SCHOOL OF POSTGRADUATE STUDIES

A STUDY OF THE RELATIONSHIP BETWEEN DEMOGRAPHIC TRANSITION AND ECONOMIC GROWTH IN ZAMBIA

A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, UNIVERSITY OF LUSAKA IN PARTIAL FULFILLMENT OF THE AWARD OF THE MASTER OF SCIENCE IN ECONOMICS AND FINANCE.

BY

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Declaration

I, Martin Ndonji Sakuhuka, student number MSCECF211463101, hereby declare that the thesis entitled "A Study of the Relationship between Demographic Transition and Economic Growth in Zambia," submitted for the accomplishment for the Master's degree in Economics and Finance at University of Lusaka has not been submitted by me or anyone else for a postgraduate degree at this or any other academic institution, and that secondary data and information utilized has been acknowledged by means of references.

Signature: Date: 14th January, 2024

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Dr Francis Mulenga Muma (Supervisor)

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Firstly, I would like to thank God for the gift of life and blessing me with the opportunity to pursue this master's program.

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Abstract

Demographic transition is a phenomenon that has influenced societies globally since the late 1800s. Following World War II, numerous countries experienced demographic changes, each progressing at its own distinctive rate and moment. The research delves into the intricate relationship between demographic transition variables and economic growth, employing a robust quantitative analysis spanning from 1981 to 2022. Utilizing the Augmented Dickey-Fuller Test and Auto Regressive Distributed Lag model, the study unveils the dynamic nature of these variables over time, offering significant insights into the complex interplay between demographic shifts and economic development. Focusing on critical factors such as GDP growth, working-age population dynamics, population growth, total fertility rate, and death rate, the research provides nuanced understanding of their relationships with economic trajectories. The long-run equation reveals that Death Rate (DR), Population Growth (PG), and Birth Rate (TFR) significantly influence GDP growth, with positive effects for all coefficients except Total Fertility Rate (TFR), which negatively impacts GDP. Interestingly, Working Age Population (WAP) is deemed statistically insignificant in the long run. In the short run, lagged GDP growth negatively influences current GDP, while Death Rate (DR) positively affects short-term GDP growth. Total Fertility Rate (TFR) negatively impacts short-term GDP, and Population Growth (PG) has an insignificant effect. The study's recommendations underscore the significance of human capital development, diversified economic strategies, and targeted family planning and health services for fostering sustainable economic growth in Zambia.

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CHAPTER ONE:

INTRODUCTION AND BACKGROUND OF THE STUDY

1.0 Introduction

Demographic transition, a global phenomenon since the late 1800s, has shaped societies worldwide. Post-World War II, various developing nations underwent demographic shifts, each at its unique pace and juncture (Lee 2003). This transition involves evolving birth and death rates, influencing population structures and alterations in social structures. Analyzing these patterns helps comprehend economic, social, and political changes. The interconnected nature of these shifts highlights the complex interaction between demographic trends and broader global developments, emphasizing the significance of understanding and managing demographic transitions for sustainable future planning and development.

Goujon (2006) emphasizes that the demographic transition is a crucial concept illustrating the evolution of population demographics from a phase characterized by high fertility and mortality rates to a stage marked by low rates for both. The complex interactions of factors such as economic development, healthcare advancements, and cultural shifts contributes to the distinct paths observed in different regions. Analyzing demographic transition allows for a comprehensive understanding of societal changes, facilitating informed policy decisions and strategic planning. As the world continues to navigate demographic shifts, ongoing research remains vital for adapting to evolving population dynamics and addressing associated challenges on a global scale.

Lee. R and Reher. D (2011) assert that this historical process is perhaps one of the biggest changes that have affected human society in the last five centuries, comparable to the dissemination of democratic governance, the industrial revolution, the growth of urbanization, and the continual elevation of global education levels among human communities. Preceding this demographic transition, the world struggled with heightened mortality and fertility rates. The initial demographic shift unfolded during the eighteenth and nineteenth centuries, marking a departure from historically high mortality and fertility rates, which were in a complex manner linked to economic circumstances. This significant change not only altered population dynamics but also had a significant impact on the political and socioeconomic environments. Comprehending the significance of this demographic shift provides scholars with important insights into the complex dynamics that have molded human history. A complicated web of interrelated causes, such as disease, poor sanitation, starvation, and inadequate healthcare, have influenced mortality rates throughout history. In pre-industrial societies, where the majority of the population engaged in agriculture, the specter of frequent crop failures and famines loomed large, contributing to elevated mortality rates. Moreover, the absence of medical knowledge and limited access to healthcare services intensified the problem, leading to distressingly high rates of infant and child mortality.

In the post-World War II era, there has been a global trend of decreasing mortality rates and increasing life expectancy, as highlighted by Rocco L, et al (2021). Exceptions to this positive trajectory include the Former Soviet Union during the challenging transition from communism and Southern Africa during the devastating HIV-AIDS epidemic. Despite these improvements in health outcomes, the nuanced relationship between enhanced health and concurrent global economic development remains theoretically uncertain. The multifaceted nature of these historical patterns underscores the need for comprehensive analysis to better understand the intricate dynamics at play in the intersection of health and socio-economic progress

During this period, fertility rates soared due to a combination of factors. The demand for agricultural labor was a significant driver, pushing families to have more children. Additionally, the prevalence of high infant and child mortality rates compelled parents to increase family size, ensuring the survival of some offspring. Traditional cultural norms and beliefs further reinforced the notion of larger families, encouraging prolific reproduction. The absence of family planning was exacerbated by limited knowledge or its complete absence, amplifying the challenge of controlling birth rates. These multifaceted influences collectively contributed to the elevated fertility rates observed during this historical era.

Many Less Developed Countries (LDCs) grapple with the complex dynamics of population growth, a phenomenon that significantly shapes their socio-economic landscape. While some LDCs, particularly in Africa and other regions, are currently witnessing a decline in population due to the devastating impact of HIV/AIDS, a broader trend of substantial population expansion persists across these nations. It is worth noting that, despite the scourge of HIV/AIDS, the 49 designated 'least developed countries' have maintained a compound growth rate of 2.5% per annum from 1975 to 2002. This stands in stark contrast to the mere 0.6% per annum growth observed in 'high income developed countries' during the same period.

The repercussions of population growth extend beyond numerical statistics, manifesting as an increase in the proportion of individuals living at or below the subsistence or 'poverty' line. This line is defined by the minimum calorie intake required for basic survival. Even in cases where the population growth rate is relatively modest, such as in China, or experiencing a decline, as seen in India, the absolute size of the population remains a significant factor, influencing resource allocation, social services, and overall development strategies in these nations.

LDCs, such as Zambia, initially experienced a baby boom, where high fertility rates were essential to offset equally high death rates. However, these nations underwent a demographic transition marked by declining mortality rates, disrupting the equilibrium and necessitating a downward adjustment in fertility. The reduction in mortality was attributed to various factors, including improved sanitation, advancements in medical knowledge and technology, enhanced nutrition and food supply, economic development, and rising living standards (Caldwell, 2001; Bongaarts, 2017). This transition aligns with demographic transition theory, indicating a shift from high birth and death rates to low birth and death rates as societies progress (Notestein, 1945). Understanding these dynamics is crucial for policymakers and public health professionals to formulate effective strategies for sustainable population growth and development in LDCs.

As nations experience demographic transformations, marked by diminishing fertility rates and enhanced life expectancy, the repercussions extend to labor dynamics, savings, and investment trends (David E., et al., 2001). Rocco L et al (2021), Lucas R (1988), Bloom DE., et al. (2019) posit that improved health can positively impact economic performance, as reduced mortality rates and longer lifespans tend to favor investments in both physical and human capital, serving as key drivers of sustained economic growth. The United Nations Population Fund (UNFPA) underscores that a country witnessing a simultaneous rise in the number of young individuals and a decline in fertility stands to benefit from a 'demographic dividend' a surge in economic productivity facilitated by an expanding workforce relative to the number of dependents (UNFPA, 2020).

This demographic dividend phenomenon is characterized by a unique window of opportunity for increased economic output and development, as a substantial working-age population potentially contributes to heightened productivity and innovation (UNFPA, 2020). Policymakers, recognizing the importance of harnessing this demographic dividend, may implement strategic measures to capitalize on the economic advantages associated with favorable demographic shifts (UNFPA, 2020.).

Analysing how demographic transition affects a country can provide important insights into the many opportunities and problems that exist at different stages of the demographic transition. This study looks at how changing demographics affect economic development. Variations in the age distribution, fertility rates, and mortality rates during demographic transition have a significant effect on labour markets and productivity, as demonstrated by Bloom et al. (2003). Additionally, it impacts healthcare systems, social welfare, and budgetary considerations.

Governments can utilize this knowledge to formulate effective policies. For instance, strategic workforce planning is essential in addressing changes in the labor force, as highlighted by Lee and Mason (2010). Social welfare programs need to adapt to evolving demographics, ensuring the well-being of diverse age groups. The healthcare sector, crucial in demographic transition, requires targeted policies for varying healthcare needs at different stages of life (Bloom et al., 2011). This comprehensive understanding aids nations in making informed decisions, fostering sustainable economic development.

1.2 Background of the Study

Demographic transition, as described by Coale (1979), is a distinctive alteration in the reproductive patterns of a population that unfolds during the metamorphosis of a society from a traditional to an advanced, highly modernized state. This phenomenon, as defined by Lee and Reher (2011), is characterized by a secular shift in both fertility and mortality, transitioning from elevated and erratic levels to lower and relatively consistent ones. The intricate process of demographic transition unfolds across multiple phases, reshaping a country's population dynamics over time. The interaction of mortality and fertility transitions introduces variations in population growth, marking a departure from the earlier scenario characterized by nearly equal birth and death rates at lower levels. This intricate transformation captures the essence of how societies evolve in response to changing social, economic, and cultural dynamics, influencing the trajectory of their demographic landscapes.

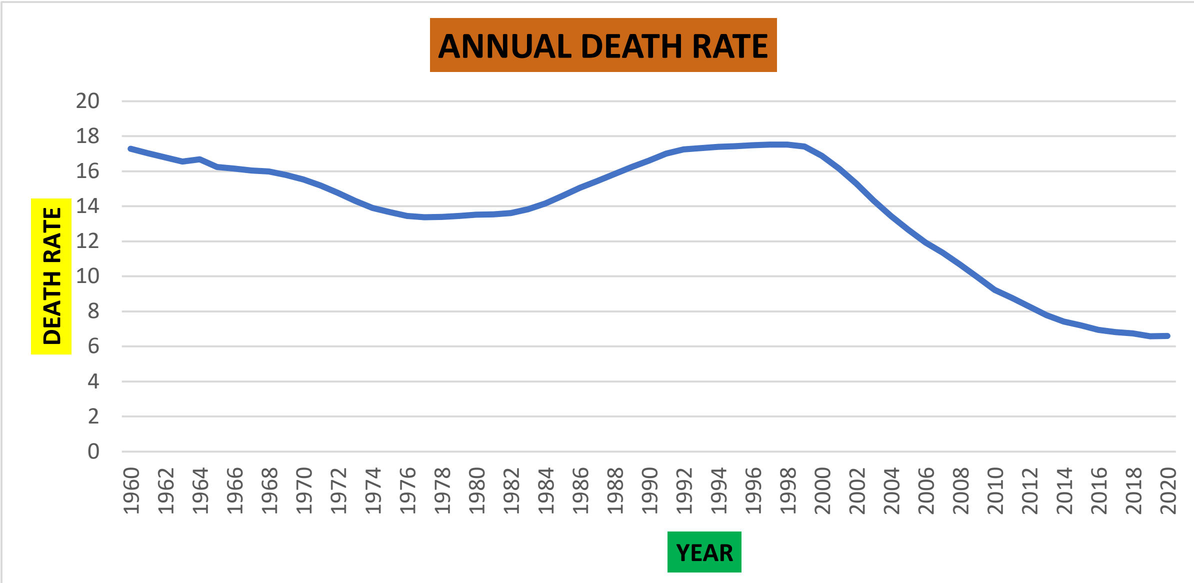
Scholars have identified four main distinct stages in the demographic transition model, each marked by specific demographic indicators shaping the population's trajectory. The first stage is typified by both high and fluctuating birth and death rates, resulting in slow population growth. In the second stage, a high birth rate persists, but the death rate initiates a decline, contributing to rapid population growth. The third stage features a declining death rate coupled with a low birth rate, leading to a deceleration in population growth. Finally the fourth stage witnesses slow population growth influenced by low birth and death rates. Some scholars have argued that a fifth stage exists which represents a state of demographic equilibrium, with birth and death rates approximately equal, resulting in zero population growth.

Presently, Zambia finds itself in the midst of the second stage of demographic transition. This phase is distinguished by a high birth rate and a declining death rate, working synergistically to drive rapid population growth. Natural increase becomes palpable as the rate of deaths falls below the rate of births, spurred by advancements in health services, technology, and evolving lifestyles. Zambia, akin to numerous other nations, has undergone substantial changes in its mortality rates, experiencing a noteworthy decline from a recorded peak of 17.5 deaths per 1000 people in 1997 to 6.6 deaths per 1000 people in 2020. This remarkable decrease can be predominantly attributed to strides in medical science and technology, which have not only enhanced healthcare infrastructure but have also contributed to a healthier populace overall. As per demographic theories, Zambia's situation aligns with the projections of demographic transition models, emphasizing the need for strategic policies to manage the associated challenges (Caldwell, 2001; Casterline, 2001).

