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Statistical Analysis of Effect of Population on Economic Growth in Uganda (2000-2020)

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Abstract

This study was aimed at examining the effect of population on economic growth in Uganda from 2000 to 2020. Specifically, the objectives were to; examine the Effect of age dependency ratio on economic growth in Uganda, to establish the effect of total fertility rate on economic growth in Uganda, and to assess the effect of enrollment in primary schools on economic growth in Uganda. A longitudinal study design was used to study the effect of population increase in Uganda from years 2000 to 2020 and relevant data were sourced World Bank Development Indicators database. Augmented Dickey Fuller test was applied for test of stationarity. Similarly, the test for classical linear regression model (CLRM), autocorrelation and heteroscedasticity assumptions was done. Multiple linear regression model was employed to model the effect of the increase in population on economic growth in Uganda. The study found a statistically significant negative effect of age dependency ratio on economic growth ($\beta = -1.201591$, P-value = $(0.029) < 0.05$). The model findings revealed that total fertility rate had a statistically significant negative effect on economic growth in Uganda ($\beta = -6.465372$, P-value = $(0.046) < 0.05$). The findings revealed that primary school enrolment did not have a significant effect on economic growth in Uganda. Conclusively, growth in age dependency ratio and increase in total fertility rate significantly reduces the economic growth in Uganda.

Keywords

Economic, Growth, Population, Statistics, Uganda

1. Introduction

Population increase is defined as the change in population size either positively

or negatively over time basing on the number of births and deaths. In case the deaths are more, the growth in population will be slow and vice versa. Both the absolute and relative terms are used to measure population where the former looks at the difference in figures over time while the latter focuses on the rate or percentage (Daultrey et al., 2018). On the other hand, economic growth refers to increase in the economy to ably support production of goods and services over a given period of time. Its measurement can be real or nominal. The real is adjustable for inflation. In the traditional setting, cumulative economic growth is measured in the form of Gross National Product or Gross Domestic Product though at times there are metrics alternatively applied (Romer, 2021). In light of the current study, it is the GDP that was used to measure economic growth. Certainly, the persistent increase in population globally has affected many areas including the Age structure, International migrations, economic inequalities and the magnitude of a country's work force. These also, have hindered overall economic growth particularly in developing countries (Peterson, 2017). For majority of countries the world over that are densely populated like Bangladesh with a population of over 3310 people per square mile, three times more than India and 36 times more than the United States have had several hindrances due to the rapidly growing population hence straining the economic growth (Chowdhury & Hossain, 2018). However, the International Monetary Fund and World Bank are pressurizing developing nations to regulate growth of birth rates in order to enhance sustainable economic growth (Sibe et al., 2016).

In Africa, this is where population fast grows naturally and world over at 2.5% rate. In Asia, the population grows at 1.1% and in Europe at 0.4%, while in Caribbean and Latin America at 1.2%. Consequently, this has had adverse effects on economic growth (Amade & Ibrahim, 2018). Given the low standard of living throughout the Sub-Saharan region, in terms of health, education, housing, and other factors, rapid population growth has raised questions about the region's economic growth prospects (Amade & Ibrahim, 2018). In Tanzania, population has been rising steadily, however the same could not be asserted on economic growth, as the economy maintains a cyclical growth. It is therefore difficult to pronounce that economic growth prospects in Tanzania are a result of its growing population (Robert, 2020).

The population of Uganda was estimated to have an increased rate of 3.0% to the tune of 42 million in 2021, additionally expected to be 71.4 million by the year 2040 (Roberts & Anyumba, 2022). The escalating fertility rate was recognized by Uganda vision 2014 at 5.4 children for each woman and consequently, a high growth rate of 3.0% annually with an age structure that is not favorable. For instance, nearly half way of 47.9% of the Ugandan population is 15 years below which rises the dependency burden and consequently affects the economic growth (Roberts & Anyumba, 2022). Hence, it is against such background that this study examined the effect of population increase on Economic growth in Uganda, covering a period from 2000 to 2020 (Roberts & Anyumba, 2022).

