,68	-0,27	0,99	0,94	0,95	0,99	0,99	0,97	-0,93	0,99	0,94	0,99	1,00	0,88	1,00		
AC	1,00	0,94	0,83	0,99	0,98	0,95	0,98	0,84	0,94	-0,89	0,99	-0,44	-0,22	0,64	-0,28	1,00	0,95	0,96	1,00	0,99	0,98	-0,93	0,98	0,93	1,00	1,00	0,90	1,00	1,00	
AD	0,98	0,90	0,87	0,96	0,96	0,92	0,98	0,77	0,94	-0,86	0,99	-0,46	-0,19	0,70	-0,20	0,99	0,90	0,92	0,98	0,97	0,95	-0,89	0,98	0,96	0,99	0,99	0,84	0,99	0,99	1,00

*Variable names are abbreviated with letters. The letter designation can be matched with corresponding variable name in table A-2.

Table A-2: personal finance wealth inequality model variable designation for table A-1.

Variable name	Table A-1 designation
Total annual taxable income	A
Registered PAYE individuals	B
Effective income tax rate	C
Population of working age	D
Labour force	E
Employed	F
Unemployed	G
Discouraged work seekers	H
Total enrolment in public higher education	I
Years to higher education completion (at graduation rate exceeds 50% of intake)	J
Total grants and tuition in higher education	K
Number of property transfers	L
Purchase price	M
Prime interest rate	N
Gross household savings	O
Number of households	P
Number of active members (retirement funds)	Q
Number of pension members (retirement funds)	R
Total retirement contributions	S
Total benefits paid	T
Total assets	U
Average births per woman	V
Average life expectancy	W
Median age of mother by birth	X
Total risk contributions (medical schemes)	Y
Total claims (medical schemes)	Z
Number of beneficiaries (medical schemes)	AA
Retail trade sales	AB
Population	AC
Vehicle price	AD

Table A-3: independent variable values for consumption function q1 for the period 2010 to 2019.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
H_P	4.58	4.51	4.46	4.42	4.39	4.37	4.36	4.34	4.33	4.32
S_R (ZAR millions)	565 605	617 765	668 148	703 801	764 300	850 446	933 854	998 949	1 044 391	1 091 504
P (thousands)	50 850	51 574	52 325	53 104	53 912	54 750	55 620	56 522	57 458	58 429
P_{C,i_P} (ZAR)	32 287	32 977	33 665	34 144	36 005	38 916	41 853	45 764	46 480	47 707
P_{P,i_P} (ZAR)	219 999	139 821	104 776	117 576	130 005	147 107	158 601	136 412	251 723	183 637
S_H (ZAR)	3 268	3 289	3 396	3 418	2 032	2 002	2 345	2 889	2 641	2 202
N_P	1.52	1.51	1.54	1.55	1.58	1.56	1.58	1.58	1.60	1.57
C_A (ZAR)	13 666	14 776	15 475	16 791	17 853	19 123	20 508	21 211	22 355	23 441
B_P (ZAR)	49 468	36 133	35 564	39 010	47 075	54 086	58 474	55 190	58 937	60 121

T_1	23	23	23	23	23	23	23	23	23	23
T_3	60	60	60	60	60	60	60	60	60	60
T_4	66.6	66.9	67.0	67.5	67.6	68.3	68.7	69.2	69.2	69.2

Table A-4: independent variable values for healthcare function q2 for the period 2010 to 2019.

	Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
C_{MR,T_i} per age band	Under 1	13 106	14 037	18 123	16 337	36 588	19 914	21 719	33 357	26 886	25 711
	1-4	4 631	4 891	5 149	5 672	6 588	7 156	7 976	8 260	8 883	9 205
	5-9	3 466	3 696	3 799	4 134	4 507	4 867	5 253	5 633	5 812	6 079
	10-14	3 421	3 747	4 009	4 475	4 911	5 458	5 610	6 060	6 375	6 670
	15-19	4 462	4 925	5 332	6 002	7 078	7 743	8 237	8 959	9 342	9 921
	20-24	5 607	6 352	7 142	7 954	9 064	10 849	11 561	12 655	12 648	13 648
	25-29	7 531	8 019	8 825	9 823	13 009	13 399	13 925	15 605	15 963	16 570
	30-34	10 343	11 101	11 650	12 608	13 807	15 348	16 104	17 475	18 152	18 952
	35-39	10 042	10 960	11 692	13 115	14 974	16 382	17 358	18 131	19 051	20 145
	40-44	11 585	12 403	12 958	14 360	16 239	18 138	19 192	20 337	21 353	22 360
	45-49	13 351	14 513	15 363	17 124	18 303	20 758	22 018	23 339	25 027	26 262
	50-54	16 508	17 542	18 313	20 081	21 305	24 327	26 378	28 019	30 107	31 739
	55-59	22 111	23 622	24 068	26 237	25 387	30 552	32 373	33 941	36 678	39 409
	60-64	27 155	29 090	30 400	33 301	31 490	38 148	41 080	42 617	45 980	49 453
	65-69	35 992	38 609	38 125	41 307	38 817	46 191	49 582	52 766	56 854	60 747
	70-74	42 943	45 261	45 992	50 224	44 108	53 964	58 414	60 291	66 236	71 724
	N_C	2.58	2.51	2.46	2.42	2.39	2.37	2.36	2.34	2.33	2.32
	T_1	23	23	23	23	23	23	23	23	23	23
	T_4	66.6	66.9	67.0	67.5	67.6	68.3	68.7	69.2	69.2	69.2
	T_{MA}	26.4	26.5	26.6	26.3	26.5	26.8	27.2	27.5	27.9	27.9
	T_{EG}	8	7	6	6	6	6	5	5	5	5

Table A-5: independent variable values for education function q3 for the period 2010 to 2019.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
N_C	2.58	2.51	2.46	2.42	2.39	2.37	2.36	2.34	2.33	2.32
C_{HE} (ZAR)	45 869	47 689	50 995	53 970	60 042	61 870	69 034	71 122	76 436	82 265
T_{MA}	26.4	26.5	26.6	26.3	26.5	26.8	27.2	27.5	27.9	27.9
T_{EG}	8	7	6	6	6	6	5	5	5	5

Table A-6: independent variable values for bequeathed estate function q4 for the period 2010 to 2019.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
N_C	2.58	2.51	2.46	2.42	2.39	2.37	2.36	2.34	2.33	2.32
V_{P,T_1} (ZAR)	1 912 171	1 295 033	986 181	1 129 033	1 198 006	1 325 559	1 332 139	1 147 218	2 160 910	1 570 973
C_A (ZAR)	13 666	14 776	15 475	16 791	17 853	19 123	20 508	21 211	22 355	23 441
B_P (ZAR)	49 468	36 133	35 564	39 010	47 075	54 086	58 474	55 190	58 937	60 121
r_P (%)	2	2	2	2	2	2	2	2	2	2
r_R	5	5	5	5	5	5	5	5	5	5

(%)										
T_1	23	23	23	23	23	23	23	23	23	23
T_3	60	60	60	60	60	60	60	60	60	60
T_4	66.6	66.9	67.0	67.5	67.6	68.3	68.7	69.2	69.2	69.2

Table A-7: independent variable values for cost of unemployment function q5 for the period 2010 to 2019.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
P_E (thousands)	13 061	13 125	13 447	14 692	15 094	15 657	15 545	16 100	16 288	16 313
P_{WA} (thousands)	31 946	32 435	32 903	34 712	35 332	35 955	36 591	37 217	37 832	38 433
T_1	23	23	23	23	23	23	23	23	23	23
T_4	66.6	66.9	67.0	67.5	67.6	68.3	68.7	69.2	69.2	69.2

Table A-8: results for the personal finance wealth inequality model for tranche 2010.