Zambia has witnessed a noteworthy reduction in its death rate, a significant drop from a peak of 17.5 per 1000 people in 1997 to 6.6 in 2020. This positive trend can be primarily attributed to advancements in medical science and technology. The pivotal factor influencing the surge in death rates in 1997 was the devastating HIV/AIDS pandemic, significantly impacting the population. Improved healthcare infrastructure, access to antiretroviral therapy, and enhanced public health measures have played a crucial role in reversing this trend. This transformation underscores the resilience of Zambia's healthcare system in the face of substantial challenges (World Bank, 2020; UNAIDS, 1998).

As Zambia navigates through the second stage of demographic transition, it is important for policymakers, healthcare professionals, and researchers to anticipate and address the associated challenges and opportunities. The escalated population growth, while indicative of positive trends in healthcare and socio-economic conditions, necessitates strategic planning and resource allocation to ensure a sustainable and prosperous future. Navigating this demographic transition requires a sophisticated approach, drawing lessons from other nations that have successfully managed similar shifts, thereby fostering a balanced and resilient society capable of navigating the complexities inherent in evolving population dynamics. This proactive stance can facilitate the creation of policies that align with the changing demographic landscape, ensuring that Zambia not only copes with the challenges but also leverages the opportunities for sustainable development. The annual death rate of Zambia is illustrated in figure 1 below.

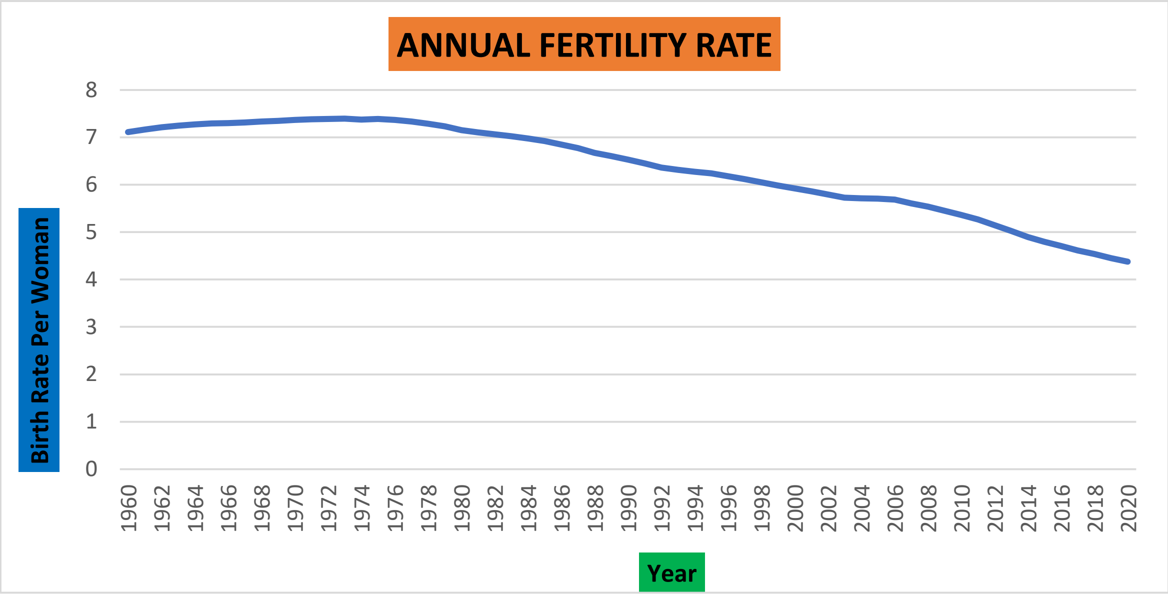
Figure 1.1: Annual death rate in Zambia



Source: The World Bank (2023)

Despite a decline, Zambia's birth rate remains relatively high. According to The World Bank (2023), the rate decreased from 7.4 births per woman in 1973 to 4.4 in 2020, as depicted in Figure 2. A comprehensive survey conducted by the Central Statistics Office (CSO) in 2007 revealed a relationship between a woman's education and wealth and her likelihood of having fewer children. Higher education and increased wealth were associated with lower fertility rates. Consequently, this phenomenon has contributed to Zambia's current population growth rate of 2.8% per annum. The Zambia Statistics Agency (2023) underscores the country's substantial natural increase, with the population expanding from 4.1 million in 1969 to 19.6 million in 2022. This data suggests that socio-economic factors play a crucial role in shaping demographic trends and population dynamics in Zambia (The World Bank, 2023; CSO, 2007; Zambia Statistics Agency, 2023). The annual fertility rate trend in Zambia is illustrated in figure 2 below:

Figure 1.2: Annual fertility rate in Zambia



Source: The World Bank (2023)

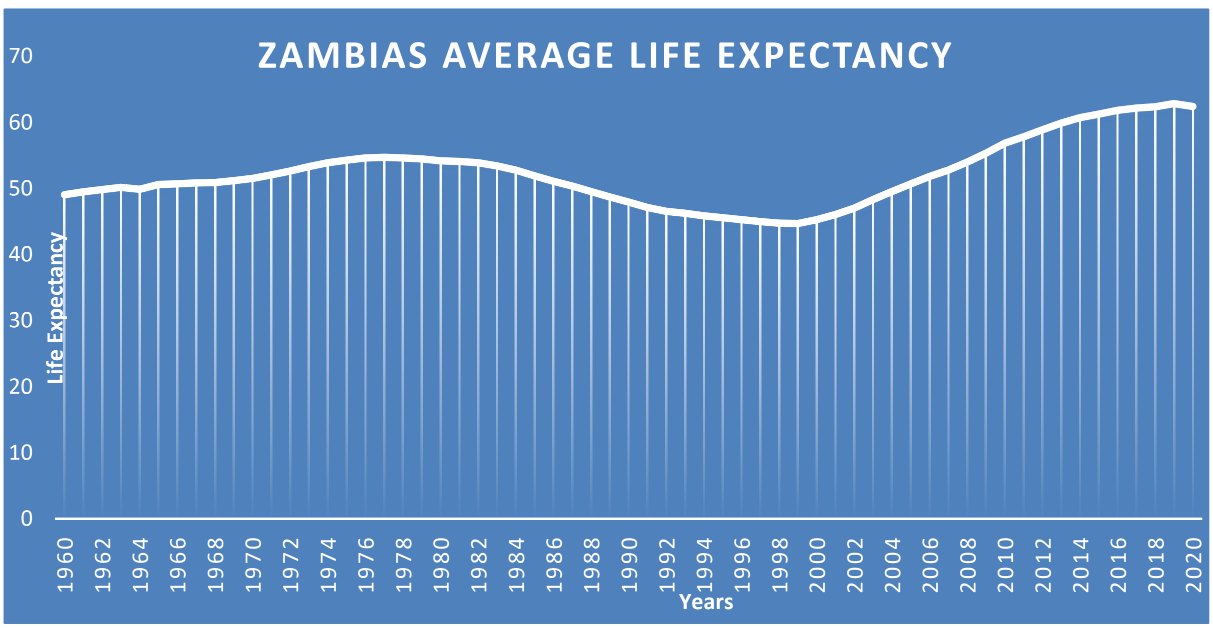
Demographic transition, as explored by Weil (2005), extends beyond population growth trends, summerizing profound economic consequences. Global demographic transitions, as discussed by Lee (2003), have not only altered the demographic life cycle but also restructured the composition of populations worldwide. The consequences of demographic transition on population size are interconnected with notable effects on age distribution, resulting in economic implications such as increased youth dependency, reduced tax revenues, and savings (Nayab, 2006). Productivity is another important factor that is impacted by demographic change. It is determined by the number and make-up of the working-age population cohort (Fyerer, 2007).

Increased life expectancy in many countries is a notable effect of the demographic change and is attributed to healthier, better lifestyles. A demographic dividend from this rise in the share of the working-age population could accelerate economic growth. However, this demographic dividend comes with concerns, specifically a demand on social expenditure due to the concomitant rise in life expectancy (Iqba et al., 2015). Iqba et al. (2015) referenced Prskawetz et al. (2007) for pointing out the detrimental effects of demographic transition on population growth rates and dependency ratios in 97 countries.

Countries like Pakistan have experienced adverse impacts on economic growth due to population growth, acting as a limiting factor to overall development (Afzal, 2009). The case of China, as highlighted by Feng (2011), demonstrates that demographic transition can trigger social costs, including population aging, abnormal sex ratios, leading to millions of life-long involuntary bachelors, tragic predeceases of children, and challenges for parents.

Zambia presents a contrasting scenario, showcasing a positive shift in life expectancy rates. From a low of 44.7 years in 1999, the life expectancy rose significantly to 62.4 years in 2020 (World Bank, 2021). This increase signifies the potential benefits of demographic transition, where improved health conditions and healthcare access contribute to an enhanced quality of life. The average life expectancy of Zambia over the years is illustrated in figure 3 below.

Figure 1.3: Average life expectancy in Zambia



Source: The World Bank (2023)

The demographic landscape of Zambia, characterized by a rapid population growth rate of 2.7% per annum and a corresponding high fertility rate, presents significant challenges and opportunities for the nation's future (The World Bank, 2023). As the large youth population in Zambia approaches reproductive age, it is anticipated that the overall population will double in the next 25 years. This demographic shift is poised to exert additional pressure on various aspects of the societal infrastructure, including job availability, healthcare services, and social welfare programs.

Moreover, the youthfulness of the population in Zambia has played a pivotal role in fostering industrialization and reaping demographic dividends. Research by Chesnais (1992) highlights the inverse relationship between industrialization and fertility. The industrial revolution tends to elevate the standard of living, giving rise to aspirations for greater influence and luxury, ultimately contributing to a reduction in the fertility rate. This demographic transition, in turn, has far-reaching economic implications for nations.

High population numbers can lead to increase per capita incomes, provided that economic growth surpasses population growth. This is particularly evident in the case of a growing Gross Domestic Product (GDP), which signifies a larger economic output that can potentially be distributed among the population. The interplay between demographic trends and economic outcomes emphasizes the need for comprehensive policy frameworks that address the challenges and harness the opportunities arising from population dynamics.

Furthermore, the rise in population has been observed to correlate with increased government expenditure as the demand for social amenities escalates. This underscores the importance of strategic governance and public policy responses to manage the consequences of population growth effectively. In summary, the complex relationship between demographic factors, industrialization, and economic outcomes necessitates a multifaceted and integrated approach to ensure sustainable development in Zambia.

1.3 Statement of the Problem

Zambia has had a rapid population growth resulting from a decline in the death rate. However, despite the rapid population growth experienced, there has been an improvement in standard of living of people. It has been observed that under normal circumstances when there is increased population growth, there is also an increase in public expenditure which negatively affects public expenses leading to lower economic growth and standard of living in developing countries. On the contrary, this has not been the case for Zambia, as standard of living has been increasing positively. It is in this regard that this research was conceived to investigate the effect of demographic transition on economic growth.

1.4 Research Objectives

1.4.1 General Objective

The research aimed to investigate the correlation between demographic transition and economic growth.

1.4.2 Specific Objectives

- To analyze the impact of the Working Age Population on economic growth.
- To evaluate the impact of population growth on economic growth.
- To investigate how total fertility rate affects economic growth.
- To examine the influence of birth rate on economic growth.
- To assess the effect of death rate on economic growth
- To explore the effect of Age Dependency ratio on economic growth

1.5 Research Hypothesis

H_0: The working-age population has no appreciable influence on economic expansion.

H_1: There is a considerable impact of the Working Age Population on economic growth.

H_0: The population's increase has no appreciable effect on economic expansion..

H_1: Population growth significantly affects economic growth.

H_0: Economic growth is unaffected by the overall fertility rate

H_1: The overall fertility rate influences the expansion of the economy

H_0: The birth rate has no appreciable effect on economic expansion.

H_1: The birth rate has a major effect on economic expansion

H_0: The death rate has no discernible impact on economic expansion.

H_1: The death rate has a major impact on economic expansion

H_0: The Age Dependency Ratio has no appreciable impact on economic growth.

H_1: The Age Dependency Ratio significantly affects economic growth.

1.6 Significance of Study

Studying the relationship between demographic transition and economic growth in Zambia holds significant importance for several reasons. Understanding how demographic changes, such as shifts in birth and death rates, affect economic growth can inform policymakers in Zambia about the most effective strategies for sustainable development. For instance, if there's a demographic dividend resulting from a decline in birth rates and a rise in the working-age population, policymakers can implement policies to harness this dividend for economic growth.

It will go into greater detail about how population growth-related increases in public spending affect economic growth. Government agencies as well as commercial and public organizations in the nation will need to consider how the country's expanding labour force will impact economic growth.

1.7 Scope of the Study

This study delves into the intricate relationship between demographic transition and economic growth, focusing on a 42-year span from 1981 to 2022. The specific timeframe was chosen due to data availability, ensuring a substantial sample size for robust and conclusive findings. The research employs aggregate data, using Zambia's annual Gross Domestic Product (GDP) as the dependent variable. Independent variables encompass the Working Age Population (WAP), Population Growth (PG), Total Fertility Rate (TFR), Birth Rate (BR), Death Rate (DR), and Age Dependency Ratio (ADR). Data from reputable sources, such as the World Bank, the Ministry of Finance, and the Zambia Statistics Agency (previously the Central Statistics Office), is essential to verify. This methodical methodology ensures that the data are current and accurate, providing a strong basis for an in-depth examination of the correlation between demographic shifts and economic growth within the given era.