In order for a country to position itself on the course of economic growth that is sustainable, its population growth rate must be in tandem with development or else without serious attention, the growth rate can frustrate efforts geared towards development. The increasing population of Uganda estimated at 42 m in 2021 has caused a lot of dynamics in achieving sustainable economic growth and human capital development in Uganda. In the current times, the vital services including education, housing and health care in Uganda are being outstripped by population growth. A burgeoning population of unclear employability especially among the youth, high fertility rate, and high dependency among others are the key factors affecting the Gross Domestic Product (GDP) in Uganda (Roberts & Anyumba, 2022).

The Uganda Bureau of Statistics (UBOS) released real GDP estimates to have grown by 3.9% from 2016 to 2017, approximately 0.6 points hence lesser than the revised estimation of 4.5% and 0.8 points lesser than the yields for FY 2015/2016 at 4.7% (Ssempala et al., 2020). However, the previous studies conducted in Uganda have been putting focus on studying population size as an indicator of population growth and leaving out indicators like total fertility rate, dependency ratio, and enrollment in schools as determinants of the economic growth in Uganda. Thus, need for this study in Uganda. This study intends to examine the effect of population on Economic growth in Uganda since the year 2000 to 2020.

The following are the objectives of the study. They include:

1) To examine the effect of age dependency ratio on economic growth in Uganda.

2) To establish the effect of total fertility rate on economic growth in Uganda.

3) To assess the effect of primary school enrolment on economic growth in Uganda.

The paper is organized based on the following structure: an abstract which provides a summary of the paper, then an introduction, which provides background to the study, a literature review section, which provides reviews from other scholars on the population and economic growth, then materials and methods section, which provides the research design, method of data collection, as well as the testing procedures. Then result and analysis, discussion, conclusion and recommendations are based on the stated objectives.

2. Literature Review

2.1. Introduction

The chapter covers the theory on Population growth and Economic growth, related literature to the study objectives, and empirical literature.

2.2. Theoretical Review

The Malthusian theory of population growth developed by Thomas Robert Malthus in 1798 guided the study. The theory states that population growth

lowers the per capita production since demand growth cannot keep pace with population growth. Consequently, Malthus argued that in absence of regular checks on population growth, in a short period of time, thus the increasing number of individuals will require sharing the scarce resources among each of them (Robert, 2020).

The theory contends that population increases at a faster rate than their food supply. While population is growing at a geometrical rate, production capacity or food is only increasing arithmetically (Robert, 2020). The available food influences the size of the population, for instance if food is less, the population is likely to reduce. The greater the food production, the greater the size of the population and the more burden would be imposed on the little resources available thus reduced economic growth (Seth, 2019).

The theory contends that increase in population reduces the standard of living of the people hence reduced economic development and growth. The theory explains that if more children are born, they may not be able to access proper education which may lower their standard of living thus reducing growth and development. However, theory suggested preventive checks and positive checks like diseases, wars and famines would help in curtailing the growth in population thus increasing development (Seth, 2019).

However, the Malthusian theory is critiqued by Marxist theory which contended that exponential growth in population encourages Economies of scale and also promotes advanced technology that may promote growth inevitably (Maganga & Omwenga, 2018).

The Malthusian theory was relevant to the current study since it is believed that persistent growth in population may lower economic growth in terms of imposing a lot of burden on the available limited resources. For instance, increased fertility rate and dependency ratio may negatively affect the level of economic growth in Uganda.

2.3. Conceptual Review

This section reviews the concepts of population increase and economic growth as perceived by different scholars.

2.3.1. Population Increase

Population increase is defined as the change in population size either positively or negatively over time based on the number of births and deaths. In case the deaths are more, the growth in population will be slow and vice versa. Both the absolute and relative terms are used to measure population where the former looks at the difference in figures over time while the latter focuses on the rate or percentage (Daultrey et al., 2018).

Daultrey et al. also define population increase as an additional population growth in a given year. Many countries in Sub-Saharan Africa, South East Asia, South Asia, and the Middle East have experienced a huge increase in population. This, subsequently puts pressure on natural resources, food supplies, fuel sup-

plies, employment, consumption patterns and housing among others (Daultrey et al., 2018). In the current study, population increase was measured in terms of increase in total fertility rate, increase in age dependency ratio, and growth in enrollment in primary schools in Uganda.