Year T	q1 (ZAR)	q2 (ZAR)	q3 (ZAR)	q4 (ZAR)	q5 (%)	W_{QOL} (ZAR)	W'_{QOL} (ZAR)
23	306 159	11 213	0	1 939 503	49.7	2 414 642	475 140
24	612 317	22 427	0	2 006 445	49.7	2 956 724	950 279
25	918 476	37 489	0	2 075 587	49.7	3 506 767	1 431 180
26	1 253 332	132 006	0	832 177	49.7	2 906 175	2 073 998
27	1 588 188	187 706	0	860 784	49.7	3 519 486	2 658 702
28	1 923 044	243 406	0	890 349	49.7	4 133 756	3 243 406
29	2 225 612	299 107	0	920 912	49.7	4 700 685	3 779 773
30	2 528 181	367 688	0	952 512	49.7	5 287 936	4 335 424
31	2 830 749	430 933	0	985 191	49.7	5 868 277	4 883 086
32	3 133 318	494 179	0	1 018 993	49.7	6 449 741	5 430 749
33	3 435 886	557 424	0	1 053 964	49.7	7 032 375	5 978 411
34	3 738 455	620 670	0	1 090 152	49.7	7 616 226	6 526 074
35	4 041 023	682 535	0	1 127 608	49.7	8 199 278	7 071 671
36	4 343 592	744 196	0	1 166 383	49.7	8 783 343	7 616 960
37	4 646 160	805 856	0	1 206 533	49.7	9 368 783	8 162 249
38	4 948 729	867 516	0	1 248 116	49.7	9 955 655	8 707 539
39	5 251 297	929 177	0	1 291 191	49.7	10 544 019	9 252 828
40	5 553 866	997 903	0	1 335 821	49.7	11 144 517	9 808 697
41	5 856 434	1 071 398	0	1 382 072	49.7	11 753 776	10 371 704
42	6 159 003	1 144 893	0	1 430 013	49.7	12 364 724	10 934 711
43	6 241 572	1 218 389	0	1 479 716	49.7	12 648 072	11 168 356
44	6 324 141	1 291 884	0	1 531 256	49.7	12 933 257	11 402 001
45	6 406 710	1 373 467	118 342	1 584 713	49.7	13 409 637	11 824 924
46	6 489 279	1 460 293	236 684	1 640 168	49.7	13 895 866	12 255 698
47	6 571 849	1 547 120	355 025	1 697 708	49.7	14 384 180	12 686 472
48	6 654 418	1 633 946	473 367	1 757 425	49.7	14 874 670	13 117 246
49	6 736 987	1 720 773	591 709	1 819 412	49.7	15 367 431	13 548 019
50	6 819 556	1 822 059	710 051	1 883 768	49.7	15 884 209	14 000 441
51	6 902 126	1 932 158	828 392	1 950 599	49.7	16 416 655	14 466 056

52	6 984 695	2 042 257	946 734	2 020 012	49.7	16 951 684	14 931 672
53	7 038 567	2 075 274	946 734	2 092 121	49.7	17 153 874	15 061 753
54	7 092 438	2 108 290	946 734	2 167 046	49.7	17 358 880	15 191 834
55	7 146 310	2 152 512	946 734	2 244 912	49.7	17 583 602	15 338 690
56	7 200 182	2 196 733	946 734	2 325 850	49.7	17 811 396	15 485 547
57	7 254 054	2 240 955	946 734	2 409 996	49.7	18 042 399	15 632 403
58	7 307 926	2 285 176	946 734	2 497 495	49.7	18 276 754	15 779 259
59	7 361 798	2 329 398	946 734	2 588 497	49.7	18 514 612	15 926 116
60	7 415 670	2 383 708	946 734	2 683 159	49.7	18 771 235	16 088 075
61	7 514 606	2 438 018	946 734	2 675 654	49.7	18 993 155	16 317 501
62	7 613 542	2 492 328	946 734	2 668 766	49.7	19 215 693	16 546 927
63	7 712 479	2 546 638	946 734	2 662 506	49.7	19 438 860	16 776 353
64	7 811 415	2 600 948	946 734	2 656 889	49.7	19 662 668	17 005 779
65	7 910 352	2 672 932	946 734	2 651 926	49.7	19 913 591	17 261 666
66	8 009 288	2 744 916	946 734	2 647 630	49.7	20 165 182	17 517 552
67	8 108 224	2 816 900	946 734	2 644 016	49.7	20 417 454	17 773 438

Table A-9: results for the personal finance wealth inequality model for tranche 2011.

Year T	**q1 (ZAR)**	**q2 (ZAR)**	**q3 (ZAR)**	**q4 (ZAR)**	**q5 (%)**	W_{QOL} **(ZAR)**	W'_{QOL} **(ZAR)**
23	230 656	12 704	0	1 324 584	50.1	1 689 778	365 194
24	461 312	25 408	0	1 381 513	50.1	2 111 901	730 387
25	691 969	41 445	0	1 440 512	50.1	2 541 095	1 100 583
26	952 690	140 917	0	598 274	50.1	2 239 374	1 641 100
27	1 213 412	199 137	0	623 536	50.1	2 743 250	2 119 714
28	1 474 133	257 357	0	649 731	50.1	3 248 059	2 598 328
29	1 701 878	315 578	0	676 902	50.1	3 704 358	3 027 456
30	1 929 623	387 702	0	705 089	50.1	4 182 538	3 477 449
31	2 157 367	454 440	0	734 337	50.1	4 653 695	3 919 358
32	2 385 112	521 178	0	764 692	50.1	5 125 959	4 361 267
33	2 612 857	587 915	0	796 202	50.1	5 599 378	4 803 177
34	2 840 602	654 653	0	828 917	50.1	6 074 003	5 245 086
35	3 068 346	720 752	0	862 891	50.1	6 548 927	5 686 037
36	3 296 091	787 078	0	898 178	50.1	7 025 507	6 127 329
37	3 523 836	853 405	0	934 837	50.1	7 503 458	6 568 621
38	3 751 581	919 731	0	972 929	50.1	7 982 842	7 009 913
39	3 979 325	986 057	0	1 012 517	50.1	8 463 722	7 451 205
40	4 207 070	1 058 895	0	1 053 668	50.1	8 955 936	7 902 269
41	4 434 815	1 137 047	0	1 096 451	50.1	9 457 758	8 361 307
42	4 662 560	1 215 199	0	1 140 940	50.1	9 961 285	8 820 345
43	4 750 483	1 293 351	0	1 187 211	50.1	10 256 775	9 069 564
44	4 838 407	1 371 504	0	1 235 345	50.1	10 554 127	9 318 782
45	4 926 331	1 459 169	119 700	1 285 425	50.1	11 047 326	9 761 901
46	5 014 255	1 553 269	239 399	1 337 540	50.1	11 552 217	10 214 677
47	5 102 179	1 647 369	359 099	1 391 783	50.1	12 059 235	10 667 453
48	5 190 102	1 741 469	478 799	1 448 249	50.1	12 568 477	11 120 228
49	5 278 026	1 835 569	598 499	1 507 041	50.1	13 080 045	11 573 004
50	5 365 950	1 943 330	718 198	1 568 264	50.1	13 614 545	12 046 280
51	5 453 874	2 058 607	837 898	1 632 031	50.1	14 162 866	12 530 835
52	5 511 732	2 093 691	837 898	1 698 458	50.1	14 368 765	12 670 307