1.8 Definition of Key terms and Concepts

To enhance comprehension of the study, the subsequent terms are defined within the framework of this research:

Age Dependency Ratio. The age dependency ratio is the sum of the young population (under age 15) and elderly population (age 65 and over) relative to the working-age population (ages 15 to 64) (United Nations 2022).

Birth Rate. Refers to the total number of live human births per 1000 population for a given period divided by the length of the period in years (United Nations 2022).

Death Rate. Is defined as the number of deaths every year per 1000 people in population (Collins Dictionary 2023).

Demographic Dividend. This is the economic growth potential that can result from shifts in a population’s age structure, mainly triggered when the working-age population (15 to 64) is greater than the non-working-age population (14 and younger, and 65 and older) (UNFPA 2016).

Demographic transition. Refers to a phenomenon where there is a long-term trend of declining birth and death rates, resulting in substantive change in the age distribution of a population (Rodgers et al 2013)

Economic growth. It is the increase in the worth of the goods and services within an economy compared to the previous period (The Investopedia Team 2013).

Life expectancy. Refers to the number of years on average a person can expect to live (Ortiz-Ospina 2017).

Natural Increase. The rate of natural increase refers to the difference between the number of live births and the number of deaths occurring in a year, divided by the mid-year population of that year, multiplied by a factor (usually 1,000) (ESCWA 2020)

Population Ageing. Refers to change in the age composition of a population such that there is an increase in the proportion of older persons (Land & Lamb 2018)

Population growth rate. Refers to the average annual rate of change in population size over a specific period of time for a particular nation, territory, or geographic location (World Health Organization 2024)

Population Size. Refers to the total number of people within a geographical range that is chosen arbitrarily (Tarsi & Tuff 2012)

Productivity. It measures how efficiently production inputs, such as labour and capital, are being used in an economy to produce a given level of output (OECD 2024).

Standard of Living. Is defined as the level of wealth, comfort, material goods and necessities available to a certain socio economic class or geographic area.

Total Fertility Rate. The average number of live births a hypothetical cohort of women would have at the end of their reproductive period if they were subject during their whole lives to the fertility rates of a given period and if they were not subject to mortality. It is expressed as live births per woman (UNFPA 2016).

Working Age Population. Is defined as those aged 15 to 64 (OECD 2024).

CHAPTER TWO:

LITERATURE REVIEW

Within this chapter, an exhaustive exploration of the complex literature concerning the tie between demographic transition and economic growth unfolds. A thorough examination is conducted, encompassing both empirical and theoretical dimensions of the study. The discourse delves into a comprehensive analysis of scholarly works that illuminate the dynamic interplay between demographic shifts and economic advancement.

The review entails an in-depth survey of empirical studies, drawing on concrete data and real-world observations to unveil patterns and relationships. Simultaneously, theoretical frameworks are scrutinized, offering conceptual lenses through which to interpret the multifaceted relationship between demographic transitions and economic progress.

2.1 Empirical Literature

The effects of demographic shifts on economic growth have long been a topic of discussion among economists and social scientists. Bloom et al. (2001) have deliberated on three alternative viewpoints: the notion that population growth impedes, fosters, or operates independently of economic growth.

However, the majority of recent discussions have been on the population's age distribution, which can alter significantly as the population increases. (2011) Lee and Reher, Bloom et al.

Song (2013) conducted research from an Asian viewpoint. The paper claims that since the 1960s, Asia has experienced tremendous economic growth and the "East Asian economic miracle." Even with the world's largest economies struggling with debt and banking crises, Asian emerging countries have managed to maintain their rapid growth. Asian countries are now experiencing significant demographic transitions. Using an economic development model, this article delves deeper into the effects of population movements on economic growth in thirteen Asian countries between 1965 and 2009. The results show that while increases in the proportion of the working-age population and the working-age population itself have positive effects on economic growth, increases in the population as a whole and in the younger population have the opposite effect. These findings support the theory that beneficial demographic changes in Asia are to blame for the robust economic expansion of the area.

Sibe et al. (2016) conducted a study investigating the enduring connection between economic growth and population growth. They selected a sample of thirty of the world's most populous nations, irrespective of their developmental status. The research employed panel data analysis for these 30 countries. The augmented Dickey Fuller test was applied to assess stationarity. The Error Correlation Model (ECM) was utilized to examine the long-term relationship between population growth and per capita income. The ECM results revealed a sustained equilibrium relationship between economic growth and population increase, and the Granger causality test indicated a mutual causal link between the two variables. The researchers concluded that a positive correlation exists between population expansion and economic growth. Their data provided robust evidence for a lasting association between population and growth, supporting the notion that population growth is positively linked to economic growth. In the long run, across the selected panel of nations, the causality tests' outcomes suggested a bidirectional causality, suggesting a causal relationship from population to real per capita income or vice versa.

In a study conducted in 2020, Rostiana and Rodesbi investigated the correlation between demographic transition and economic growth in Indonesia. The primary focus of the study was to evaluate the connection between age structure and economic growth. The study designated the economic growth rate as the dependent variable, while the independent factors included capital, population growth rate, young age dependence ratio, and old age dependency ratio. A multiple regression model was employed as the analytical tool. The results showed that the inclusion of an economic crisis dummy variable, capital growth, and the growth of the young age dependency ratio—all of which are indicators of demographic transition—all favorably impact economic growth. The study concluded that the demographic transition in Indonesia yields a bonus in the form of a positive contribution to economic growth.

Iqbal K et al. (2015) explored the impact of demographic transition on the economic growth of Pakistan, utilizing time series data covering the period from 1974 to 2011. The study employed the bound testing approach for co-integration, and the Autoregressive Distributed Lag (ARDL) model was utilized to analyze the long-term relationship. Additionally, the Error Correction Mechanism (ECM) was applied to examine the short-term connection between demographic variables and economic growth. The numerical simulation of the study indicated that demographic transition had a positive effect on economic growth in the long run and a negative impact in the short run. The study suggested the implementation of coherent policies to harness the demographic advantage. Ismail et al. (2015), on the other hand, looked at how ageing affected Malaysia's economic growth. For the years 1970 to 2013, the study used the ARDL technique and the dynamic growth model. The life expectancy, old dependency ratio, and fertility rate were the three proxies for ageing that were utilized. Only the fertility rate, though, was found to have long-term cointegration. The study's main conclusions showed that lower fertility rates are associated with faster economic growth. This implied that even though Malaysia was facing aging society by 2020, the economic growth was still stable and could increase by investing more on human capital.

Bekturganova et al. (2022) investigated the correlation between demographic transition elements and the demographic dividend in developing countries, using Kazakhstan as a case study. The primary factors under scrutiny were the labor force and the working-age population, identified as indirect contributors to economic growth. Through regression and correlation analyses, the study explored the relationship between these factors, considering both urban and rural contexts. The researchers employed SPSS software to test four hypotheses. In the first two hypotheses, the dependent variable was the number of women of working age in both urban and rural areas, while the independent variable was the total number of women of working age. For the third and fourth hypotheses, the dependent variable was the total labor force, and the independent variables included Fertility Rate, Urban Fertility Rate, Rural Fertility Rate, and Death Rate. We used official open-source data from the Bureau of National Statistics covering the years 2007 through 2020. Three hypotheses were partially accepted and one was rejected based on the results. It was shown that changes in the rural areas' demographic mix had little influence on the working-age population, with the exception of the death rate. Only in metropolitan regions did the birth rate have a favorable impact on the working-age population. The proportion of working-age females to the total population was small, notwithstanding their numerical dominance. The results of this study can help government agencies at different levels and in the scientific community design and improve current programmes and policies for managing demographic variables.

In 2018, ESENER and İPEK conducted research to find out how public spending affects economic growth. The study used annual panel data for 33 nations that the World Bank classified as Upper and Lower Middle-Income nations, together with empirical analysis. The sample period covers from 1999 to 2014. Both the dynamic generalized method of moments (GMM) and the static panel data methodology were used in the empirical investigations. The findings showed that variables related to public spending and population increase were shown to have a significant detrimental impact on economic growth.

A study on the effect of population expansion on economic growth in Africa was carried out by Peter and Bakari (2018). This study studied the impact of population expansion on the economic growth of African countries using panel data technique from 1980 -2015. They emphasized how contentious the relationship between population growth and economic expansion was on a national and local level. The World Development Indicators database provided the annual secondary data for fifty-three (53) African nations used in their analysis. Data on population growth, economic growth as measured by GDP, fertility rate, crude death rate, and inflation rate were gathered. Descriptive statistics, system GMM, and dynamic panel models of difference were then used to analyze the data. According to the results of the difference and system GMM, fertility has a negative effect on Africa's economic growth, although population increase has a favorable effect.

The importance of "demographic transition for economic growth" in Egypt was examined by Rizk (2018). The study examined the possible relationships between the increase of the working-age population, savings, tertiary enrollment, trade openness, and GDP per capita in Egypt from 1971 to 2015 using an extended exogenous Solow-Swan growth model inside a time series framework. A robust and enduring link was found through a multivariate cointegration study. As a result, an error correction model was created to investigate the short- and long-term behaviors of the model's variables. The study discovered that through its dynamic interplay with gross savings, the working-age population's expansion positively influenced economic growth. Furthermore, the impulse response function and variance decomposition showed that the expansion of the working-age population had a long-term feedback effect on GDP per capita.

Sebikabu et al (2020) explored the consequences of population growth on the economic development of Rwanda spanning the period from 1974 to 2013. The investigation relied on data sourced from the World Development Indicators (WDI) and regarded economic growth as a surrogate for economic development. By employing the neoclassical growth model, the study sought to comprehend the correlation between population growth and economic development. Furthermore, time series analysis was conducted using the ARDL technique. In the long term, the ARDL results exhibited a positive and statistically significant association between population growth and economic development. Conversely, in the short term, the findings suggested that population growth does not exert a noteworthy impact on economic development in Rwanda.

2.1.1 Critique of existing literature

Song (2013) study included 13 Asian countries out of 48. The study generalized the impact of demographic transition, overlooking the fact that countries experience different rates of demographic transition. This entails that the results from country to country may vary on the basis that they may be at different stages in demographic transition. This makes the study inaccurate. In comparison to studies by Ismail et al (2015) and Iqbal et al (2015) that focused on Malaysia and Pakistan Respectively. Further the study needed to have a larger sample size and number of countries to get a better picture of the relationship.

The Study by Bekturganova et al (2022) seemed inconclusive on the relationship between working age population and economic growth. This was due to the sample size used in the study which suggested that there was an insignificant change in the working age population. A larger sample size may have been able to depict a more accurate picture of the relationship between working age population and economic growth.

Rizk (2018) on the other hand conducted a similar study that considered a longer time frame. This study found that a significant change in the working age population had an effect on economic growth in the both the short and long run. It was found that an increase in the working age population had a positive impact on economic growth.

Based on the aforementioned, it is imperative for the study to have a sample size large enough to give a more elaborate picture of the relationship between the variables. Therefore, the study will use a specific timeframe of 42 years (1981-2022) that should be sufficient enough.

2.2 Theoretical Framework

2.2.1 Solow's growth model

The Solow Growth Model stands as an influential exogenous framework for comprehending economic growth dynamics, dissecting the evolution of an economy's output over time. Originating from the brilliant mind of Nobel Prize-winning economist Robert Solow's model examines the consequences of changes in the rates of population growth, savings, and technological progress. It serves as the foundational neoclassical growth model, taking inspiration from the preceding Keynesian Harrod-Domar model.

Robert Solow, a native of New York, embarked on his academic journey at Harvard College in 1940, supported by a scholarship. Following a hiatus for military service from 1942 to 1945, he resumed his studies at Harvard, specializing in economics (The Nobel Prize, 2022). The distinguished economist joined the Economics Department at the Massachusetts Institute of Technology in 1949, where he has made enduring contributions. Recognizing Solow's tremendous impact, he was honoured with the Nobel Prize in Economic Sciences for his pioneering work on economic growth theories (The Nobel Prize, 2022). His ground-breaking model, developed in the 1950s, clarified a range of factors impacting long-term national economic growth. Solow's work has been crucial in promoting government spending on technology R&D since 1960 in order to boost economic growth (The Nobel Prize, 2022).

Given its foundational role, the Solow Growth Model serves as the cornerstone for numerous contemporary economic growth models. It will thus function as the linchpin of the theoretical framework guiding this study's exploration into the intricate dynamics of economic growth. Through this lens, the study aims to unravel the multifaceted interplay of factors shaping the economic trajectories of nations.

The Solow model, a cornerstone in contemporary economic growth theory, describes the complex dynamics of an economy by integrating factors like capital accumulation, technological progress, and labor force growth. Originally not accounting for population growth, subsequent adaptations have extended the model to incorporate demographic variables, yielding a more comprehensive analysis of economic evolution. However, it is imperative to underscore the significance of explicitly stating the model's presumptions prior to deriving any predictions. This practice acknowledges the inherent reliance on oversimplified assumptions within the model, which, in turn, form the basis for conclusions about the intricate and dynamic systems governing the world's economies. Such recognition highlights the need for cautious interpretation and application of the Solow model, ensuring a subtle understanding of its predictions in the context of the multifaceted and evolving economic landscape (Solow, 1956).

Mankiw (2010) emphasizes a key insight derived from the basic Solow model, asserting that the mere accumulation of capital is insufficient for explaining sustained economic growth. While elevated savings rates may stimulate temporary growth, the model posits that economies eventually reach a steady state marked by stability in both capital and output. To account for the continuous economic growth observed globally, Mankiw advocates for an expanded Solow model that incorporates additional drivers of economic growth—specifically, population growth and technological progress. According to Mankiw, this extension is crucial for a more comprehensive understanding of the intricate forces propelling economic development over time. Acknowledging the limitations of the original Solow model, the inclusion of population growth and technological progress enhances the explanatory capacity of the framework, bringing it closer to the complexities of real-world economic phenomena (Mankiw, 2010).