2.3.2. Economic Growth

This refers to arise in the economy to ably support production of goods and services over a given period of time. Its measurement can be real or nominal. The real is adjustable for inflation. In the traditional setting, cumulative economic growth is measured in form of Gross National Product or Gross National Product though at times there are metrics alternatively applied (Romer, 2021). In light with the current study, it is the GDP that was used to measure economic growth.

2.4. Empirical Literature

This section presents the empirical literature in line with the specific objectives of the study. It provides an evaluation of each literature to identify the gaps and provides a way forward for an improvement based on the current study.

2.4.1. The Effect of Increase in Age Dependency Ratio on Economic Growth

(Mohd et al., 2021) used time series data from 1981 to 2019 to study the impact of population that was ageing over the economic growth for short and long run estimates in Malaysia. For the short run estimation, the vector error correction approach was adopted while the Autoregressive Distributed Lag (ARDL) method and Bound test approach worked for the long run estimation. For purposes of validating and ensuring appropriateness of model specifications, various economic diagnostic tests were used. Consequently, the estimated results from the study indicated that the ageing population variable, proxy due to the ageing revealed a significantly negative impact on economic growth in Malaysia (Mohd et al., 2021).

However, the above study by (Mohd et al., 2021) focused on the short run and long run impact of the ageing population on economic growth and this required using ARDL model together with Bound Test Approach. The latter was used for the long run estimations whereas the Vector Correction Model worked for the short run estimation. The current study employed Ordinary Least Square (OLS) estimation method for purposes of examining the Effect of Age dependency ratio on the economic growth in Uganda. In addition, the current study did not employ ARDL and bound test approach since it's not aimed at looking at short run or run long run effect.

(Huang, Lee, & Lin, 2019) studied Impact of Population and Workforce ageing on Economic growth in Taiwan from the year 1981 to 2017 using quarterly data. Their findings indicated n aging workforce with a significant and positive impact on the rate of economic growth. Meanwhile, for old age, the dependency ratio characterized a significant and negative impact on economic growth.

However, the above study by (Huang et al., 2019) had two predictor variables which were studied against economic growth i.e. population and aging workforce. In light with the current study, the researcher only focused on age dependency ratio as a predictor of economic growth. Further still, this particular study's time series data occupied the period between 1981 and 2017 while this current study focused on the period between 2000 and 2020.

(Maestas, Powell, & Mullen, 2016) studied the Effect of l population aging on economic growth growth, the labor, the productivity and labour force in United states over the period 1980-2010. They found that an increase in the percentage of those aged 60 and above reduced the growth rate of Gross Domestic Product per capita. Two thirds of the decrease was a result of the labor productivity that grew slower across the age structure yet one third arose from labor force that was still slow at growth. In short, the results implied that the growth of the GDP annually would slow by 1.2% point simply because of the aging population (Maestas et al., 2016). Meanwhile the study above occurred in the United States unlike the current one conducted in Uganda. In addition, the above study covered a period between 1980 and 2010 while the current study focused on the period between 2000 and 2020.

(Lee & Shin, 2021) studied the Decomposing Effects of Population Aging on Economic growth in the OECD countries. Their study found out that aging in the OECD nations bore a negative impact on Gross Domestic Product growth per capita. They further observed evidence of decreasing statistics in working age share. However such negative impact as a result of aging proves more than nullified when there is compensated increased hours of work amidst the rate of participation of labor force (Lee & Shin, 2021). This justified the need for the current study to examine the effect of increase in age dependency ratio on economic growth in Uganda

2.4.2. The Effect of Increase in Total Fertility Rate on Economic Growth

(Karra, Wilde, & Canning, 2017) studied the Effect of the fertility decline on econmic growth on African continent taking a case study of Nigeria. They found that fertility decline having a Positive effect on economic growth. However, this focused on fertility decline and its effect on the economic growth. In line with the current study, the researcher investigated the Effect of increase in the total fertility rates on economic growth in Uganda.