53	5 569 591	2 128 775	837 898	1 767 667	50.1	14 577 446	12 809 779
54	5 627 449	2 163 859	837 898	1 839 786	50.1	14 789 038	12 949 251
55	5 685 308	2 211 103	837 898	1 914 951	50.1	15 021 923	13 106 972
56	5 743 166	2 258 348	837 898	1 993 302	50.1	15 257 995	13 264 692
57	5 801 025	2 305 592	837 898	2 074 988	50.1	15 497 400	13 422 413
58	5 858 883	2 352 836	837 898	2 160 162	50.1	15 740 295	13 580 133
59	5 916 742	2 400 081	837 898	2 248 988	50.1	15 986 842	13 737 854
60	5 974 600	2 458 261	837 898	2 341 637	50.1	16 253 622	13 911 985
61	6 046 866	2 516 442	837 898	2 334 316	50.1	16 442 053	14 107 737
62	6 119 132	2 574 622	837 898	2 327 425	50.1	16 630 914	14 303 489
63	6 191 398	2 632 802	837 898	2 320 972	50.1	16 820 213	14 499 241
64	6 263 664	2 690 983	837 898	2 314 965	50.1	17 009 958	14 694 993
65	6 335 930	2 768 200	837 898	2 309 414	50.1	17 228 726	14 919 312
66	6 408 196	2 845 417	837 898	2 304 328	50.1	17 447 959	15 143 631
67	6 480 462	2 922 634	837 898	2 299 716	50.1	17 667 666	15 367 950

Table A-10: results for the personal finance wealth inequality model for tranche 2012.

Year T	**q1 (ZAR)**	**q2 (ZAR)**	**q3 (ZAR)**	**q4 (ZAR)**	**q5 (%)**	**W_{QOL} (ZAR)**	**W'_{QOL} (ZAR)**
23	199 341	14 284	0	1 017 131	49.7	1 336 979	319 848
24	398 681	28 569	0	1 069 352	49.7	1 709 049	639 696
25	598 022	46 219	0	1 123 593	49.7	2 088 177	964 584
26	828 774	166 409	0	479 651	49.7	1 969 682	1 490 030
27	1 059 527	228 733	0	503 453	49.7	2 432 289	1 928 837
28	1 290 280	291 057	0	528 189	49.7	2 895 832	2 367 643
29	1 487 368	353 381	0	553 901	49.7	3 309 946	2 756 044
30	1 684 455	428 303	0	580 634	49.7	3 743 942	3 163 309
31	1 881 543	497 204	0	608 432	49.7	4 169 989	3 561 557
32	2 078 630	566 104	0	637 344	49.7	4 597 150	3 959 805
33	2 275 718	635 005	0	667 420	49.7	5 025 474	4 358 054
34	2 472 806	703 905	0	698 712	49.7	5 455 014	4 756 302
35	2 669 893	772 992	0	731 276	49.7	5 886 105	5 154 830
36	2 866 981	843 016	0	765 168	49.7	6 319 928	5 554 760
37	3 064 068	913 040	0	800 450	49.7	6 755 141	5 954 691
38	3 261 156	983 064	0	837 185	49.7	7 191 807	6 354 621
39	3 458 243	1 053 088	0	875 440	49.7	7 629 991	6 754 552
40	3 655 331	1 128 759	0	915 283	49.7	8 078 221	7 162 937
41	3 852 419	1 210 332	0	956 789	49.7	8 536 947	7 580 159
42	4 049 506	1 291 904	0	1 000 033	49.7	8 997 413	7 997 380
43	4 141 818	1 373 477	0	1 045 095	49.7	9 302 822	8 257 726
44	4 234 130	1 455 049	0	1 092 061	49.7	9 610 134	8 518 073
45	4 326 441	1 547 350	125 447	1 141 017	49.7	10 123 324	8 982 307
46	4 418 753	1 647 725	250 894	1 192 056	49.7	10 650 686	9 458 630
47	4 511 065	1 748 100	376 341	1 245 276	49.7	11 180 229	9 934 953
48	4 603 376	1 848 475	501 788	1 300 777	49.7	11 712 053	10 411 276
49	4 695 688	1 948 850	627 235	1 358 666	49.7	12 246 265	10 887 599
50	4 788 000	2 062 379	752 682	1 419 055	49.7	12 802 671	11 383 616
51	4 848 899	2 099 004	752 682	1 482 062	49.7	13 011 695	11 529 634
52	4 909 799	2 135 629	752 682	1 547 808	49.7	13 223 459	11 675 652
53	4 970 698	2 172 254	752 682	1 616 422	49.7	13 438 092	11 821 670

54	5 031 598	2 208 880	752 682	1 688 040	49.7	13 655 728	11 967 688
55	5 092 497	2 257 016	752 682	1 762 803	49.7	13 893 743	12 130 940
56	5 153 397	2 305 152	752 682	1 840 860	49.7	14 135 053	12 294 193
57	5 214 296	2 353 288	752 682	1 922 367	49.7	14 379 812	12 457 445
58	5 275 196	2 401 424	752 682	2 007 486	49.7	14 628 184	12 620 698
59	5 336 095	2 449 560	752 682	2 096 390	49.7	14 880 341	12 783 951
60	5 396 995	2 510 361	752 682	2 189 258	49.7	15 155 424	12 966 165
61	5 468 124	2 571 162	752 682	2 177 026	49.7	15 340 723	13 163 696
62	5 539 253	2 631 963	752 682	2 165 128	49.7	15 526 355	13 361 227
63	5 610 382	2 692 764	752 682	2 153 570	49.7	15 712 328	13 558 758
64	5 681 510	2 753 565	752 682	2 142 359	49.7	15 898 649	13 756 289
65	5 752 639	2 829 815	752 682	2 131 503	49.7	16 108 455	13 976 952
66	5 823 768	2 906 066	752 682	2 121 007	49.7	16 318 622	14 197 614
67	5 894 897	2 982 316	752 682	2 110 880	49.7	16 529 157	14 418 277

Table A-11: results for the personal finance wealth inequality model for tranche 2013.