Mankiw (2010) further emphasizes the role of population growth as a pivotal force shaping the dynamics of capital per worker. In his analysis, Mankiw (2010) suggests that the expansion of the workforce exerts downward pressure on capital per worker, inducing a decline. This insight underscores the influence of population growth on the steady-state level of capital per worker within the model. Mankiw (2010) asserts that elevated population growth necessitates increased capital accumulation to offset the dilution effect on capital per worker, thereby maintaining a stable level. This nuanced consideration of population growth as a determinant of capital dynamics enriches the Solow model, providing a more nuanced understanding of the interplay between demographic factors and economic growth (Mankiw, 2010).

Mankiw (2010) highlights three critical modifications to the basic Solow model induced by population growth. Firstly, this addition brings economists a step closer to unraveling the enigma of sustained economic growth. When accounting for population growth, the steady state entails the stability of capital per worker and output per worker. Nevertheless, the expanding workforce at a rate denoted as 'n' requires a simultaneous growth in both total capital and total output at the same rate 'n'. While population growth may not directly account for sustained growth in the standard of living, given the constancy of output per worker in the steady state, it does play a pivotal role in elucidating sustained growth in the aggregate output of the economy. This nuanced understanding broadens the Solow model's explanatory power by acknowledging the intricate interplay between population dynamics and overall economic growth (Mankiw, 2010).

Furthermore, Mankiw (2010) asserts that population growth provides an additional lens through which to comprehend global economic disparities. According to the Solow model, an escalation in population growth predicts lower levels of GDP per capita in countries with higher demographic expansion. This insight offers an alternative explanation for the economic divergence between nations, shedding light on why some countries are affluent while others languish in poverty. It is crucial to recognize that alterations in the population growth rate, analogous to shifts in the saving rate, instigate a level effect on income per capita but do not impact the steady-state growth rate of income per capita within the Solow model framework. This delineation underscores the nuanced role of population dynamics in influencing not only overall economic output but also the distribution of wealth across nations (Mankiw, 2010).

The third pivotal aspect highlighted by Mankiw (2010) is that population growth has implications for establishing the Golden Rule (consumption-maximizing) level of capital. In the Solow model, changes in population growth influence the criteria used to identify the optimal level of capital that maximizes consumption. This underscores the multifaceted impact of demographic factors on the key parameters governing economic growth and underscores the need to consider population dynamics when formulating policies related to capital accumulation and consumption (Mankiw, 2010).

To observe alterations in this criterion, it's important to consider the consumption per worker

$$c = y - i. \text{ ……………..equation 1}$$

Given that steady-state output is represented by $f(k^*)$, and steady-state investment is $(d + n)k^*$, we can articulate steady-state consumption as follows:

$$c^* = f(k^*) - (d + n)k^*. \text{ ……………..equation 2}$$

By employing a reasoning closely resembling the one presented earlier, we deduce that the optimal level of k^* that maximizes consumption is the point at which

$$MPK = d + n, \text{ ……………..equation 3}$$

or equivalently,

$$MPK - d = n. \text{ ……………..equation 4}$$

In the steady state of the Golden Rule, the net marginal product of capital, accounting for depreciation, is equal to the rate of population growth.

2.2.2 Demographic transition theory

It stands as one of the paramount theories illustrating the historical evolution of demographic studies. The term demographic transition is argued to have been first been used by Warren S. Thompson (1929) and later a clear cut theory was developed by Frank W Notestein (1945). Kingsley Davis (1945) and Judith Blake (1968) expanded the theory by emphasizing the role of social and economic factors in shaping demographic trends. Their work highlighted the importance of societal changes in fertility patterns.

The theory makes assumptions about the patterns of growth rate, mortality, and reproduction as countries transition from one demographic regime to another. The phrase "demographic transition" describes the slow but steady decline in fertility and death rates from high and erratic to lower and more stable. One of the biggest historical shifts to affect human society in the last 500 years is thought to have occurred during this period (Lee and Reher 2011). The relationship between population increase and economic development is examined by the demographic transition theory. Frank W Notestein (1945) postulated that as societies undergo industrialization and modernization, they experience a series of distinct stages in their population dynamics. These stages are characterized by changes in birth rates, death rates, and population growth. The theory typically identifies four stages:

Stage 1: During Stage 1 of demographic transition, pre-industrial societies exhibit distinct characteristics. High birth rates are a hallmark, attributed to factors like limited access to family planning, high infant mortality rates, and the necessity for additional labor in agriculture. Simultaneously, high death rates prevail due to epidemics, famines, inadequate healthcare, and poor sanitation. These adverse conditions contribute to a relatively stable or slowly growing population during Stage 1. The interplay of elevated birth and death rates creates a delicate equilibrium, resulting in modest population growth. Scholars often refer to this stage as the "high stationary" phase, where demographic indicators paint a picture of societal conditions marked by struggles with healthcare, limited resources, and a predominantly agrarian economy (Caldwell, 2006; Omran, 2005). Understanding these stages is crucial for policymakers and researchers, offering insights into the complex interrelationships shaping population dynamics and societal progress..

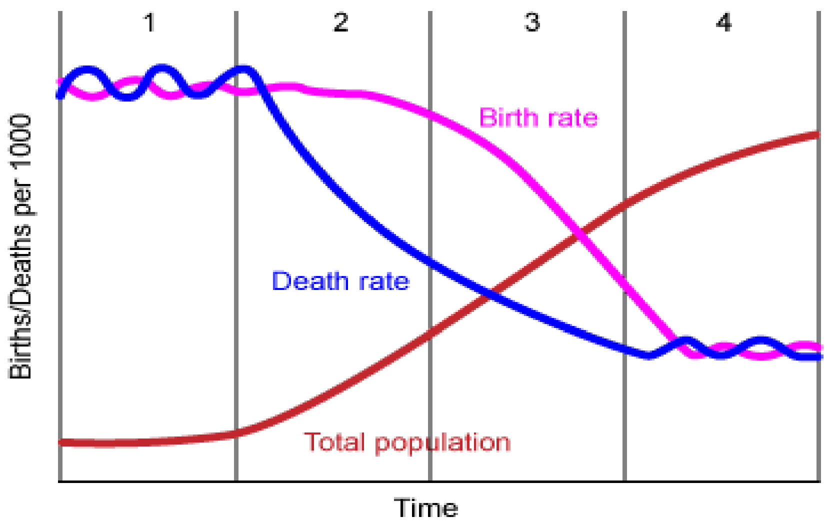
Stage 2: In Stage 2 of demographic transition, societies undergo distinctive changes. High birth rates persist, influenced by cultural, social, and economic factors, including limited access to contraception (Caldwell, 2006). Notably, a defining feature of this stage is a significant reduction in death rates. Improved healthcare, sanitation, and nutrition contribute to lower mortality, with advancements in medical technology, increased vaccine accessibility, and better hygiene practices playing crucial roles (Omran, 2005). This concurrent rise in birth rates and decline in death rates triggers a rapid population increase, often termed a "population explosion." The demographic pyramid in Stage 2 typically exhibits a broad base due to a substantial youth population. Understanding these dynamics is vital for policymakers, as Stage 2 encapsulates the epidemiological transition, representing a shift from high mortality and high fertility to a scenario marked by declining death rates and persistent high birth rates (Caldwell, 2006; Omran, 2005). This insight is invaluable for formulating strategies that address evolving healthcare needs and demographic challenges.

Stage 3: In Stage 3 of demographic transition, advancing societies witness a decline in birth rates attributed to factors like increased contraceptive accessibility, urbanization, and evolving social norms. Concurrently, death rates continue their descent or stabilize, leading to a deceleration in population growth. Davis (1955) delves into the intricate connections between urbanization, education, and demographic transition, elucidating how these variables play pivotal roles in the reduction of birth rates during this stage. Urbanization tends to reshape lifestyle choices, education fosters awareness about family planning, and shifting social norms contribute to smaller family sizes. This interplay of factors underscores the complex web influencing demographic trends and highlights the need for comprehensive policy considerations to address the changing dynamics of fertility and population growth during this phase of development. Understanding these nuances aids policymakers in crafting effective strategies to address the evolving demographic landscape (Davis, 1955).

Stage 4: In Stage 4 of demographic transition, birth rates typically reach low levels, approaching or even falling below replacement levels. This decline is often linked to increased contraceptive access, higher education, and changing societal attitudes towards family size. The low birth rates are complemented by sustained low death rates attributable to improved healthcare, sanitation, and overall living conditions. Advances in medical technology and disease prevention contribute to increased life expectancy. This equilibrium between low birth and death rates results in a stabilized or slowly growing population. This stage signifies a demographic balance, characterized by minimal population growth and a notable proportion of elderly individuals. Understanding the factors influencing this stage is crucial for policymakers navigating the challenges associated with an aging population and its implications for healthcare, pension systems, and societal structures (Caldwell, 2006; Omran, 2005).

These stages are illustrated in Figure 4 below which is a demographic transition model.

Figure 2.1: Demographic transition model



Source: Population Analysis for Policies & Programmes

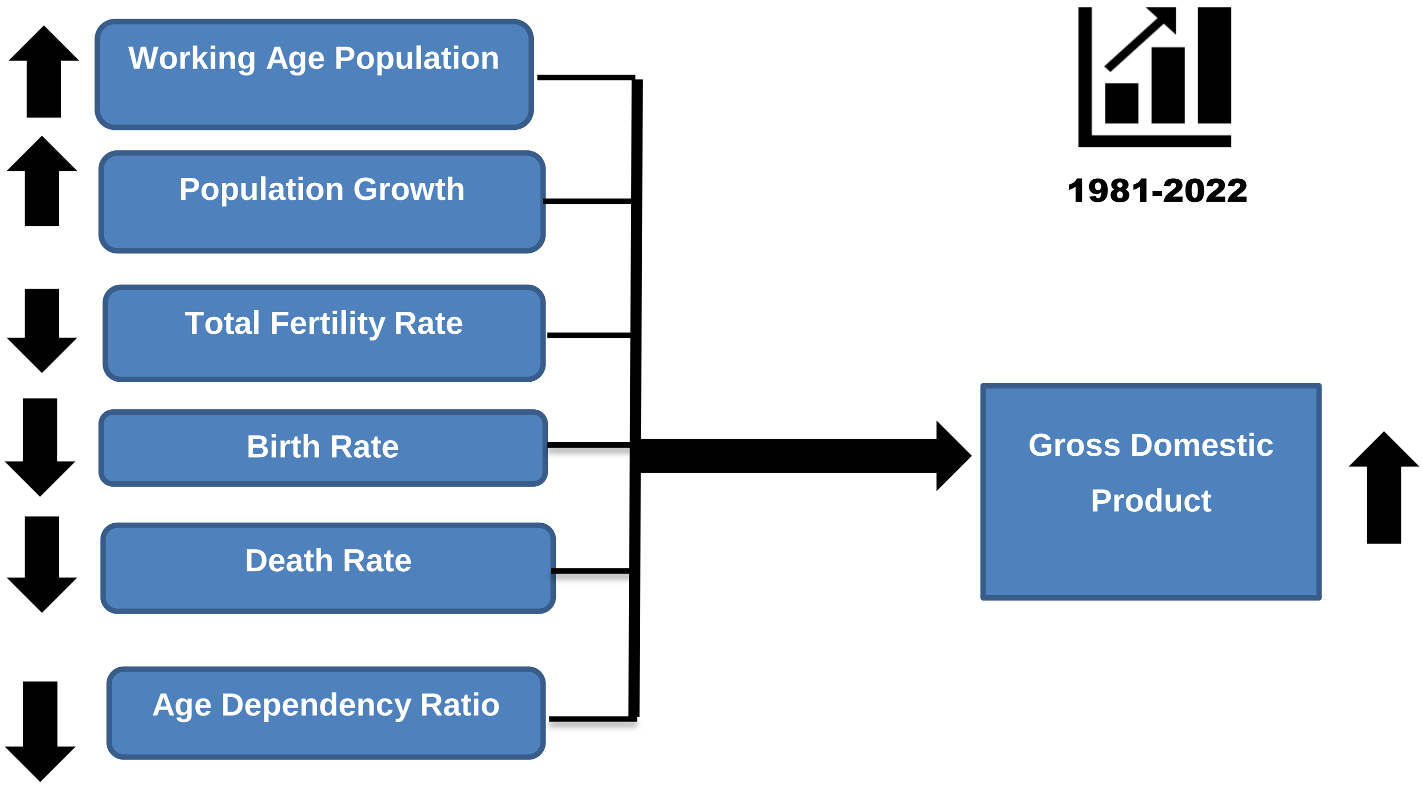
Frank W. Notestein (1945) observed that while demographic transition is a universal phenomenon, the exact sequence of stages outlined by the theory may not be universally applicable. Unique social, cultural, and economic factors can introduce variations and deviations in the demographic patterns of different countries, emphasizing the need for a nuanced understanding of regional contexts when analyzing population dynamics and transitions. This insight underscores the importance of considering diverse factors that shape demographic transitions in individual nations (Notestein, 1945).