(Götmark & Andersson, 2020) investigated the fertility of humans in line with religions, contraception, education, economy and famili planning inititaives. They found that the rate of total fertility relates negatively with GDP per capita, CPR, Education but on the other hand positively with regard to religiosity. In Europe, the observation was, that TFR decreases with religiosity but goes on the increase with education. (Götmark & Andersson, 2020) concentrated on studying the association between the variables instead of focusing on the casual effect. The current study was centered on examining the effect of increase in total fertility rate on economic growth in Uganda.

(Fox, Klüsener, & Myrskylä, 2015) studied the relationship between fertility and economic development in more than twenty countries in Europe and two hundred fifty six sub-national regions from 1990 to 2012. They found a negative relationship between fertility and economic development within many countries. However, the study by (Fox et al., 2015) focused on examining the association between fertility and economic development. For the case of the current study, the researcher focused on examining effect of increase in total fertility rate on the economic growth in Uganda.

Yujie, 2015 studied the Relationship between fertility rate and Economic growth in developing countries using panel data. The scholar employed random and mixed effects models and found that total fertility rate a negatively significant effect on the growth of GDP in developed countries. Whereas, much as Yujie, 2015 study was targeting many developing countries, the current study will be conducted in Uganda. In addition, the above study was based on panel data which required using panel data analysis models such as random and mixed effect models. The current study employed time series data from 2000 to 2020 and analyzed using OLS esrimation methods.

2.4.3. Effect of Increase in Enrollment in Primary Schools on Economic Growth

(Seebens & Wobst, 2003) studied the impact of increased school enrollment on income inequality and economic growth. An application of a 2000 SAM for Tanzania helped evaluate quantitative long term impacts of increasing school attendance on the entire economic growth using a dynamic computable equilibrium model. They found that higher economic growth and household incomes were to be ultimately possible due to formation of human capital. It was further established that enhanced human capital posed positive effects which were moderate in the distributed gains of economic growth implying that income inequality does not substantially alternate (Seebens & Wobst, 2003). However, the study above, was looking at overall enrollment in schools in Tanzania which may not be the case with the current study which focused only on enrollment in primary schools. In addition, the above used DCGE model in examining the casual effect of enrollment on Economic growth. This current study employed OLS techniques in examining the effect of enrollment in primary schools on Economic growth in Uganda.

(Gumus & Kayhan, 2012) investigated the relationship between Gross Domestic Product per capita and the school enrollment rates at tertiary, secondary and primary levels between 1980 and 2008 in Turkey. The Toda-Yamamoto's causality test was employed. A statistical significant relationship between GDP per capita and rate at primary level was observed. At tertiary, no causal association was observed between GDP per capita changes and school enrollment rates (Gumus & Kayhan, 2012). However, much as (Gumus & Kayhan; 2012) observed a significant association between the school enrollment rate and GDP per capita using Toda-Yamamoto's causality test. The current study employed OLS estimation techniques to examine the effect of enrollment in primary schools on eco-

nomic growth in Uganda.

(Taşel & Bayarçelik, 2013) studied the effect of schooling enrolment rates on economic sustainability. They found that there was a positive effect of enrollment at primary, secondary and high-level education on economic growth, which means that if there is increase in human capital investment at this level of education; it helps to increase economic growth (Taşel & Bayarçelik, 2013). This justified the need for the study in Uganda.

(Nenbee & Danielle, 2021) investigated the impact of enrollment in primary school setting and public expenditure on the economic growth of Nigeria with the use of the Autoregressive Distributed Lag Model from 1987 to 2017. The outcomes revealed that public expenditure on education and enrollment of primary schools significantly increased Nigeria's economic growth. However, (Nenbee & Danielle, 2021) employed ARDL model to analyze the effect of primary school enrolment. For the current study, the researcher employed OLS method to examine the Effect of increase in primary school enrollment on economic growth in Uganda.

(Maneejuk & Yamaka, 2021) studied the impact of higher education on economic growth in the ASEAN-5 nations of Philipines, Singapore, Thailand, Malaysia and Indonesia from 2000 to 2018. The measurement for education took the form of government spending in Tertiary institutions on each student, primary enrollment rates and secondary levels. The education was measured in terms of public expenditure on tertiary education per student, enrolment rates of primary, secondary, and tertiary levels and the workforce of educated personnel. The study found that higher education impacts became doubled strong upon the enrollment rates growing greater than a particular level. Hence, the study concluded that secondary enrollment rates positively affected economic growth (Maneejuk & Yamaka, 2021). However, the above study looked at secondary enrollment while the current study focused on primary school enrollment.