Year T	**q1 (ZAR)**	**q2 (ZAR)**	**q3 (ZAR)**	**q4 (ZAR)**	**q5 (%)**	W_{QOL} **(ZAR)**	W'_{QOL} **(ZAR)**
23	216 215	15 908	0	1 162 616	47.4	1 504 814	342 198
24	432 429	31 816	0	1 220 458	47.4	1 904 854	684 396
25	648 644	51 462	0	1 280 516	47.4	2 312 621	1 032 106
26	896 931	167 089	0	554 911	47.4	2 123 505	1 568 594
27	1 145 219	235 578	0	581 681	47.4	2 617 270	2 035 589
28	1 393 506	304 067	0	609 492	47.4	3 112 077	2 502 585
29	1 607 650	372 556	0	638 390	47.4	3 557 635	2 919 245
30	1 821 793	453 352	0	668 425	47.4	4 022 473	3 354 048
31	2 035 936	527 352	0	699 646	47.4	4 478 479	3 778 833
32	2 250 079	601 352	0	732 107	47.4	4 935 725	4 203 618
33	2 464 222	675 353	0	765 862	47.4	5 394 265	4 628 403
34	2 678 366	749 353	0	800 971	47.4	5 854 159	5 053 188
35	2 892 509	825 595	0	837 494	47.4	6 318 772	5 481 277
36	3 106 652	903 343	0	875 495	47.4	6 787 083	5 911 588
37	3 320 795	981 092	0	915 041	47.4	7 256 940	6 341 899
38	3 534 938	1 058 841	0	956 203	47.4	7 728 412	6 772 210
39	3 749 081	1 136 589	0	999 053	47.4	8 201 573	7 202 520
40	3 963 225	1 219 842	0	1 043 669	47.4	8 684 614	7 640 945
41	4 177 368	1 309 842	0	1 090 131	47.4	9 179 449	8 089 318
42	4 391 511	1 399 842	0	1 138 525	47.4	9 676 215	8 537 690
43	4 488 078	1 489 843	0	1 188 938	47.4	10 001 668	8 812 730
44	4 584 645	1 579 843	0	1 241 464	47.4	10 329 234	9 087 770
45	4 681 212	1 682 058	130 607	1 296 201	47.4	10 869 560	9 573 359
46	4 777 779	1 792 902	261 214	1 353 250	47.4	11 424 920	10 071 670
47	4 874 346	1 903 746	391 821	1 412 719	47.4	11 982 699	10 569 980
48	4 970 913	2 014 589	522 428	1 474 720	47.4	12 543 010	11 068 290
49	5 067 480	2 125 433	653 035	1 539 371	47.4	13 105 971	11 566 600
50	5 164 047	2 249 349	783 642	1 606 795	47.4	13 690 976	12 084 181
51	5 228 541	2 289 511	783 642	1 677 122	47.4	13 915 589	12 238 468
52	5 293 035	2 329 674	783 642	1 750 487	47.4	14 143 241	12 392 754
53	5 357 530	2 369 837	783 642	1 827 033	47.4	14 374 074	12 547 040
54	5 422 024	2 409 999	783 642	1 906 910	47.4	14 608 237	12 701 327

55	5 486 518	2 462 473	783 642	1 990 273	47.4	14 864 036	12 873 763
56	5 551 012	2 514 947	783 642	2 077 287	47.4	15 123 486	13 046 199
57	5 615 506	2 567 421	783 642	2 168 125	47.4	15 386 759	13 218 635
58	5 680 000	2 619 895	783 642	2 262 966	47.4	15 654 036	13 391 071
59	5 744 494	2 672 369	783 642	2 362 000	47.4	15 925 507	13 563 507
60	5 808 988	2 738 970	783 642	2 465 426	47.4	16 222 195	13 756 769
61	5 887 008	2 805 571	783 642	2 452 602	47.4	16 422 572	13 969 970
62	5 965 027	2 872 172	783 642	2 440 165	47.4	16 623 336	14 183 171
63	6 043 046	2 938 774	783 642	2 428 125	47.4	16 824 497	14 396 372
64	6 121 066	3 005 375	783 642	2 416 488	47.4	17 026 062	14 609 574
65	6 199 085	3 087 989	783 642	2 405 264	47.4	17 251 646	14 846 382
66	6 277 104	3 170 604	783 642	2 394 460	47.4	17 477 650	15 083 190
67	6 355 123	3 253 218	783 642	2 384 084	47.4	17 704 083	15 319 999
68	6 433 143	3 335 832	783 642	2 374 146	47.4	17 930 953	15 556 807

Table A-12: results for the personal finance wealth inequality model for tranche 2014.

Year T	**q1 (ZAR)**	**q2 (ZAR)**	**q3 (ZAR)**	**q4 (ZAR)**	**q5 (%)**	W_{QOL} **(ZAR)**	W'_{QOL} **(ZAR)**
23	232 638	18 128	0	1 233 712	47.1	1 602 579	368 867
24	465 275	36 255	0	1 295 163	47.1	2 032 896	737 733
25	697 913	62 274	0	1 358 968	47.1	2 477 176	1 118 208
26	964 433	280 008	0	596 331	47.1	2 426 860	1 830 530
27	1 230 953	366 040	0	625 129	47.1	2 974 249	2 349 120
28	1 497 473	452 071	0	655 047	47.1	3 522 758	2 867 711
29	1 727 988	538 102	0	686 137	47.1	4 019 476	3 333 339
30	1 958 504	627 633	0	718 448	47.1	4 522 564	3 804 116
31	2 189 019	708 029	0	752 037	47.1	5 013 492	4 261 455
32	2 419 534	788 425	0	786 959	47.1	5 505 754	4 718 795
33	2 650 049	868 821	0	823 275	47.1	5 999 409	5 176 134
34	2 880 564	949 217	0	861 048	47.1	6 494 521	5 633 473
35	3 111 079	1 034 738	0	900 342	47.1	6 998 694	6 098 352
36	3 341 594	1 122 032	0	941 227	47.1	7 507 065	6 565 838
37	3 572 109	1 209 326	0	983 776	47.1	8 017 099	7 033 324
38	3 802 625	1 296 620	0	1 028 062	47.1	8 528 872	7 500 810
39	4 033 140	1 383 914	0	1 074 166	47.1	9 042 461	7 968 295
40	4 263 655	1 476 760	0	1 122 170	47.1	9 566 119	8 443 949
41	4 494 170	1 579 120	0	1 172 162	47.1	10 105 758	8 933 596
42	4 724 685	1 681 480	0	1 224 232	47.1	10 647 476	9 423 244
43	4 825 196	1 783 840	0	1 278 476	47.1	11 000 136	9 721 659
44	4 925 706	1 886 199	0	1 334 995	47.1	11 355 069	10 020 074
45	5 026 217	1 997 622	143 500	1 393 892	47.1	11 936 796	10 542 905
46	5 126 727	2 117 763	287 001	1 455 278	47.1	12 533 837	11 078 559
47	5 227 238	2 237 904	430 501	1 519 269	47.1	13 133 483	11 614 214
48	5 327 748	2 358 045	574 001	1 585 984	47.1	13 735 853	12 149 869
49	5 428 259	2 478 186	717 502	1 655 552	47.1	14 341 076	12 685 524
50	5 528 770	2 611 506	861 002	1 728 105	47.1	14 968 670	13 240 564
51	5 595 397	2 654 117	861 002	1 803 782	47.1	15 205 033	13 401 251
52	5 662 025	2 696 727	861 002	1 882 730	47.1	15 444 667	13 561 937
53	5 728 653	2 739 338	861 002	1 965 102	47.1	15 687 724	13 722 623
54	5 795 281	2 781 949	861 002	2 051 058	47.1	15 934 367	13 883 309

55	5 861 909	2 832 724	861 002	2 140 767	47.1	16 196 771	14 056 005
56	5 928 537	2 883 499	861 002	2 234 405	47.1	16 463 106	14 228 700
57	5 995 165	2 934 274	861 002	2 332 159	47.1	16 733 555	14 401 396
58	6 061 793	2 985 049	861 002	2 434 223	47.1	17 008 314	14 574 091
59	6 128 421	3 035 824	861 002	2 540 800	47.1	17 287 587	14 746 787
60	6 195 049	3 098 804	861 002	2 652 104	47.1	17 589 541	14 937 437
61	6 289 199	3 161 785	861 002	2 633 570	47.1	17 802 141	15 168 571
62	6 383 349	3 224 766	861 002	2 615 453	47.1	18 015 157	15 399 704
63	6 477 499	3 287 747	861 002	2 597 762	47.1	18 228 600	15 630 838
64	6 571 648	3 350 727	861 002	2 580 505	47.1	18 442 476	15 861 971
65	6 665 798	3 428 362	861 002	2 563 690	47.1	18 678 351	16 114 661
66	6 759 948	3 505 997	861 002	2 547 327	47.1	18 914 677	16 367 350
67	6 854 098	3 583 632	861 002	2 531 425	47.1	19 151 464	16 620 039
68	6 948 248	3 661 267	861 002	2 515 992	47.1	19 388 721	16 872 728

Table A-13: results for the personal finance wealth inequality model for tranche 2015.