Bloom, Canning, and Sevilla (2003) support Frank W. Notestein's observations by asserting that during the demographic transition, marked by declining birth and death rates, societies experience a "demographic dividend." This dividend emerges from shifts in population structure, notably a larger working-age population relative to dependents (children and elderly), presenting potential economic advantages. They elucidate how a move towards lower fertility rates diminishes the dependency burden, creating a window of opportunity for heightened investments in education, health, and productive sectors. This strategic allocation of resources can lead to elevated productivity, technological advancements, and comprehensive economic development. Bloom, Canning, and Sevilla's analysis reinforces the importance of recognizing unique demographic patterns, as variations in the transition process can impact the realization and magnitude of the demographic dividend, emphasizing the multifaceted interplay between demographic dynamics and economic outcomes (Bloom et al., 2003; Notestein, 1945)***.***

2.3 Conceptual Framework

A conceptual framework serves as a theoretical structure guiding research or analysis in a specific field, organizing and explaining phenomena through key concepts, variables, and relationships. In examining the relationship between demographic transition and economic growth, this study employed Gross Domestic Product (GDP) as the dependent variable. The independent variables included Working Age Population (WAP), Population Growth (PG), Total Fertility Rate (TFR), Birth Rate (BR), Death Rate (DR), and Age Dependency Ratio (ADR). This framework offers a structured approach to unravel the intricate dynamics between demographic transitions and economic growth, facilitating a comprehensive understanding of the interplay between these variables in the context of diverse social, cultural, and economic factors (Mankiw, 2010; Bloom et al., 2003). This is shown in figure 5 below.

Figure 2.2: Conceptual Framework



CHAPTER THREE:

RESEARCH METHODOLOGY

The methodology for analyzing the connection between economic growth and demographic transition is presented in this chapter. It also provides a thorough explanation of the model specification and statistical diagnostic tests that were carried out to evaluate the study's variables (Mankiw, 2010; Bloom et al., 2003). This methodical methodology strengthens the study's resilience and guarantees a comprehensive examination of the intricate relationship between demographic shifts and economic expansion within the given constraints and variables.

3.1 Research Approach

The inferential component of hypothesis testing was employed, encompassing a literature review, examination of existing studies, and exploration of relevant theories in the field. By extending upon prior research and established theories, this study aimed to assess hypotheses and draw conclusions based on data gathered from diverse sources.

3.2 Research Design

The chosen study or research approach heavily relied on the examination of existing literature to meet the research objectives. In this inquiry, a causal research design was utilized to examine the connections among variables. Particularly, the emphasis is on understanding the relationships between Gross Domestic Product (GDP) as the dependent variable, Working Age Population (WAP), Population Growth (PG), Total Fertility Rate (TFR), Birth Rate (BR), Death Rate (DR), and Age Dependency Ratio (ADR) as independent variables.

3.3 Study Population

The population encompasses the all-time series variables used in the study within Zambia. Zambia was picked because very few studies have been done to assess the relationship between demographic transition and economic growth.

3.4 Sample Size

This research investigates the correlation between demographic transition and economic growth within a specific timeframe of 42 years (1981-2022), dictated by data availability. Despite the limitation, this choice contributed to a substantial sample size, ensuring conclusive results. The extended time frame allowed for a comprehensive analysis of trends and patterns over a significant period.

3.5 Sampling Techniques

It is imperative to emphasize that the data utilized in this investigation came from secondary sources, such reports that were published, databases, or earlier research projects. Consequently, because the data was easily accessible in an annual format that had been pre-established, no particular sampling technique was used. The data that was provided on an annual basis provided a regular and organized schedule for measuring the relevant variables over the course of the research project. Additional sampling techniques were therefore not required because the data was already organized in a way that made sense for the goals of the study.

3.6 Data Collection

Both theoretical underpinnings and empirical data served as a guidance for the approach and variable selection in this study. The study mostly used secondary data that was obtained by the use of web-based data from organizations like the World Bank, Ministry of Finance, and Zambia Statistics Agency. The variables employed comprised annual data sourced from the World Bank, Ministry of Finance, and Zambia Statistics Agency. The study utilized time series data covering each year from 1981 to 2022. This time span was chosen to provide a more extensive coverage for a conclusive and comprehensive analysis.

3.7 Data Analysis

Microsoft Excel was used in the study to prepare and transform the data into a monthly time series format. E-Views was then utilized to perform the data analysis. E-Views was chosen because of its intuitive interface, which made the process of creating graphs and outputs more efficient. Regression models will also be used for data analysis.

3.8 Model Specification

The study specified an Autoregressive Distributed Lag Model (ARDL) which has been presented below;

Below is the structure of the Autoregressive Distributed Lag Model model:

$Yt = \beta 0 + \beta 1 Yt - 1 + \beta 2 Yt - 2 + \ldots + \beta p Yt - p + \gamma 1 Xt - 1 + \gamma 2 Xt - 2 + \ldots + \gamma q Xt - q + \varepsilon$ …………..equation 5

In the equation above, Yt represents the dependent variable, Xt stands for the independent variable, β0 is the intercept term, β1, β2, ..., βp denote the coefficients of the lagged dependent variable, γ1, γ2, ..., γq are the coefficients of the lagged independent variable, εt represents the error term, and p and q indicate the lag lengths. To align with the study, the following equation was calculated:

$$\mathrm{GDP}_{\boldsymbol{t}} = \boldsymbol{\alpha_0} + \sum \boldsymbol{\alpha_{1i} GDP_{t-1}} \sum \boldsymbol{\alpha_{2i}} \mathrm{PG}_{\boldsymbol{t-1}} + \sum \boldsymbol{\alpha_{3i}} \mathrm{TFR}_{\boldsymbol{t-1}} + \sum \boldsymbol{\alpha_{4i}} \mathrm{BR}_{\boldsymbol{t-1}} + \sum \boldsymbol{\alpha_{5i}} \mathrm{DR}_{\boldsymbol{t-1}} + \sum \boldsymbol{\alpha_{6i}} \mathrm{ADR}_{\boldsymbol{t-1}} + \boldsymbol{\varepsilon t}$$ ……………..equation 6

Where; GDP is economic growth rate; WAP is working Age Population; PG is Population growth; TFR is Total Fertility Rate; BR is Birth Rate; DR is Death Rate; and ADR is Age – Dependence ratio.

3.9 Statistical Diagnostic Tests

Statistical diagnostic tests are tools used in statistics to assess the performance or characteristics of statistical models, data, or hypotheses. These examinations assist researchers and analysts in making well-informed decisions regarding the validity or suitability of statistical analyses. They are frequently used in many different disciplines, including engineering, social sciences, medicine, and economics. Several statistical diagnostic tests will be carried out to guarantee the ARDL model's reliability and credibility. These examinations include:

3.9.1 Pre-diagnostic Test

3.9.1.1 Unit root test

To ascertain whether a set of time series data is stationar or non-stationar, a statistical technique known as a unit root test is employed in time series analysis. A time series is considered stable if its statistical characteristics, such as mean and variance, remain constant over time. Stationarity is a fundamental idea in time series analysis. Edward Herranz (2017) described unit roots as nonstationary autoregressive (AR) or autoregressive moving average (ARMA) time series processes which may include an intercept and/or a trend. Although these techniques are commonly utilised in economics and finance, they are also used in other scientific fields. Unit root tests address the null hypothesis of a unit root and the alternative hypothesis of a stationary (or trend stationary) time series. Critical values for unit root testing are typically derived via simulation of limiting distributions, which are characterised as functionals of Brownian motions. The unit root test can be used by researchers to select the most appropriate modelling and analytical strategies for a time series variable. To do this, tests like the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are commonly utilised.

Still, this investigation used the augmented Dickey-Fuller (ADF) test. Dickey (1979) states that this test computes the test statistic's significance and compares it to crucial values at various confidence levels in order to ascertain whether a unit root exists. The ADF test is based on the regression equation that follows:

$\Delta yt = \alpha + \beta yt - 1 + \gamma \Delta yt - 1 + \delta 1 \Delta yt - 2 + \ldots + \delta p \Delta yt - p + \varepsilon t$ .....equation 7

The first difference of the variable is represented by Δyt, the intercept term is α, the lagged level variable's coefficient is β (yt-1), the lagged first difference variable's coefficient is γ (Δyt-1), and the coefficients of subsequent lagged first difference variables are δ1,..., δp, according to Equation 7. "εt" stands for the term of error. The ADF test computes the test statistic, which is given by:

$ADF = \frac{(\beta - 1)}{SE(\beta)}$ ……………..equation 8

In this instance, SE(β) stands for the coefficient β's standard error. The statistical significance of the test is determined by comparing the test statistic with crucial values. Non-stationarity is demonstrated when the test statistic crosses the key value and the unit root null hypothesis is not rejected. However, stationarity is suggested if the test statistic is less than the crucial value and the null hypothesis is rejected..

3.9.2 F-Bounds Test

In order to ascertain whether a long-term relationship existed between variables inside a time series framework, this study also used the F Bounds test (Pesaran & Pesaran, 1997). The F Bounds test is based on the regression equation that follows:

$$yt = \beta 0 + \beta 1xt1 + \beta 2xt2 + \ldots + \beta kxtk + \varepsilon t \text{ ....equation 9}$$

The dependent variable in this equation is denoted by yt, and the independent variables are represented by xt1, xt2,..., xtk. The error term is represented by εt, while the coefficients are shown by β0, β1, β2,..., βk. The F Bounds test computes the F-statistic, expressed as:

$$F = \frac{(RSSUR - RSSR)\ /q}{RSSR\ /\ (T - k - 1)} \text{ ....equation 10}$$

k denotes the number of independent variables in the model, T denotes the number of observations, q denoted the number of restrictions imposed on the model, and RSSUR and RSSR stand for the residual sum of squares from the unrestricted and restricted models, respectively.

3.9.3 Cusum Test of stability

The Cumulative Sum (CUSUM) test assesses a statistical model's stability over time. This test sums the cumulative residuals or other relevant values to search for any shifts or structural changes in the data. A reference value is set for the CUSUM test based on predicted values or the model's intended stability.

3.9.4 Assumptions of OLS Regression:

Normality test of residuals: the residuals are examined using the normality test. Methods such as the Shapiro-Wilk test and the Jarque-Bera test will be applied.

Test for autocorrelation: This test looks into whether the residuals show any signs of autocorrelation. We'll use techniques like the Ljung-Box test and the Durbin-Watson test.

Test for heteroscedasticity: This analysis determines if the residuals exhibit heteroscedasticity. We'll use tests like White's test and the Breusch-Pagan test..

3.9.5 Ethical Considerations

In every research endeavor, it is crucial to consider the consequences of deviating from ethical guidelines. Throughout the study, careful consideration will be given to utilizing information obtained from diverse sources and agencies for its intended purpose. Any request for usage will be transparently explained in a straightforward manner. The primary focus of the study remains on enhancing comprehension regarding the correlation between demographic transitions and economic growth.

CHAPTER FOUR:

DATA ANALYSIS AND PRESENTATIONS

This Chapter offers a comprehensive exploration and insightful analysis of the gathered data, shedding light on the intricate relationships between various key demographic variables and their influence on the economic landscape of Zambia.

4.1 DESCRIPTIVE STATISTICS

The following Table offers a thorough overview of the statistical measures for different variables, illuminating their distributions, variances, and central tendencies. Gross Domestic Product (GDP), Working Age Population (WAP), Population Growth (PG), Total Fertility Rate (TFR), Birth Rate (BR), Death Rate (DR), and Age Dependency Ratio (ADR) are among the variables taken into account.

Table 4.1: Descriptive Statistics

	GDP	WAP	PG	TFR	BR	DR	ADR
Mean	3.980957	50.48078	2.980708	12.85676	43.73202	98.46802	98.46802
Median	4.506014	49.88455	3.012848	13.82800	45.22700	100.4629	100.4629
Maximum	10.29822	55.39595	3.571097	17.51100	47.84500	110.6233	110.6233
Minimum	-8.625442	47.47814	2.405463	6.571000	34.51100	80.51860	80.51860
Std. Dev.	3.708170	2.243354	0.350034	4.024923	4.276294	8.605655	8.605655

Kurtosis	4.811215	2.228007	1.929070	1.607230	2.399735	2.076815	2.076815
Jarque-Bera	14.18402	3.656644	2.047463	4.299396	5.942510	3.260375	3.260375
Probability	0.000832	0.160683	0.359252	0.116519	0.051239	0.195893	0.195893
Sum Sq. Dev.	550.0209	201.3054	4.900944	648.0002	731.4677	2962.292	2962.292
Observations	41	41	41	41	41	41	41

Source: Author's Computations (2023)

The average of each variable across the dataset was displayed by the "Mean" values. The aforementioned table showed that the data set's average GDP growth was roughly 3.98. This suggests that over the course of the study period, Zambia's GDP has grown positively on average. Conversely, the average proportion of the working age population is approximately 50.48% of the overall population. This suggests that during the study period, roughly 50% of the population engaged in economic activity on average.

The Standard Deviation " (Std. Dev) values provide insights into the dispersion or spread of data points around the mean. Higher values indicate greater variability in the dataset. For instance, the Std. Dev. for GDP is approximately 3.71, suggesting moderate variability around the mean. The "Jarque-Bera" statistic and associated "Probability" provide insights into the normality of the distribution. Lower probability values suggest departures from normality. For instance, the table above showed that all the Jarque-Bera p values were greater the 0.05 except for GDP growth. This implies that all the variables were normally distributed. The "Observations" column shows the number of data points available for each variable, which is consistent at 41 observations for all variables.