3. Materials and Methods

This section shows procedures which were followed in executing of data to achieve meaningful statistical results. It entails the research design, model specification, data collection types and sources, estimation and diagnostic testing procedures, and ethical issues.

3.1. Research Design

A longitudinal study design was used to study the effect of increase in population on the economic growth in Uganda between the years 2000 and 2020. This type of design was considered because research units are repeatedly measured overtime but regularly overtime (Salkind, 2010).

3.2. Method of Data Collection

The world Bank Development Indicators Database provided source for Second-

ary data on economic growth, ADR, TFR, and PSE from 2000 to 2020 (World Bank, 2022). World Bank provides free access to data via their website for development indicators for various countries across the world.

3.3. Estimation and Diagnostic Testing Procedures

The following are the testing procedures that were conducted in this study. They include:

3.3.1. Testing Stationarity (Unit Root) in the Series of Variables

According to (Granger & Newbold, 2013) the classical regression model argue that DV and IV variables should not be in motion, errors bear a zero mean and with a finite variance. The first stage involved testing unit root, that is pre-testing each variable to establish whether the variables are stationery or otherwise determine if the variables are stationary or not. In this study, to test the presence of unit root with in the series of the variables, the Augmented Dicky Fuller (ADF) test was used in testing the unit root presence within the variables' series. The series of the variables would be stationary (no unit root) in case the *P*-value for ADF is below 0.05 significance level (taking the Null hypothesis for series not being stationary (have a unit root)). For variables with series which are not stationary, the researcher would carry out differencing of variables to bring back the series to stationarity level.

3.3.2. Testing for the Assumptions of Classical Linear Regression Model (CLRM)

Atop testing the unit root, the researcher further embarked on testing for the theories of the classical linear regression model (CLRM) of Autocorrelation, Multicollinearity and Heteroscedasticity. The study employed Pearson/pair-wise correlation matrix to test for multicollinearity i.e. by assessing if the variables are having a correlation which is less than 0.8. To test for Heteroscedasticity (variance of the residuals), the researcher used Breusch-Pagan/Cook-Weisberg heteroscedasticity Test. The study further tested correlation of serial with in residuals (autocorrelation of residual) of the model using Portmanteau test for White noise.

3.4. Model Specification

Malthusian theory of population growth suggests an association between the population growth and economic growth (Robert, 2020). Basing on the theory above, the following function was developed to make an estimation on the effect of Population increase on economic growth in Uganda. A multivariate function was expressed as Equation (1) below:

$$\mathrm{EG} = f\left(\mathrm{ADR}, \mathrm{TFR}, \mathrm{PSE}, \mu\right) \tag{1}$$

The econometric model is given as follows;

$$\mathrm{EG}_t = \beta_0 + \beta_1 \mathrm{ADR}_t + \beta_2 \mathrm{TFR}_t + \beta_3 \mathrm{PSE}_t + \mu_t \tag{2}$$

where, EG is the economic growth of Uganda measured by GDP, ADR is the age dependency ratio, TFR is the total fertility rate, PSE is primary school enrollment. The intercept that is used to measure the response in economic growth is β_0, that is, where independent variables are zero, β_1, β_2, β_3 are coefficients of the independent variables. μ_t appears to be an error term and the subscript t represents the nth year. Missing data in the observations were completely ignored.

3.5. Model Estimation

According to (Frost, 2018), the famous method for estimating linear models is by use of the Ordinary Least Squares. For it satisfies the assumptions for linear regression. Regression is powerful in simultaneously analyzing multiple variables and answering research questions that are complex (Frost, 2018). Besides testing for CLRM assumptions, the study made use of the ordinary least square estimation method. The researcher finally estimated an econometric multiple regression model to establish the effect of population increase on Economic growth in Uganda.