Year T	**q1 (ZAR)**	**q2 (ZAR)**	**q3 (ZAR)**	**q4 (ZAR)**	**q5 (%)**	**W_{QOL} (ZAR)**	**W'_{QOL} (ZAR)**
23	257 899	21 698	0	1 363 805	45.4	1 770 362	406 557
24	515 797	43 395	0	1 430 475	45.4	2 243 588	813 114
25	773 696	70 193	0	1 499 683	45.4	2 726 770	1 227 087
26	1 068 408	215 771	0	663 097	45.4	2 530 404	1 867 307
27	1 363 121	305 595	0	694 583	45.4	3 121 039	2 426 456
28	1 657 833	395 419	0	727 288	45.4	3 712 892	2 985 605
29	1 913 629	485 243	0	761 264	45.4	4 249 430	3 488 166
30	2 169 426	583 585	0	796 569	45.4	4 799 683	4 003 114
31	2 425 222	671 928	0	833 261	45.4	5 336 783	4 503 522
32	2 681 018	760 271	0	871 402	45.4	5 875 332	5 003 930
33	2 936 815	848 614	0	911 057	45.4	6 415 395	5 504 338
34	3 192 611	936 957	0	952 294	45.4	6 957 039	6 004 745
35	3 448 407	1 029 815	0	995 183	45.4	7 506 903	6 511 719
36	3 704 204	1 125 253	0	1 039 800	45.4	8 062 244	7 022 444
37	3 960 000	1 220 691	0	1 086 222	45.4	8 619 391	7 533 169
38	4 215 796	1 316 129	0	1 134 531	45.4	9 178 425	8 043 894
39	4 471 593	1 411 567	0	1 184 812	45.4	9 739 431	8 554 619
40	4 727 389	1 514 681	0	1 237 157	45.4	10 313 661	9 076 505
41	4 983 185	1 627 783	0	1 291 657	45.4	10 904 571	9 612 914
42	5 238 981	1 740 884	0	1 348 413	45.4	11 497 736	10 149 323
43	5 347 671	1 853 986	0	1 407 527	45.4	11 879 354	10 471 827
44	5 456 361	1 967 088	0	1 469 108	45.4	12 263 439	10 794 331
45	5 565 051	2 091 639	146 632	1 533 269	45.4	12 879 968	11 346 698
46	5 673 741	2 229 761	293 263	1 600 130	45.4	13 518 929	11 918 799
47	5 782 431	2 367 883	439 895	1 669 815	45.4	14 160 715	12 490 900
48	5 891 120	2 506 006	586 527	1 742 455	45.4	14 805 456	13 063 001
49	5 999 810	2 644 128	733 159	1 818 187	45.4	15 453 290	13 635 102
50	6 108 500	2 797 844	879 790	1 897 156	45.4	16 127 034	14 229 878
51	6 180 376	2 846 497	879 790	1 979 511	45.4	16 384 649	14 405 138
52	6 252 252	2 895 150	879 790	2 065 411	45.4	16 645 808	14 580 397
53	6 324 128	2 943 803	879 790	2 155 022	45.4	16 910 679	14 755 657
54	6 396 004	2 992 456	879 790	2 248 518	45.4	17 179 434	14 930 916

55	6 467 880	3 053 560	879 790	2 346 080	45.4	17 470 360	15 124 280
56	6 539 756	3 114 663	879 790	2 447 901	45.4	17 765 544	15 317 643
57	6 611 632	3 175 766	879 790	2 554 180	45.4	18 065 187	15 511 007
58	6 683 508	3 236 870	879 790	2 665 128	45.4	18 369 498	15 704 370
59	6 755 384	3 297 973	879 790	2 780 965	45.4	18 678 699	15 897 734
60	6 827 260	3 374 269	879 790	2 901 923	45.4	19 015 111	16 113 188
61	6 935 432	3 450 564	879 790	2 879 556	45.4	19 260 975	16 381 419
62	7 043 604	3 526 859	879 790	2 857 654	45.4	19 507 305	16 649 651
63	7 151 777	3 603 155	879 790	2 836 227	45.4	19 754 110	16 917 883
64	7 259 949	3 679 450	879 790	2 815 284	45.4	20 001 399	17 186 115
65	7 368 121	3 771 832	879 790	2 794 835	45.4	20 272 573	17 477 738
66	7 476 294	3 864 214	879 790	2 774 890	45.4	20 544 251	17 769 360
67	7 584 466	3 956 596	879 790	2 755 459	45.4	20 816 442	18 060 983
68	7 692 638	4 048 977	879 790	2 736 552	45.4	21 089 159	18 352 606
69	7 800 810	4 141 359	879 790	2 718 180	45.4	21 362 409	18 644 229

Table A-14: results for the personal finance wealth inequality model for tranche 2016.

Year T	**q1 (ZAR)**	**q2 (ZAR)**	**q3 (ZAR)**	**q4 (ZAR)**	**q5 (%)**	**W_{QOL} (ZAR)**	**W'_{QOL} (ZAR)**
23	278 019	23 122	0	1 373 156	46.3	1 813 615	440 460
24	556 037	46 245	0	1 442 865	46.3	2 323 785	880 919
25	834 056	74 096	0	1 515 261	46.3	2 843 556	1 328 295
26	1 112 075	101 946	0	673 925	46.3	2 449 595	1 775 670
27	1 429 718	257 354	0	707 030	46.3	3 174 601	2 467 571
28	1 747 360	352 843	0	741 431	46.3	3 813 264	3 071 832
29	2 023 150	448 331	0	777 186	46.3	4 392 064	3 614 877
30	2 298 940	553 318	0	814 355	46.3	4 986 170	4 171 815
31	2 574 730	646 435	0	853 001	46.3	5 564 392	4 711 391
32	2 850 520	739 552	0	893 190	46.3	6 144 157	5 250 967
33	3 126 309	832 669	0	934 991	46.3	6 725 535	5 790 544
34	3 402 099	925 786	0	978 478	46.3	7 308 598	6 330 120
35	3 677 889	1 024 373	0	1 023 726	46.3	7 901 422	6 877 696
36	3 953 679	1 124 516	0	1 070 816	46.3	8 498 365	7 427 549
37	4 229 469	1 224 659	0	1 119 831	46.3	9 097 232	7 977 402
38	4 505 258	1 324 802	0	1 170 858	46.3	9 698 113	8 527 255
39	4 781 048	1 424 945	0	1 223 990	46.3	10 301 097	9 077 107
40	5 056 838	1 533 084	0	1 279 322	46.3	10 917 977	9 638 655
41	5 332 628	1 652 674	0	1 336 957	46.3	11 553 908	10 216 952
42	5 608 418	1 772 264	0	1 396 998	46.3	12 192 247	10 795 248
43	5 725 606	1 891 854	0	1 459 558	46.3	12 601 127	11 141 569
44	5 842 794	2 011 444	0	1 524 753	46.3	13 012 642	11 487 889
45	5 959 983	2 143 353	0	1 592 704	46.3	13 444 933	11 852 229
46	6 077 171	2 289 757	162 920	1 663 540	46.3	14 139 601	12 476 061
47	6 194 359	2 436 161	325 841	1 737 393	46.3	14 837 287	13 099 894
48	6 311 548	2 582 565	488 761	1 814 405	46.3	15 538 132	13 723 727
49	6 428 736	2 728 969	651 682	1 894 723	46.3	16 242 283	14 347 560
50	6 545 925	2 894 385	814 602	1 978 502	46.3	16 977 702	14 999 201
51	6 623 489	2 947 142	814 602	2 065 902	46.3	17 255 715	15 189 813
52	6 701 053	2 999 899	814 602	2 157 094	46.3	17 537 519	15 380 425
53	6 778 617	3 052 655	814 602	2 252 257	46.3	17 823 293	15 571 037