4.3 UNIT ROOT TEST (Augmented Dickey Fuller Test)

The unit root test was used to determine whether the variables were stationarity, as shown in the table below. The results of a unit root test at zero difference and a test at the first difference are shown in the table for both the level and the first difference. In statistics, stationarity is an important notion, especially in time series analysis. A time series that maintains its statistical characteristics throughout time, like its mean, variance, and autocorrelation, is said to be stationary. There are various assumptions related with stationarity:

I. Constant Mean: Over time, the time series' mean doesn't change. The average value of a stationary time series remains constant.

ii. Constant Variance: Over time, the time series' variance remains constant. This suggests that there is no change in the data points' distribution around the mean.

iii. Constant Autocorrelation: The autocorrelation function (ACF) of the time series is constant across time. The association between a time series and its own historical values is measured by autocorrelation.

iv. No Trend: Over time, there is no discernible trend or systematic pattern in the time series. A trend in data is a sustained rise or fall in the data.

v. Seasonal Patterns (if present): If there is a seasonal component to the time series, the seasonal patterns' frequency and amplitude do not change with time.

For many time series analysis models and methodologies, achieving stationarity is a necessity. A time series that deviates from the stationarity assumptions may produce erroneous conclusions and forecasts that are not trustworthy**.** The augmented dick fuller version allows for more flexibility by including additional lag terms in the model, which can be useful when dealing with more complex time series that might have higher orders of autoregressive behavior. The Table also shows t statistics and the respective p – values.

Table 4.2: Unit root test

	LEVEL		1ST DIFFERENCE		INTERGRATION ORDER
	T statistics	**P - Value**	**T statistics**	**P - Value**	
GDP	-1.354713	0.8581	-7.033994	0.0000	**I(1)**
WAP	1.268344	0.9451	-3.303227	0.0819	**I(1)**
PG	-3.100352	0.1211	-2.170417	0.0305	**I(1)**
TFR	-4.021204	0.0160	0.406063	0.9986	**I(0)**
DR	-1.786265	0.0706	-0.870694	0.3325	**I(0)**
BR	-0.185478	0.9907	-3.292006	0.0852	**I(1)**
ADR	-0.385748	0.9844	-3.511529	0.0532	**I(1)**

Source: Author's Computations (2023)

It is evident from the table above that variables such as gross domestic product (GDP), working age population (WAP), population growth (PG), Birth Rate (BR), and Age Dependence Ratio (ADR) were integrated of order one implying that they were stationary after taking the first difference. However, Death rate (DR) and total fertility rate (TFR) were found to be integrated of order zero. This insight provides the possibility of using time series models such as the Auto Regressive Distributed Lag (ARDL) Model in establishing the link between demographic transition variables and economic growth.

Auto distributed lag model

The Auto-Distributed Lag (ADL) model is a time-series econometric model that incorporates lagged values of both the dependent variable and the independent variables. This type of model is particularly useful when analyzing dynamic relationships between variables over time. The distributed lag structure allows for a gradual response of the dependent variable to changes in the independent variables. The following Table shows the output for the Auto distributed lag model. The dependent variable for the study was GDP growth rate, while the independent variables were lagged GDP growth rate (GDP), death rate DR, population growth PG, total fertility rate (TFR) and working age fertility (WAP).

Table 4.3: Auto distributed Lag model

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDP(-1)***	-0.785450	0.177125	-4.434443	0.0002
GDP(-2)***	-0.819138	0.209618	-3.907766	0.0008
GDP(-3)***	-0.683129	0.222358	-3.072206	0.0058
GDP(-4)*	-0.429164	0.206898	-2.074276	0.0505
DR***	6.427385	1.500247	4.284218	0.0003
PG	-27.53828	23.05041	-1.194698	0.2455
PG(-1)	58.35955	44.75597	1.303950	0.2064
PG(-2)	25.32504	33.37580	0.758784	0.4564
PG(-3)	-30.93920	20.24418	-1.528301	0.1414
PG(-4)**	32.86859	12.93758	2.540552	0.0190
TFR***	-31.36715	10.06707	-3.115818	0.0052
WAP*	-19.06381	10.17348	-1.873873	0.0749
WAP(-1)**	65.90254	29.66692	2.221415	0.0374
WAP(-2)**	-69.23277	31.28295	-2.213115	0.0381
WAP(-3)*	22.95510	12.09403	1.898052	0.0715
C*	-113.9818	44.33632	-2.570845	0.0178

Source: Author's Computation

The previously mentioned auto-distributed lag model reveals a notable adverse influence on the current GDP growth rate at 5% when considering the lagged GDP growth rate. The death rate exhibited a favorable and significant impact on the GDP growth rate at the 5% significance level. Conversely, the overall fertility rate was found to have a negative and significant effect at the 5% significance level. The impact of the working-age population on economic growth varied, showing a positive effect in the initial lag period and a negative effect in the subsequent one. Notably, there was no observed correlation between population growth and economic expansion.

4.4 Bounds Test

The bounds test commonly denotes a statistical method employed to examine whether there is a long-term relationship among two or more economic variables, particularly in the context of time series data. The results of the F bound test, which assesses whether there was a long-term association between the variables, are displayed in the accompanying Table.

Table 4.4: Bounds Test

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	7.013503	10%	2.26	3.35
k	5	5%	2.62	3.79
		2.5%	2.96	4.18
		1%	3.41	4.68

Source: Author's Computations (2023)

From the F bound test above it can be seen that the F statistic value of 7.0 was greater than the critical value of 4.48 at 10 percent level of significance. We therefore reject the null hypothesis of no level relationship and conclude that there exists a long run relationship among the variables. With this insight the study further estimated the long run form which was presented below.

4.5 Long run form

The following Table shows the long run equation of the ARD model

Table 4.5: Long run form

Levels Equation

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DR***	1.729242	0.247522	6.986201	0.0000
PG***	15.62485	1.237023	12.63101	0.0000
TFR***	-8.439105	1.984005	-4.253571	0.0004
WAP	0.150946	0.202569	0.745159	0.4644
C	-30.66598	9.974036	-3.074581	0.0057

EC = GDP - (1.7292*DR + 15.6248*PG -8.4391*TFR + 0.1509*WAP -30.6660)

Source: Author's Computations (2023)

This study found that age population (WAP) was insignificant at 5% level of significance in long run. On the other hand, total fertility rate (TFR), death rate (DR) and birth rate (BR) were found to be significant at 5% level of significance since their P value was less than 0.05. The study also found that all the coefficients had positive signs except for total fertility rate (TFR), this implies that all the variables had the positive impact on GDP growth except total fertility rate which had a negative effect.

4.6 Short run dynamics

The provided output below represents the results of an Error Correction Model (ECM) regression analysis, which examined the relationships between various variables and GDP growth over time.

The model considered an unrestricted constant and no trend in its analysis.

Table 4.6: Short Run Dynamics

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-113.9818	44.33632	-2.570845	0.0178
GDP(-1)**	-3.716881	0.624158	-5.955036	0.0000
DR**	6.427385	1.500247	4.284218	0.0003
PG(-1)	58.07571	11.87516	4.890521	0.0001
TFR**	-31.36715	10.06707	-3.115818	0.0052
WAP(-1)	0.561048	0.773005	0.725802	0.4760
D(GDP(-1))	1.931431	0.518190	3.727266	0.0012
D(GDP(-2))	1.112293	0.374586	2.969392	0.0073
D(GDP(-3))	0.429164	0.206898	2.074276	0.0505
D(PG)	-27.53828	23.05041	-1.194698	0.2455
D(PG(-1))	-27.25443	24.95401	-1.092186	0.2871
D(PG(-2))	-1.929396	13.49986	-0.142920	0.8877
D(PG(-3))	-32.86859	12.93758	-2.540552	0.0190
D(WAP)	-19.06381	10.17348	-1.873873	0.0749
D(WAP(-1))	46.27768	19.51614	2.371252	0.0274
D(WAP(-2))	-22.95510	12.09403	-1.898052	0.0715

Source: Author's Computations (2023)

The provided table indicates that short-term impacts include a negative effect of lag GDP growth, a positive effect of death rate (DR), a negative effect of total fertility rate, and a non-significant effect of population growth.

Table 4.7: Error Correction model

ECM Regression

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))***	1.931431	0.381943	5.056856	0.0001
D(GDP(-2))***	1.112293	0.268571	4.141524	0.0005
D(GDP(-3))**	0.429164	0.153849	2.789522	0.0110
D(PG)**	-27.53828	12.92985	-2.129822	0.0452
D(PG(-1))	-27.25443	16.38085	-1.663798	0.1110
D(PG(-2))	-1.929396	10.23339	-0.188539	0.8523
D(PG(-3))***	-32.86859	8.119074	-4.048318	0.0006
D(WAP)***	-19.06381	6.440523	-2.959979	0.0075
D(WAP(-1))***	46.27768	12.55233	3.686779	0.0014
D(WAP(-2))***	-22.95510	6.773387	-3.389013	0.0028
CointEq(-1)***	-0.907231	0.482422	-7.704625	0.0000

Source: Author's Computations (2023)

The Table above shows the error correction model which is a representation of how the model gets back to its long run equilibrium when it is in a short position in the short run. The cointergration term (CointEq(-1)) has a negative coefficient which shows that the model quickly adjust within one year when there is a disturbance in the variables.

4.7 Summary of the model

Table 4.8: Summary of the model

R-squared	0.962517	Mean dependent var	3.791941
Adjusted R-squared	0.831326	S.D. dependent var	3.842158
S.E. of regression	1.577972	Akaike info criterion	3.786249
Sum squared resid	19.91995	Schwarz criterion	5.048860
Log likelihood	-41.04560	Hannan-Quinn criter.	4.231378
F-statistic	7.336773	Durbin-Watson stat	2.397468
Prob(F-statistic)	0.003173		

Source: Author's Computations (2023)

The provided data suggests that a substantial 96.3% of the variability in the dependent variable is accounted for by the independent variables, as reflected in the elevated R-squared value of 0.96. The F-statistic, assessing the overall significance of the model, is 7.3, accompanied by a p-value of 0.003, signaling that the combined coefficients of the independent variables differ significantly from zero. In summary, the table above affirms that the model has satisfactorily passed crucial diagnostic tests, establishing its suitability for subsequent discussions and analysis with confidence.

4.8 Heteroscedasticity Test: Breusch-Pagan-Godfrey

To identify heteroscedasticity in a regression study, a statistical test known as the Breusch-Pagan-Godfrey test is administered. Heteroscedasticity is the term used to describe the situation in a regression model where the variance of the errors or residuals is not uniform across all levels of the independent variables. Put more simply, it indicates that the residuals' spread changes in response to the independent factors. The findings of a Breusch-Pagan-Godfrey test for heteroskedasticity are shown in the output that has been provided below. This test determines whether the residual variance in a regression model was heteroskedastic—varying across the independent variable levels—or homoskedastic—constant. The absence of heteroscedasticity, or equal variance, is the null hypothesis.

Table 4.9: Heteroskedasticity Test: Breusch-Pagan-Godfrey

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.938213	Prob. F(10,26)	0.5160
Obs*R-squared	9.811136	Prob. Chi-Square(10)	0.4572
Scaled explained SS	7.922570	Prob. Chi-Square(10)	0.6364

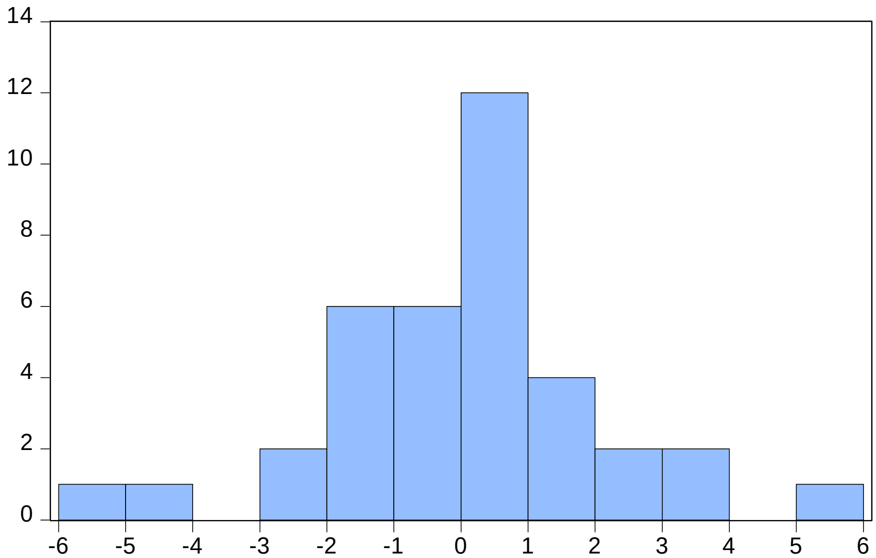
Source: Author's Computations (2023)

The F-statistic for the Breusch-Pagan-Godfrey test was calculated to be 0.5160. With a relatively low F-statistic, there is no significant evidence of heteroskedasticity in the model. The associated p-value for the F-statistic, Prob. F(28,8), was 0.5160. This p-value represents the probability of obtaining the observed F-statistic under the assumption of no heteroskedasticity. Since the p-value was quite high (greater than the typical significance level of 0.05), the null hypothesis of homoskedasticity was not rejected. Consequently, there was no significant evidence of heteroskedasticity in the model.

4.9 Normality test

The following Table shows the diagnostics for the normality results based on the Jarque-Bera test. The Jarque-Bera test assumes that the residuals of the model are normally distributed.

Figure 5.1: Normality test



Series: Residuals	
Sample 1986 2022	
Observations 37	
Mean	8.30e-14
Median	0.272087
Maximum	5.011020
Minimum	-5.885565
Std. Dev.	2.098723
Skewness	-0.400843
Kurtosis	4.270646
Jarque-Bera	3.479915
Probability	0.175528

An important characteristic sought in statistical models is the close-to-normal distribution of residuals, evident through a near-zero mean and a low Jarque-Bera test probability value. The model's residuals are expected to conform to a normal distribution based on the null hypothesis. However, the null hypothesis is not rejected, as the calculated p-value (0.175528) exceeds 0.05, signifying that the model's residuals exhibit a normal distribution—an advantageous feature for the model.