3.6. Ethical Consideration

In this study, ethics were observed by ensuring that the source of data is World Bank. Data was cleaned and only variables needed for the study were maintained to enable the researcher analyze the data. The researcher took prior permission from the World Bank to allow access the data to be used for analysis for the period ranging from 2000-2020. In the theoretical analysis the researcher availed proper references in the research and maintained the ethical formalities throughout our study.

3.7. Limitation of the Study

The study faced a challenge of outbreak of Covid-19 in 2020 which could have caused structural breaks in GDP growth due to the fall in performance of several sectors. To cater for structural breaks caused by the outbreak of Covid-19, test for unit root to assess presence of non-stationarity in the variables' series was employed.

4. Results and Analysis

The author used data from 2000-2022 instead 2023 because the study was conducted in 2021 and ended in 2022, by the time of analysis the available data stopped on 2020.

The summary presented in this section includes the mean, maximum value, minimum value, and the standard deviation of the variables.

Table 1 above shows statistics of Study variables. The results show that there was average annual GDP growth from 2000 to 2020 was 6.08% with a standard deviation of 2.2%. The observations from Table 1 reveal that the average age dependency ratio from 2000 to 2020 stood at 102.74% per year with a standard deviation of 4.97. The study findings also reveal that total fertility rate stood at

Table 1. Results of statistical analysis.

Descriptive Stat / Study Variables	GDP (annual growth, %)	Age Dependency Ratio (% of working-Age Population)	Total Fertility Rate (Births per Woman)	Primary School Enrolment (% of the population corresponding to the primary school age group)
Minimum	2.95	92.31	4.7	102.65
Maximum	10.78	108.22	6.87	138.28
Mean	6.08	102.74	5.97	120.92
Standard Deviation	2.20	4.97	0.71	11.41
Number of observations	21	21	21	17

Source: Author's own computations based on data from (World Bank, 2022).

an average of 6 children per mother per year from 2000 to 2020 with a standard deviation of 1 child. Lastly, the findings show that the average primary school enrollment stood at 120.9% per year with a standard deviation of 11.41%.

4.1. Test for Unit Root (Non-Stationary) within Series of the Variables

This study employed the Augmented Dickey Fuller to test or assess whether variables of the study possessed non-stationary series or trends which would lead to spurious results. The variables with non-stationary series were transformed using Natural logarithm or differenced to, ensure that the series are stationary as presented in Table 2.

The results in Table 2 reveal non-stationarity of all variables (had a unit) in levels (GDP, ADR, TFR, PSE) and after log transformation (LGDP, LADR, LTFR, LPSE) as indicated with *P*-values above 0.05 level of significance. Later after the first difference (DLGDP, DLADR, DLTFR, DLPSE), the series of all the variables became stationary as indicated with *P*-values below 0.05 level of significance.

4.2. Testing for the Model Diagnostics

The section shows results accruing from diagnostic tests of the applied model. The classical regression model assumptions pertaining to homoscedasticity, multicollinearity (constant variance of the residuals) were tested plus auto correlation of residuals.

4.2.1. Testing for Multicollinearity of Covariates/Independent Variables

The test was on whether there was no high correlation or relationship (80% and above) between the independent variables. Findings are presented using pairwise (Pearson) correlation matrix feature in Table 3.

Table 2. ADF unit root test for stationarity of the series of the variables.

INTERCEPT				
VARIABLES	ADF T-STATISTIC VALUE	ADF 5% CRITICAL VALUE	*P*-VALUE	STATUS OF UNIT ROOT
GDP	−1.141	−3.000	0.6984	Non Stationary
L (GDP)	−1.033	−3.000	0.7409	Non Stationary
D (LGDP)	**−3.887**	**−3.000**	**0.0021**	**Stationary**
ADR	1.518	−3.658	0.9999	Non Stationary
L (ADR)	2.920	−3.658	0.9999	Non Stationary
D (LADR)	**−4.151**	**−3.691**	**0.0218**	**Stationary**
TFR	−2.219	−3.691	0.4522	Non Stationary
L (TFR)	−1.893	−3.691	0.6166	Non Stationary
D (LTFR)	**−3.830**	**−3.000**	**0.0026**	**Stationary**
PSE	−3.328	−3.933	0.1140	Non Stationary
L (PSE)	−3.629	−3.933	0.0760	Non Stationary
D (LPSE)	**−3.624**	**−3.000**	**0.0053**	**Stationary**
We reject the H_0 of presence of Unit root in case *P*-Value < 5% significance level				

Source: Author's own computations based on data from (World Bank, 2022).