54	6 856 181	3 105 412	814 602	2 351 576	46.3	18 113 224	15 761 649
55	6 933 746	3 170 159	814 602	2 455 247	46.3	18 425 045	15 969 798
56	7 011 310	3 234 906	814 602	2 563 477	46.3	18 741 424	16 177 947
57	7 088 874	3 299 653	814 602	2 676 479	46.3	19 062 576	16 386 097
58	7 166 438	3 364 400	814 602	2 794 481	46.3	19 388 727	16 594 246
59	7 244 002	3 429 147	814 602	2 917 719	46.3	19 720 114	16 802 395
60	7 321 566	3 511 307	814 602	3 046 441	46.3	20 082 455	17 036 014
61	7 438 514	3 593 468	814 602	3 020 377	46.3	20 347 613	17 327 237
62	7 555 461	3 675 629	814 602	2 994 782	46.3	20 613 241	17 618 459
63	7 672 408	3 757 789	814 602	2 969 666	46.3	20 879 348	17 909 681
64	7 789 356	3 839 950	814 602	2 945 040	46.3	21 145 944	18 200 904
65	7 906 303	3 939 115	814 602	2 920 912	46.3	21 437 909	18 516 997
66	8 023 250	4 038 279	814 602	2 897 292	46.3	21 730 382	18 833 090
67	8 140 198	4 137 444	814 602	2 874 191	46.3	22 023 375	19 149 184
68	8 257 145	4 236 609	814 602	2 851 619	46.3	22 316 896	19 465 277
69	8 374 092	4 335 774	814 602	2 829 587	46.3	22 610 957	19 781 370

Table A-15: results for the personal finance wealth inequality model for tranche 2017.

Year T	**q1 (ZAR)**	**q2 (ZAR)**	**q3 (ZAR)**	**q4 (ZAR)**	**q5 (%)**	**W_{QOL} (ZAR)**	**W'_{QOL} (ZAR)**
23	263 597	25 311	0	1 189 639	44.7	1 607 596	417 956
24	527 194	50 621	0	1 257 126	44.7	2 093 039	835 913
25	790 791	81 831	0	1 327 298	44.7	2 589 702	1 262 404
26	1 054 388	113 041	0	598 409	44.7	2 287 304	1 688 895
27	1 359 342	325 536	0	630 850	44.7	3 068 325	2 437 475
28	1 664 295	429 108	0	664 601	44.7	3 693 082	3 028 481
29	1 923 484	532 681	0	699 721	44.7	4 253 002	3 553 281
30	2 182 674	644 371	0	736 272	44.7	4 826 096	4 089 824
31	2 441 863	756 061	0	774 320	44.7	5 400 687	4 626 367
32	2 701 053	856 351	0	813 932	44.7	5 960 350	5 146 418
33	2 960 242	956 641	0	855 180	44.7	6 521 650	5 666 470
34	3 219 431	1 056 932	0	898 139	44.7	7 084 660	6 186 521
35	3 478 621	1 160 068	0	942 887	44.7	7 653 577	6 710 689
36	3 737 810	1 263 203	0	989 507	44.7	8 224 364	7 234 857
37	3 997 000	1 368 192	0	1 038 085	44.7	8 799 790	7 761 705
38	4 256 189	1 473 180	0	1 088 711	44.7	9 377 264	8 288 553
39	4 515 379	1 578 168	0	1 141 480	44.7	9 956 882	8 815 401
40	4 774 568	1 692 729	0	1 196 492	44.7	10 552 590	9 356 098
41	5 033 757	1 807 291	0	1 253 851	44.7	11 150 646	9 896 795
42	5 292 947	1 934 434	0	1 313 666	44.7	11 769 360	10 455 694
43	5 415 724	2 061 578	0	1 376 051	44.7	12 193 300	10 817 249
44	5 538 501	2 188 721	0	1 441 127	44.7	12 619 931	11 178 804
45	5 661 278	2 328 897	0	1 509 020	44.7	13 068 231	11 559 211
46	5 784 055	2 469 072	166 425	1 579 861	44.7	13 760 243	12 180 382
47	5 906 833	2 625 289	332 849	1 653 790	44.7	14 478 550	12 824 760
48	6 029 610	2 781 506	499 274	1 730 952	44.7	15 200 089	13 469 137
49	6 152 387	2 937 723	665 699	1 811 498	44.7	15 925 013	14 113 515
50	6 275 164	3 114 251	832 123	1 895 589	44.7	16 682 865	14 787 276
51	6 356 585	3 170 289	832 123	1 983 392	44.7	16 969 528	14 986 135
52	6 438 006	3 226 328	832 123	2 075 084	44.7	17 260 079	15 184 995
53	6 519 427	3 282 367	832 123	2 170 848	44.7	17 554 703	15 383 855

54	6 600 848	3 338 405	832 123	2 270 878	44.7	17 853 592	15 582 715
55	6 682 268	3 406 288	832 123	2 375 376	44.7	18 174 085	15 798 709
56	6 763 689	3 474 171	832 123	2 484 556	44.7	18 499 259	16 014 703
57	6 845 110	3 542 053	832 123	2 598 640	44.7	18 829 337	16 230 697
58	6 926 531	3 609 936	832 123	2 717 864	44.7	19 164 554	16 446 691
59	7 007 952	3 677 818	832 123	2 842 471	44.7	19 505 156	16 662 685
60	7 089 373	3 763 052	832 123	2 972 721	44.7	19 876 502	16 903 781
61	7 199 753	3 848 286	832 123	2 945 951	44.7	20 132 724	17 186 772
62	7 310 134	3 933 521	832 123	2 919 590	44.7	20 389 354	17 469 764
63	7 420 515	4 018 755	832 123	2 893 645	44.7	20 646 400	17 752 756
64	7 530 895	4 103 989	832 123	2 868 124	44.7	20 903 871	18 035 747
65	7 641 276	4 209 521	832 123	2 843 036	44.7	21 191 140	18 348 104
66	7 751 657	4 315 054	832 123	2 818 390	44.7	21 478 851	18 660 461
67	7 862 037	4 420 587	832 123	2 794 194	44.7	21 767 013	18 972 819
68	7 972 418	4 526 120	832 123	2 770 458	44.7	22 055 634	19 285 176
69	8 082 799	4 631 652	832 123	2 747 191	44.7	22 344 724	19 597 533
70	8 193 179	4 752 234	832 123	2 724 402	44.7	22 656 063	19 931 661

Table A-16: results for the personal finance wealth inequality model for tranche 2018.