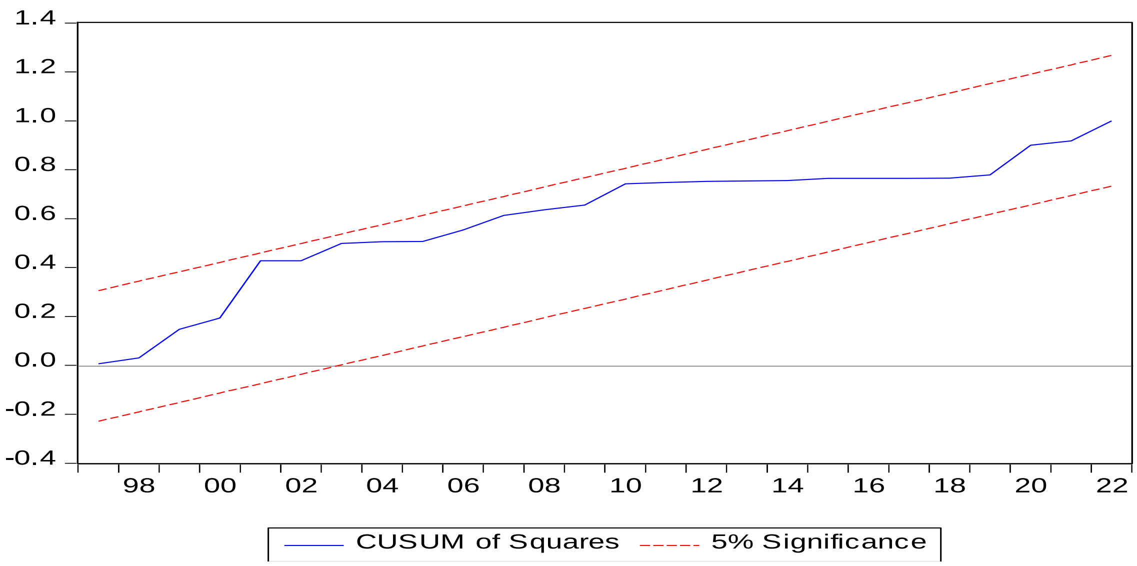
4.10 CUSUM test

The Cumulative Sum (CUSUM) test is a statistical technique used for detecting changes or shifts in the mean of a time series or sequential data. It is particularly useful for identifying when a process or system starts to deviate from its expected behavior. Since the blue line in the figure below is within the 5% level of acceptable range indicating that the model is stable. The CUSUM involves plotting the cumulative sums of deviations from a target value or a reference value. It's particularly useful in detecting small and gradual shifts in the mean of a process that might not be easily detectable using other methods like traditional control charts.

In time series analysis, CUSUM is used to monitor changes or trends in data. It involves calculating the cumulative sums of differences between observed values and expected values (which can be based on a mean or a predicted value). By plotting these cumulative sums over time, analysts can visually identify when significant deviations or shifts occur in the time series data.

4.11 Cusum of Squares

Figure 4.2: Cusum of Squares

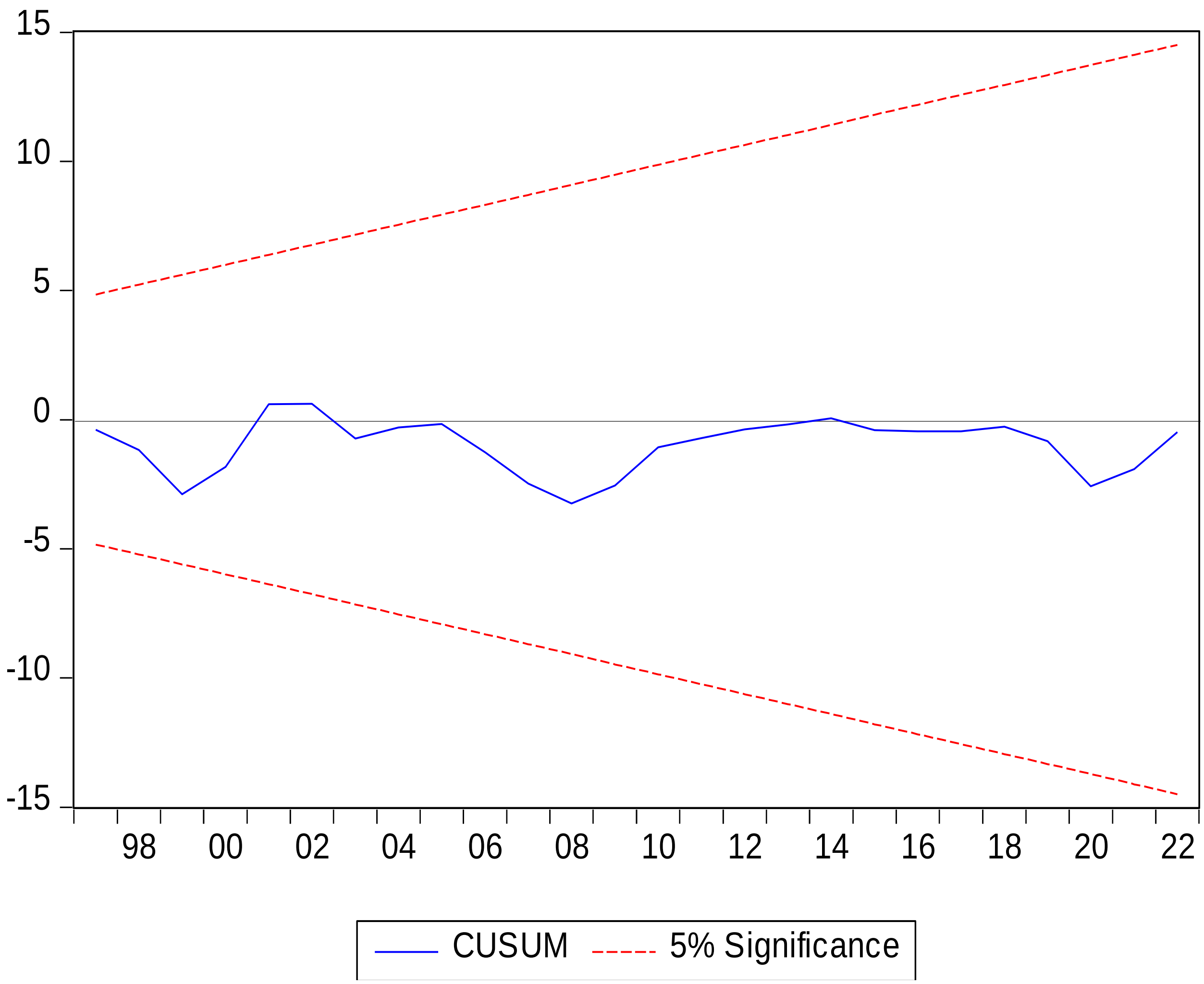


The Cumulative Sum of Squares (CUSUM of Squares) is a variation of the CUSUM test that focuses on detecting changes in the variance of a time series or sequential data rather than changes in the mean. It is a statistical method used for monitoring variability shifts in a process (Brown, 1975).

4.12 The CUSUM of Squares:

Like the standard CUSUM test, the effectiveness of CUSUM of Squares also depends on selecting an appropriate threshold and understanding the characteristics of the data being analyzed.

Figure 4.3: The CUSUM of Squares



The results of the F bound test, which assesses whether there was a long-term association between the variables, are displayed in the accompanying Table. According to Ling (2004) and Brown et al. (1975), the CUSUM test confirmed the model's parameter stability over time by showing that the cumulative sum of recursive residuals stayed within allowable bounds. The CUSUM test of Squares was also used to validate this stability criteria because the cumulative sum of squares of the recursive residuals remained within allowable ranges.

Chapter Summary: Data Analysis and Model Evaluation

This chapter presented a comprehensive data analysis and model evaluation using various statistical techniques. The chapter started by providing descriptive statistics of the main variables, including GDP, WAP, PG, TFR, and DR. The summary included mean, median, maximum, minimum, standard deviation, skewness, kurtosis, Jarque-Bera statistics, and their corresponding probabilities. This analysis offered insights into the central tendencies, variability, and distribution of the data.

The analysis comprised two models that examined the relationship between economic variables and GDP growth: the long-run ARD model and an error correction model (ECM) for short-run dynamics. The long-run equation indicated that Death Rate (DR), Population Growth (PG), and Birth Rate (TFR) significantly impacted GDP growth, with all coefficients displaying positive effects, except for Total Fertility Rate (TFR), which negatively affected GDP. Notably, Working Age Population (WAP) was found to be statistically insignificant in the long run. In the short run, lagged GDP growth negatively influenced current GDP, while Death Rate (DR) positively affected short-term GDP growth. Total Fertility Rate (TFR) negatively impacted short-term GDP, and Population Growth (PG) had an insignificant effect. The error correction model demonstrated how the model readjusted to its long-run equilibrium after short-term disruptions, with the Cointegration term displaying a negative coefficient, indicating rapid adjustment within a year when variables were disturbed. These models provided insights into the complex interactions between economic variables and their impacts on both short-term and long-term GDP growth.

Overall, the model exhibited high explanatory power (R-squared of 0.96) and passed major diagnostic tests, making it suitable for further discussions and analysis. The insights gained from this chapter could contribute to a deeper understanding of the relationships between demographic transition variables and economic growth.

CHAPTER FIVE:

DISCUSSION OF RESULTS

This Chapter provides a comprehensive discussion on the findings of the study and bases its results to various findings in the literature review. It further demonstrates how the objectives in th4is study have been met.

5.1 GDP Growth

Research on Zambia's GDP growth often delves into conventional factors such as inflation, trade, and unemployment. However, a noteworthy gap exists in the exploration of how demographic changes might influence this economic growth. Recognizing the significance of demographic variables becomes imperative in comprehending and steering economic development. A robust GDP growth not only enhances a country's overall capacity but also contributes to job creation, increased consumer spending, and the overall expansion of the economy.

Studies conducted by Jongen (2004), Oulton (2018), and Gertner (2010) shed light on the multifaceted dynamics affecting GDP growth. Past research indicates that the historical performance of GDP can be influenced by prevailing interest rates. As Jongen argues, interest rates play a pivotal role in shaping the economic landscape, impacting investment decisions and overall economic activity. Oulton's work in 2018 further emphasizes the interconnectedness between interest rates and GDP growth, highlighting the need for a nuanced understanding of these relationships.

Upon conducting a thorough data analysis, a significant revelation emerged: past GDP growth indeed wields considerable influence on current economic expansion. Specifically, the statistical analysis unveiled a substantial coefficient of 3.72 for the previous period's GDP, signifying a robust and positive impact on subsequent growth. This finding aligns with Gertner's assertion that historical economic performance serves as a reliable predictor for future growth trajectories.

In conclusion, while existing studies have traditionally focused on macroeconomic variables, the inclusion of demographic considerations provides a more holistic understanding of Zambia's GDP growth dynamics. The findings underscore the intricate interplay between historical economic performance, interest rates, and the trajectory of the country's economic development.

5.2 Working age population and GDP growth

The significance of the working-age population on economic growth has been extensively studied. Muhammad et al. (2021) underscored its profound impact, asserting that an expansion in the working-age cohort positively correlates with heightened GDP growth and reduced poverty rates in numerous countries (Muhammad et al., 2021). Contrarily, the mere abundance of individuals in the production age bracket does not guarantee economic prosperity (David & Aart, 2001). This dichotomy prompted an empirical investigation into the nuanced relationship between the working-age population and economic growth.

Studies by David et al. (2009) contribute to the discourse by supporting the notion that an augmented working-age demographic is instrumental in fostering economic development. Through rigorous empirical analysis, this research aims to provide nuanced insights into the complex dynamics governing the interplay between the working-age population and economic growth, thereby contributing to the existing body of literature on this critical subject.

. The study was guided by the following hypothesis:

Null hypothesis: there is no significant relationship between working age population and economic growth.

Alternative Hypothesis: there is a significant relationship between working age population and economic growth.

The p-values on the first lagged variables of working age population (WAP) was 0.03 which is less than 5%. This lead to failing to reject the null hypothesis and concluded that the past working age population had a significant positive effect on the economic growth in the short run. The study however did not find any significant effect in the long run since the coefficients in the long run had p-values (0.4644) greater than 5%. This aligns with several studies that have a found a positive effect of the working age population in the short run (Narayana, 2015), (Suresh, et al., 2019) and (Muhammad, et al., 2021).

5.3 Population growth and economic growth

The relationship between population growth and economic growth has been a widely studied topic in economics and demography. This is accompanied by several theories such as the Solow growth model which postulates that capital accumulation, population growth, and technological progress contribute to economic growth over time. While the Malthusian theory which associated the population growth with food supply suggesting that the unbalanced population and economic growth would result into devastating economic outcome. It is for this reason that economic growth is considered as one of the complex subject that has ever been debated. This study investigated the relationship between economic growth and population growth. The study tested the following hypothesis:

Null hypothesis: there is no significant relationship between population growth and economic growth.

Alternative hypothesis: there a significant relationship between population growth and economic growth.