Table 3. Testing for multicollinearity between independent variables using pairwise correlation matrix.

	ADR	TFR	PSE
ADR	1		
TFR	0.784	1	
PSE	0.699	0.605	1

Source: Author's own computations based on data from (World Bank, 2022).

Results from multicollinearity test using Pearson's correlation show that all the independent variables were not collinear as indicated with correlation values below 0.8 or 80%.

4.2.2. Test for Heteroscedasticity of Residuals of the Model

The researcher tested using Breusch-pagan test whether the residuals of the estimated regression model were constant throughout the years. The findings appear in **Table 4**.

The findings for **Table 4** reveal that the residuals of the model had constant variance throughout the years since the *P*-value (0.5721) was above the significance level of 0.05 thus failed in rejecting the Null Hypothesis that residuals had constant variance.

Table 4. Breusch pagan test for Heteroscedasticity of residuals.

Breusch Pagan/Cook Weisberg Test for Heteroscedasticity
Ho: Constant Variance Constant variance
Variables: residuals
Chi2(1) = 0.32
P-value > Chi12 = 0.5721

Source: Author's own computations based on data from (World Bank, 2022).

The model findings in Table above show a statistically significant negative effect of Age dependency ratio on GDP (Coefficient = −1.201591, *P*-value (0.029) < 0.05). Holding the other variables constant, and increase in age dependency ratio by 1% results into a reduction in GDP growth by 1.2% per year in Uganda. The results show that age dependency ratio has a significant and negative effect on Economic growth in Uganda. The implication is that as people grow older beyond the working age, they become less productive and this consequently affects the economic growth in terms of the resources. The findings are in agreement with (Mohd et al., 2021), who found a negative significant impact of the aging population on the economic growth in Malaysia. Such findings also concur with the findings of (Maestas et al., 2016) in United States, which established that any increase in the percentage of population aged 60 and above could decrease the GDP per capita growth rate.

The model findings reveal that total fertility rate had a statistically significant negative effect on GDP in Uganda (Coefficient = 6.465372, *P*-value (0.046) < 0.05). The model findings show that when adjusting for other variables, when a woman bears additional child every year results into decline in GDP by 6.5% in Uganda. This shows that total fertility rate brings about a negative effect on economic growth in Uganda. The implication is that bearing more children by women in Uganda affects GDP growth as they negatively affect social services like education, health, and increases government expenditure. The findings agree with who found a negative association between the rate of total fertility and education, GDP per capita and CPR. The findings also agree with the findings of (Li, 2015) who found that growth in total fertility rate had a significantly negative effect on the growth of GDP in developing countries.

Observations from the model findings show that primary school enrolment had no significant effect on GDP as shown with a *P*-value (0.103) bigger than the significance level of 0.05.

The adjusted R-squared value reveals that Age Dependency Ratio, total fertility rate, and primary school enrolment explain 26.6% of the total variations in economic growth and other variables that did not appear in the model explain 73.4%.

5. Discussion

The discussion of findings is presented in line with the findings deduced from

this study. The results found a negative and significant effect of age dependency ratio on GDP. The study confirmed with the rejecting of the Null hypothesis in support of the Alternative hypothesis that "increase in Age dependency ratio has a significant effect on Economic growth in Uganda". The findings imply that as people grow older beyond the working age, they become less productive and this consequently affects the economic growth in terms of the resources. The model findings in Table 5 show a statistically significant negative effect of Age dependency ratio on GDP (Coefficient = 1.201591, *P*-value (0.029) < 0.05). Holding the other variables constant, and increase in age dependency ratio by 1% results into a reduction in GDP growth by 1.2% per year in Uganda. The results show that age dependency ratio has a significant and negative effect on Economic growth in Uganda. The implication is that as people grow older beyond the working age, they become less productive and this consequently affects the economic growth in terms of the resources. The findings are in agreement with (Mohd et al., 2021) who found a negative significant impact of the aging population on the economic growth in Malaysia. Such findings also concur with the findings of (Maestas et al., 2016) in United States which established that any increase in the percentage of population aged 60 and plus could decrease the GDP per capita growth rate.