Year T	**q1 (ZAR)**	**q2 (ZAR)**	**q3 (ZAR)**	**q4 (ZAR)**	**q5 (%)**	**W_{QOL} (ZAR)**	**W'_{QOL} (ZAR)**
23	382 558	25 297	0	2 205 619	44.8	2 796 316	590 697
24	765 117	50 594	0	2 295 782	44.8	3 477 177	1 181 395
25	1 147 675	82 520	0	2 389 157	44.8	4 170 850	1 781 694
26	1 530 233	114 446	0	1 066 900	44.8	3 448 893	2 381 993
27	1 955 143	299 981	0	1 109 908	44.8	4 376 009	3 266 101
28	2 380 052	407 567	0	1 154 476	44.8	5 191 790	4 037 315
29	2 758 483	515 152	0	1 200 669	44.8	5 941 881	4 741 212
30	3 136 913	632 215	0	1 248 558	44.8	6 707 395	5 458 837
31	3 515 343	749 279	0	1 298 215	44.8	7 474 676	6 176 461
32	3 893 773	853 045	0	1 349 715	44.8	8 224 542	6 874 827
33	4 272 203	956 811	0	1 403 139	44.8	8 976 331	7 573 193
34	4 650 633	1 060 577	0	1 458 568	44.8	9 730 127	8 271 559
35	5 029 063	1 168 237	0	1 516 091	44.8	10 491 655	8 975 564
36	5 407 494	1 275 897	0	1 575 798	44.8	11 255 367	9 679 569
37	5 785 924	1 385 994	0	1 637 784	44.8	12 024 889	10 387 104
38	6 164 354	1 496 091	0	1 702 151	44.8	12 796 790	11 094 640
39	6 542 784	1 606 188	0	1 769 001	44.8	13 571 176	11 802 175
40	6 921 214	1 726 251	0	1 838 445	44.8	14 362 587	12 524 143
41	7 299 644	1 846 313	0	1 910 597	44.8	15 156 707	13 246 111
42	7 678 074	1 979 223	0	1 985 577	44.8	15 972 262	13 986 685
43	7 804 781	2 112 133	0	2 063 512	44.8	16 426 200	14 362 688
44	7 931 488	2 245 042	0	2 144 533	44.8	16 883 224	14 738 691
45	8 058 195	2 393 861	0	2 228 778	44.8	17 366 514	15 137 736
46	8 184 901	2 542 681	178 097	2 316 391	44.8	18 111 110	15 794 719
47	8 311 608	2 705 815	356 194	2 407 526	44.8	18 879 960	16 472 434
48	8 438 315	2 868 949	534 291	2 502 339	44.8	19 652 489	17 150 150
49	8 565 021	3 032 083	712 388	2 600 998	44.8	20 428 864	17 827 865
50	8 691 728	3 217 215	890 485	2 703 678	44.8	21 241 117	18 537 440
51	8 776 083	3 277 429	890 485	2 810 559	44.8	21 557 380	18 746 820

52	8 860 438	3 337 644	890 485	2 921 836	44.8	21 878 037	18 956 201
53	8 944 794	3 397 858	890 485	3 037 707	44.8	22 203 288	19 165 581
54	9 029 149	3 458 072	890 485	3 158 384	44.8	22 533 345	19 374 962
55	9 113 504	3 531 429	890 485	3 284 086	44.8	22 887 462	19 603 376
56	9 197 859	3 604 785	890 485	3 415 046	44.8	23 246 836	19 831 790
57	9 282 215	3 678 142	890 485	3 551 505	44.8	23 611 709	20 060 205
58	9 366 570	3 751 498	890 485	3 693 717	44.8	23 982 336	20 288 619
59	9 450 925	3 824 855	890 485	3 841 948	44.8	24 358 982	20 517 033
60	9 535 280	3 916 816	890 485	3 996 479	44.8	24 768 871	20 772 392
61	9 653 155	4 008 776	890 485	3 984 483	44.8	25 060 779	21 076 297
62	9 771 029	4 100 737	890 485	3 973 258	44.8	25 353 460	21 380 202
63	9 888 904	4 192 698	890 485	3 962 821	44.8	25 646 928	21 684 106
64	10 006 779	4 284 658	890 485	3 953 187	44.8	25 941 199	21 988 011
65	10 124 653	4 398 365	890 485	3 944 372	44.8	26 267 784	22 323 412
66	10 242 528	4 512 073	890 485	3 936 393	44.8	26 595 206	22 658 812
67	10 360 402	4 625 780	890 485	3 929 266	44.8	26 923 479	22 994 213
68	10 478 277	4 739 487	890 485	3 923 008	44.8	27 252 622	23 329 614
69	10 596 152	4 853 195	890 485	3 917 637	44.8	27 582 651	23 665 014
70	10 714 026	4 985 666	890 485	3 913 170	44.8	27 940 762	24 027 591

Table A-17: results for the personal finance wealth inequality model for tranche 2019.

Year T	**q1 (ZAR)**	**q2 (ZAR)**	**q3 (ZAR)**	**q4 (ZAR)**	**q5 (%)**	W_{QOL} **(ZAR)**	W'_{QOL} **(ZAR)**
23	318 385	27 295	0	1 617 854	45.3	2 120 160	502 305
24	636 771	54 590	0	1 698 499	45.3	2 703 110	1 004 610
25	955 156	87 730	0	1 782 234	45.3	3 297 642	1 515 408
26	1 273 542	120 870	0	805 687	45.3	2 831 893	2 026 205
27	1 635 267	303 525	0	844 621	45.3	3 661 860	2 817 239
28	1 996 992	414 872	0	885 071	45.3	4 389 727	3 504 656
29	2 311 009	526 220	0	927 104	45.3	5 049 853	4 122 750
30	2 625 027	647 860	0	970 789	45.3	5 726 589	4 755 800
31	2 939 045	769 501	0	1 016 201	45.3	6 405 052	5 388 851
32	3 253 063	877 635	0	1 063 417	45.3	7 065 693	6 002 276
33	3 567 080	985 769	0	1 112 518	45.3	7 728 219	6 615 701
34	3 881 098	1 093 903	0	1 163 589	45.3	8 392 714	7 229 126
35	4 195 116	1 207 187	0	1 216 718	45.3	9 066 751	7 850 034
36	4 509 134	1 320 472	0	1 271 998	45.3	9 742 940	8 470 942
37	4 823 151	1 436 312	0	1 329 526	45.3	10 425 092	9 095 566
38	5 137 169	1 552 153	0	1 389 406	45.3	11 109 595	9 720 189
39	5 451 187	1 667 994	0	1 451 743	45.3	11 796 556	10 344 812
40	5 765 204	1 793 407	0	1 516 651	45.3	12 499 996	10 983 345
41	6 079 222	1 918 820	0	1 584 246	45.3	13 206 123	11 621 877
42	6 393 240	2 058 277	0	1 654 652	45.3	13 935 469	12 280 817
43	6 523 621	2 197 734	0	1 727 998	45.3	14 400 914	12 672 916
44	6 654 001	2 337 191	0	1 804 419	45.3	14 869 434	13 065 015
45	6 784 382	2 493 504	0	1 884 058	45.3	15 365 664	13 481 605
46	6 914 763	2 649 816	190 856	1 967 063	45.3	16 142 590	14 175 527
47	7 045 144	2 822 226	381 711	2 053 590	45.3	16 946 429	14 892 839
48	7 175 524	2 994 635	572 567	2 143 803	45.3	17 753 954	15 610 151
49	7 305 905	3 167 045	763 422	2 237 873	45.3	18 565 336	16 327 463