The p-value for the coefficient of lagged population growth (PG(-1)) was less than 0.05 (0.0001), demonstrating that there is a significant correlation between population growth and economic growth in both the short and long terms, meaning that the null hypothesis was not rejected. These findings contradict the conclusions drawn by several empirical studies, including those conducted by Murphy (1999), Hoover (2015), and Peterson (2017), which identified a significant correlation between GDP growth and population growth. These disparities may stem from issues related to the quality of human capital. When population growth occurs without concurrent improvements in human capital quality, achieving economic growth becomes challenging. Another influential factor is the level of investment in infrastructure and technology; insufficient investment in these areas can hinder economic growth, even with a growing population. Additionally, a lack of job opportunities for the expanding population poses a challenge to achieving economic growth. Finally, environmental constraints such as limited natural resources or pollution can impede economic growth, even in the presence of population growth (Ashraf, Weil, and Wilde, 2013)

5.4 Total fertility rate and economic growth

The research delved into the extensively examined association between total fertility rate (TFR) and economic growth, a subject explored by scholars like Canning and Schultz in 2012. Numerous empirical studies, including the work by Cheng et al. in 2022, consistently report a negative correlation between TFR and economic growth. This suggests that as TFR decreases, economic growth tends to increase. Such findings align with the demographic transition theory, indicating that as societies progress, fertility rates decline, contributing to economic development. These studies contribute valuable insights into the complex interplay between demographic factors and economic dynamics, offering a nuanced perspective on population-related influences on growth (Canning & Schultz, 2012; Cheng et al., 2022)This also endeavored to study the relationship between total fertility rate and economic growth and was guided by the following hypothesis:

Null hypothesis: there is a no significant effect between total fertility rate and economic growth.

Alternative hypothesis: there is a no significant effect between total fertility rate and economic growth.

The p – value on the first lag of total fertility rate was (0.0052) less than 5%, which lead to the rejection of the null hypothesis and concluded that a negative relationship exists between total fertility rate and economic growth in the short run. In the long run, the p-values was also less than 5% indicating that there existed negative and significant relationship between total fertility rate and economic growth. These results are thus consistent with the majority of studies. This negative relationship can be attributed to the fact that fertility rate can be affected by various factors such as education and income among other factors. As woman become more educated and independent due increased economic growth, they are less likely to have a lot of children, as a resulting into lower levels of fertility.

5.5 Death rate and economic growth

The intricate relationship between death rates and economic growth has been a subject of extensive research, with scholars attempting to unravel its complexities. Numerous empirical studies conducted by various authors have yielded diverse findings, demonstrating the nuanced nature of this association across different countries. Some research suggests that during periods of economic growth, there is an observable increase in the death rate, particularly among middle-aged and older adults (Michelle, 2013). Conversely, alternative studies assert that mortality rates tend to decline when there is an augmentation in income levels and improved access to medical care (NBER, 2002). In contrast, recent research conducted by Guillaume (2022) found no significant correlation between death rates and economic growth. These disparate findings underscore the multifaceted nature of the interplay between economic factors and mortality rates, necessitating a nuanced understanding to inform comprehensive policy measures and interventions. This study, however investigated the relationship between death rate and economic growth in Zambia with the guidance of the following hypothesis:

- **Null Hypothesis**: there is no significant relationship between death rates and economic growth
- **Alternative Hypothesis**: there is a significant relationship between death rates and economic growth

The study observed the p-value on the coefficient of the less than 5% indicating a significant instant negative relation between death rate and economic growth. This could be due to that fact that increase in the death rate reduces economically active population and the number of people demanding goods and services. This reduction of human resource reduces economic growth (Jadhav, 2021).

Chapter summary

This chapter delves into a thorough exploration of research findings that meticulously scrutinize the influence of working-age population, population growth, total fertility rate, and death rate on economic growth. The analysis reveals a noteworthy relationship, indicating that a higher proportion of the working-age population positively impacts short-term economic growth. This aligns with existing literature, such as the work of Bloom, et.al (2003), who argue that an abundant working-age population contributes to increased productivity and economic output.

Contrastingly, the study identifies no significant relationship between population growth and economic growth, challenging conventional assumptions. This result supports the claims made by Pritchett (1997), who contends that a number of contextual variables influence how population expansion affects economic development. The total fertility rate emerges as a crucial factor, demonstrating a negative connection with economic growth. Scholars like Becker and Lewis (1973) propose that this correlation is driven by factors such as education and income levels, which influence fertility decisions and subsequently impact economic dynamics.

Furthermore, the study uncovers a significant negative relationship between death rate and economic growth. Increased mortality rates are found to adversely affect economic participation, echoing the insights of Bloom et al. (2001), who highlight the economic consequences of health-related challenges.

In conclusion, this chapter unravels the intricate interplay of these demographic variables and elucidates their multifaceted implications for Zambia's economic landscape. The insights gained from this research contribute valuable perspectives for policymakers and scholars alike in understanding and navigating the complexities of economic development in the region.

CHAPTER SIX:

CONCLUSION AND RECOMMENDATION

This will offer a thorough analysis of the study's findings and make connections to other findings in the literature. It provides more evidence of the accomplishment of the study's goals.

6.1 Conclusion

The main objective of the study was to examine the correlation between demographic transition factors and economic growth. Utilizing a quantitative research approach, the study analyzed time series data spanning from 1981 to 2022, encompassing a sample size of 41. To assess the presence of a unit root, the Augmented Dickey-Fuller Test (ADF) was employed. The results indicated that the variables under scrutiny were integrated of order zero or one. To delve deeper into the relationship, an AutoRegressive Distributed Lag (ARDL) model was applied. This comprehensive analysis not only unveiled the interconnectedness between demographic transition factors and economic growth but also shed light on the dynamic nature of these variables over time, providing valuable insights for policymakers and researchers alike. The study's meticulous methodology and robust findings contribute significantly to our understanding of the complex interplay between demographic shifts and economic development. The following were the results;

6.1.1 GDP Growth:

This chapter underscores the pivotal role of GDP growth as a barometer of prosperity and living standards. While existing research has extensively delved into non-demographic determinants impacting economic growth, this study sheds light on the critical gap in exploring demographic transition variables. Notably, the study discerns that the preceding GDP growth exerts a substantial influence on the present GDP growth, emphasizing the interconnectedness of economic trajectories across time periods. This exploration contributes to a nuanced understanding of the multifaceted dynamics shaping economic prosperity, adding depth to the discourse on the intricate relationship between demographic transitions and economic growth.

6.1.2 Working Age Population and GDP Growth:

This research delves into the intricate nexus between the working-age population and economic growth. Drawing on prior literature, it underscores the consensus that an expansion in the working-age demographic typically correlates with elevated GDP growth and diminished poverty rates. The study empirically examines this hypothesis, employing rigorous testing methodologies. Notably, the results illuminate a noteworthy positive impact of previous working-age population dynamics on short-term economic growth. This finding reinforces the notion that demographic shifts, particularly in the working-age cohort, play a crucial role in shaping economic trajectories, thereby contributing valuable insights to the ongoing discourse on the relationship between population dynamics and economic prosperity.

6.1.3 Population Growth and Economic Growth:

In investigating the complex relationship between economic growth and population increase, a number of economic models were investigated, including the Malthusian hypothesis and the Solow growth model. The research sought to empirically validate the existence of a consequential link between these pivotal variables. Despite rigorous analysis, the findings unveiled a surprising revelation - no discernible correlation between population growth and economic advancement emerged, persisting both in the short-term and long-term scenarios. This unexpected outcome challenges conventional assumptions and prompts a reevaluation of the intricate dynamics shaping economic trajectories in the face of demographic shifts.

6.1.4 Total Fertility Rate and Economic Growth:

Examining the intricate interplay of total fertility rate and economic growth, this study builds upon prior research indicating a potentially adverse relationship. Rigorous hypothesis testing confirms a consistent negative relationship between total fertility rate and economic growth, persisting over both short and long durations. This inverse association is elucidated by influential factors such as education and income, which demonstrably impact fertility rates. The findings underscore the importance of understanding socio-economic determinants in shaping demographic trends, offering valuable insights for policymakers and planners striving to navigate the complex dynamics between population growth and economic development

6.1.5 Death Rate and Economic Growth:

Investigating the relationship between death rate and economic growth, this study focuses on Zambia, aiming to contribute to the existing research. Previous findings have been inconsistent, prompting a deeper exploration. Through hypothesis testing, a noteworthy negative association between death rate and economic growth emerged. The logic behind this lies in the notion that a higher death rate diminishes the workforce, consequently impacting overall economic productivity. This discovery underscores the importance of addressing healthcare and mortality issues to sustain and enhance economic development in Zambia. Implementing policies that curb the death rate could potentially yield positive economic outcomes by fostering a more robust and productive society.

6.2 Recommendations

Based on the findings presented in the discussion, several recommendations can be made to foster sustainable economic growth in Zambia:

6.2.1 Human Capital Development:

Given the pivotal role of the working-age population in immediate economic advancement, it becomes imperative to channel resources into education and skill enhancement. The focal point should revolve around elevating the caliber of human capital, fostering an environment where the expanding populace can meaningfully engage in economic endeavors. Strategic investments in education not only empower individuals but also cultivate a workforce equipped with diverse skills, amplifying overall productivity. Prioritizing these initiatives establishes a foundation for sustained economic growth, underscoring the significance of a well-educated and skilled populace in navigating the complexities of today's dynamic global landscape.

6.2.2 Diversified Economic Strategies:

While research indicates a lack of substantial relationship between population growth and economic expansion, the emphasis on economic diversification remains paramount. Cultivating sectors beyond those influenced solely by population dynamics holds the key to fostering a more robust and sustainable economic trajectory. This strategic shift allows nations to mitigate the risks associated with relying solely on population-driven activities, fostering stability and resilience in the face of economic challenges. Prioritizing diversification not only bolsters economic growth but also ensures a well-rounded and adaptive economy capable of weathering fluctuations, ultimately contributing to long-term prosperity and resilience on a global scale.

6.2.3 Family Planning and Health Services:

Addressing the inverse relationship between total fertility rate and economic growth, implementing strategic measures such as advocating for family planning, enhancing women's education, and ensuring widespread healthcare access becomes crucial. These policies not only empower individuals to make informed choices about their family size but also foster a healthier society. By reducing fertility rates, these initiatives pave the way for long-term economic enhancement, creating a positive cycle of improved living standards, workforce productivity, and resource allocation. As societies prioritize education and healthcare alongside family planning, the potential for sustained economic development and overall well-being is significantly heightened.

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Appendix

Year	ADR	GDP	PG	TFR	DR	WAP
1982	110.6233	-2.81278	3.225708	7.103	13.533	110.6233
1983	109.8233	-1.96669	3.234878	7.063	13.614	109.8233
1984	109.2125	-0.33683	3.083425	7.022	13.828	109.2125
1985	108.6157	1.61531	3.011753	6.977	14.157	108.6157
1986	107.9109	0.723894	3.012848	6.921	14.602	107.9109
1987	107.2332	2.675662	2.920496	6.851	15.053	107.2332
1988	106.6774	6.280749	2.768026	6.773	15.438	106.6774
1989	106.2198	-1.0235	2.664236	6.675	15.836	106.2198
1990	105.8017	-0.48107	2.571365	6.605	16.239	105.8017
1991	105.4109	-0.03613	2.493438	6.533	16.597	105.4109
1992	105.1093	-1.73092	2.430372	6.447	17.001	105.1093
1993	104.8851	6.797274	2.405463	6.364	17.243	104.8851
1994	104.7302	-8.62544	2.428276	6.318	17.315	104.7302
1995	104.6706	2.897669	2.446966	6.274	17.392	104.6706
1996	104.5806	6.218546	2.478031	6.241	17.434	104.5806
1997	104.2507	3.814007	2.56332	6.183	17.483	104.2507
1998	103.8257	-0.38575	2.586109	6.117	17.511	103.8257
1999	103.3416	4.65019	2.620055	6.049	17.509	103.3416
2000	102.619	3.897323	2.766606	5.987	17.4	102.619
2001	101.5295	5.316868	2.996056	5.926	16.876	101.5295

2002	100.4629	4.506014	3.056528	5.862	16.145	100.4629
2003	99.53814	6.944974	3.089114	5.792	15.292	99.53814
2004	98.68915	7.032395	3.178936	5.726	14.32	98.68915
2005	97.88559	7.235599	3.31267	5.715	13.45	97.88559
2006	97.05934	7.903694	3.456237	5.71	12.659	97.05934
2007	96.19743	8.352436	3.532921	5.686	11.933	96.19743
2008	95.28449	7.773896	3.571097	5.609	11.351	95.28449
2009	94.37786	9.220348	3.554843	5.537	10.67	94.37786
2010	93.53341	10.29822	3.497191	5.452	9.961	93.53341
2011	92.82765	5.564602	3.37711	5.363	9.219	92.82765
2012	92.13161	7.597593	3.30148	5.271	8.763	92.13161
2013	91.31781	5.057232	3.271299	5.146	8.267	91.31781
2014	90.35598	4.697992	3.247118	5.026	7.788	90.35598
2015	89.29931	2.920375	3.191896	4.899	7.408	89.29931
2016	88.19843	3.776679	3.147407	4.793	7.196	88.19843
2017	87.05102	3.504336	3.113595	4.707	6.941	87.05102
2018	85.83898	4.034494	3.061888	4.614	6.809	85.83898
2019	84.54316	1.441306	3.007618	4.536	6.748	84.54316
2020	83.18452	-2.78506	2.933818	4.451	6.571	83.18452
2021	81.82246	4.598734	2.840806	4.379	6.602	81.82246
2022	80.5186	4.744942	2.758032	4.308	6.973	80.5186

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