The findings revealed that total fertility rate had a significant negative effect on GDP in Uganda. The findings led to the rejection of the null hypothesis in support of the alternative that "increase in total fertility rate has a significant effect on Economic growth in Uganda". The findings imply that bearing more children by women in Uganda affects GDP growth as they negatively affect services like education, health, and increases government expenditure. The model findings reveal that total fertility rate had a statistically significant negative effect on GDP in Uganda (Coefficient = 6.465372, *P*-value (0.046) < 0.05). The model findings show that when adjusting for other variables, when a woman bears additional child every year results into decline in GDP by 6.5% in Uganda. This shows that total fertility rate brings about a negative effect on economic growth in Uganda. The implication is that bearing more children by women in Uganda affects GDP growth as they negatively affect services like education, health, and

Table 5. Model findings on effect study variables on economic growth in Uganda.

Variables	Coefficient	Std. error	*P*-value
Age dependency ratio	−1.201591*	0.5515341	0.029*
Total fertility rate	−6.465372*	3.233738	0.046*
Primary school enrolment	0.0312163	0.0191359	0.103
Constant	−79.85976	37.11896	0.031
R-squared	0.4040		
R-squared (Adjusted)	0.2664		

increases government expenditure. The findings agree with who found a negative association between the rate of total fertility and education, GDP per capita and CPR. The findings also agree with the findings of (Li, 2015) who found that growth in total fertility rate had a significantly negative effect on the growth of GDP in development countries.

The findings also revealed that primary school enrolment had no significant effect on growth of GDP in Uganda. These findings failed to reject the null hypothesis that "increase in enrollment in primary schools has a significant effect on economic growth in Uganda".

Observations from the model findings show that primary school enrolment had no significant effect on GDP as shown with a *P*-value (0.103) bigger than the significance level of 0.05.

The adjusted R-squared reveal that Age Dependency Ratio, Total Fertility rate, and primary school enrolment explain 26.6% of the total variations in economic growth and other variables that did not appear in the model explain 73.4%.

6. Conclusion

The conclusion presented aligns with the objectives as shown in subsequent sections. The study concludes that growth in age dependency ratio significantly reduces economic growth in Uganda. This implies that as more people grow older beyond the working age, they become less productive and this consequently affects the economic growth because of the burden exerted on the few available resources. Similarly, the study concludes that growth in total fertility rate significantly reduces on economic growth rate in Uganda. It implies, bearing more children by women in Uganda affects the level of economic growth as they negatively affect services like education, health, and increases government expenditure. It concludes that primary school enrolment did not have a significant effect on economic growth in Uganda.

7. Recommendations

The study made the following recommendations, which are:

1) The government and partners should provide economic empowerment programs to elderly people in Uganda. For instance, they should be trained and empowered in agriculture, running small scale businesses, and allowed to access the elderly fund. This therefore, may help reduce the level of dependence thus improving economic growth.

2) The government and partners should encourage and enroll the elderly people who have retired from service in military programs and exercises. This would help them to keep physically fit and prevent diseases such as diabetes, high blood pressure among others that come with the old age.

3) The government and partners are urged to improve the programs on contraceptive uptake in the country in order to reduce the rising total fertility rate. There should be awareness campaigns in schools, rural, and urban areas to en-

courage females and males to use contraceptives.

4) The government is urged to support the young people through skill development training especially those in the dependent age bracket. This would enable them to create their own jobs which would reduce the dependency ratio and increase the economic growth.

5) The study recommends increased secondary school completion since this would lead to older age at the first marriage and this would help to reduce the rising total fertility rate and improve the economic growth in the country.

The results of this article are general in a sense that in most developing countries if dependency ratio and total fertility rate are too high, economic growth is affected negatively since the big number of dependants do not contribute to country's economic growth but instead, the fewer available resources are over stripped by the big numbers.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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