50	7 436 286	3 363 117	954 278	2 335 980	45.3	19 415 138	17 079 158
51	7 523 327	3 426 595	954 278	2 438 312	45.3	19 736 189	17 297 877
52	7 610 368	3 490 074	954 278	2 545 068	45.3	20 061 663	17 516 596
53	7 697 409	3 553 553	954 278	2 656 453	45.3	20 391 768	17 735 315
54	7 784 450	3 617 031	954 278	2 772 687	45.3	20 726 721	17 954 033
55	7 871 491	3 695 849	954 278	2 893 997	45.3	21 089 038	18 195 042
56	7 958 532	3 774 667	954 278	3 020 621	45.3	21 456 670	18 436 050
57	8 045 574	3 853 485	954 278	3 152 811	45.3	21 829 868	18 677 058
58	8 132 615	3 932 303	954 278	3 290 829	45.3	22 208 895	18 918 066
59	8 219 656	4 011 121	954 278	3 434 952	45.3	22 594 025	19 159 074
60	8 306 697	4 110 026	954 278	3 585 468	45.3	23 014 739	19 429 271
61	8 426 939	4 208 931	954 278	3 561 818	45.3	23 309 529	19 747 711
62	8 547 181	4 307 837	954 278	3 538 731	45.3	23 604 883	20 066 152
63	8 667 423	4 406 742	954 278	3 516 220	45.3	23 900 813	20 384 593
64	8 787 664	4 505 647	954 278	3 494 295	45.3	24 197 328	20 703 033
65	8 907 906	4 627 140	954 278	3 472 968	45.3	24 527 264	21 054 296
66	9 028 148	4 748 634	954 278	3 452 250	45.3	24 857 809	21 405 559
67	9 148 390	4 870 127	954 278	3 432 156	45.3	25 188 977	21 756 822
68	9 268 632	4 991 620	954 278	3 412 695	45.3	25 520 780	22 108 085
69	9 388 874	5 113 113	954 278	3 393 882	45.3	25 853 230	22 459 348
70	9 509 116	5 256 561	954 278	3 375 730	45.3	26 218 242	22 842 512

Table A-18: correlation analysis of variables for the macroeconomic wealth inequality model.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
A	1,00																	
B	1,00	1,00																
C	0,87	0,90	1,00															
D	-0,90	-0,93	-0,98	1,00														
E	-0,86	-0,89	-0,97	0,95	1,00													
F	0,97	0,98	0,87	-0,93	-0,89	1,00												
G	1,00	1,00	0,90	-0,93	-0,89	0,97	1,00											
H	1,00	1,00	0,88	-0,91	-0,87	0,97	1,00	1,00										
I	0,91	0,94	0,97	-0,98	-0,97	0,93	0,94	0,92	1,00									
J	0,99	1,00	0,91	-0,94	-0,89	0,98	1,00	1,00	0,94	1,00								
K	1,00	1,00	0,88	-0,91	-0,88	0,97	1,00	1,00	0,92	1,00	1,00							
L	0,70	0,65	0,40	-0,41	-0,33	0,57	0,66	0,69	0,48	0,65	0,69	1,00						
M	0,93	0,92	0,87	-0,85	-0,83	0,84	0,93	0,93	0,88	0,92	0,93	0,73	1,00					
N	-0,16	-0,13	0,04	-0,06	0,10	-0,13	-0,15	-0,14	0,01	-0,12	-0,16	-0,02	-0,10	1,00				
O	-0,75	-0,76	-0,53	0,63	0,59	-0,83	-0,74	-0,76	-0,69	-0,76	-0,76	-0,59	-0,57	0,01	1,00			
P	-0,14	-0,19	-0,54	0,46	0,54	-0,16	-0,19	-0,17	-0,46	-0,19	-0,17	0,20	-0,30	-0,45	-0,07	1,00		
Q	-0,21	-0,20	-0,35	0,29	0,14	-0,09	-0,22	-0,22	-0,26	-0,21	-0,20	-0,36	-0,43	-0,52	-0,11	0,26	1,00	
R	0,93	0,95	0,93	-0,96	-0,88	0,92	0,95	0,94	0,95	0,95	0,93	0,58	0,90	0,11	-0,71	-0,36	-0,38	1,00

*Variable names are abbreviated with letters. The letter designation can be matched with corresponding variable name in table A-19.

Table A-19: macroeconomic wealth inequality model variable designation for table A-18.

Variable name	Table A-18 designation
Healthcare budget	A
Population	B
Medical aid beneficiary population	C
Average births per woman	D
Years to higher education completion (at graduation rate exceeds 50% of intake)	E
Average life expectancy	F
Child support grant budget	G
Old age grant budget	H
Number of child support grants	I
Number of old age grants	J
Education budget	K
Number of children in basic edcuation	L
Number of children in higher education	M
Human settlements, water and sanitation and electrification budget	N
Public transport budget	O
Population in the 0th and 0-50th percentile income groups	P
Job creation and labour affairs budget	Q
Agriculture and land reform budget	R

Table A-20: independent variable values for the healthcare function $\bar{B}_H$ for the period 2010 to 2019.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
B_H (ZAR millions)	104 600	112 600	121 900	133 600	145 700	157 300	168 400	187 500	205 400	222 600
P (thousands)	50 850	51 574	52 325	53 104	53 912	54 750	55 620	56 522	57 458	58 429
P_{MB}	8 315 718	8 526 409	8 679 473	8 778 308	8 808 034	8 796 510	8 878 081	8 872 036	8 916 695	8 990 160
N_C	2.58	2.51	2.46	2.42	2.39	2.37	2.36	2.34	2.33	2.32
T_G	8	7	6	6	6	6	5	5	5	5
L_E	66.6	66.9	67.0	67.5	67.6	68.3	68.7	69.2	69.2	69.2

Table A-21: independent variable values for the social welfare function $\bar{B}_{SW}$ for the period 2010 to 2019.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
B_{CS} (ZAR millions)	27 273	30 594	34 036	38 190	40 029	43 428	47 459	51 351	56 017	60 603
N_{CS} (thousands)	9 424	10 336	10 903	11 406	11 050	11 677	12 052	12 051	12 239	12 508
N_C	2.58	2.51	2.46	2.42	2.39	2.37	2.36	2.34	2.33	2.32
B_{OG} (ZAR millions)	29 991	33 797	37 318	40 529	44 767	49 422	53 274	58 327	64 276	70 453
N_{OG} (thousands)	2 534	2 647	2 724	2 851	2 946	3 070	3 182	3 279	3 392	3 538
L_E	66.6	66.9	67.0	67.5	67.6	68.3	68.7	69.2	69.2	69.2

Table A-22: independent variable values for the education function $\bar{B}_E$ for the period 2010 to 2019.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
B_E (ZAR millions)	165 100	189 500	207 300	223 400	243 200	265 700	297 500	320 500	351 100	386 400
N_{BE} (thousands)	14 034	14 114	13 899	13 968	13 883	14 135	13 992	14 033	14 265	14 630
N_{HE} (thousands)	211	332	403	435	415	415	465	473	667	740
N_C	2.58	2.51	2.46	2.42	2.39	2.37	2.36	2.34	2.33	2.32
T_G	8	7	6	6	6	6	5	5	5	5

Table A-23: independent variable values for the economic development function $\bar{B}_E$ for the period 2010 to 2019.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
B_{HWE} (ZAR millions)	49 100	68 000	60 900	60 100	62 600	82 400	52 100	52 800	56 500	56 400
B_T (ZAR millions)	67 400	65 600	74 900	74 600	81 600	41 300	40 700	44 100	38 600	43 600
N_P	28 985 694	27 261 913	26 051 142	27 002 540	26 942 145	26 862 231	27 053 365	27 226 945	27 279 813	27 347 727
B_{JL} (ZAR millions)	32 200	25 100	29 800	22 300	23 100	24 091	31 276	33 236	23 200	23 200
B_{AL} (ZAR millions)	17 100	19 000	22 000	23 400	24 300	27 965	26 400	25 998	30 200	30 700
L_E	66.6	66.9	67.0	67.5	67.6	68.3	68.7	69.2	69.2	69.2