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Population dynamics and economic growth in Kenya

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Since the publication of the Malthusian population principle, the overall impact of population change on economic growth has provoked huge debates that have challenged pessimistic and optimistic postulations. Pessimists' research posits that population growth puts a strain on government services. Conversely, optimists agree that population increase is a key component of economic growth through expanded specialisation and increased labour resources. Considering these conflicts in the literature, the Malthusian population principle and the partial least square structural equation model (PLS-SEM) are used by the author to assess the impact of population dynamics on economic growth in Kenya by incorporating the effects of education and health expenditures. The results show that population dynamics influence economic growth both directly and indirectly, with their indirect impact reinforcing the pessimistic argument that an increase in population dynamics growth has a negative effect on economic growth. Without doubt, the Kenyan working population has high health- and education-related needs, which is causing a slowdown in economic growth. The study suggests that state agencies develop and implement various policy programs focusing on public health and active involvement of the population in economic activities.

KEYWORDS: PLS estimation, Kenyan population dynamics, economic growth

Since the publication of *Malthus*' essay, 'The Principle of Population' in 1798, the impact of population dynamics on economic growth has remained the subject of an intense debate. Two camps have sprung up around this issue, with Malthus' pessimists contending that the increase in population is detrimental to economic growth, straining available resources of the economy. This constraining pressure inevitably stifles economic advancement and is likely to bring about long-term development problems (*Linden–Ray* [2017]). In contrast, Malthus' optimists consider population dynamics as an essential part of economic development. There is no doubt that population development induces enhanced human capital that enables economic development due to the 'ricocheting' effects of technological progressions (*Klasen–Nestmann* [2006]). In line with the contradictory arguments about Malthus' hypothesis, this study is founded on whether population growth is ought to be encouraged to provide adequate labour force and speed up economic growth, or whether such a move would create a large population that would act as a 'drag' on economic growth in Kenya.

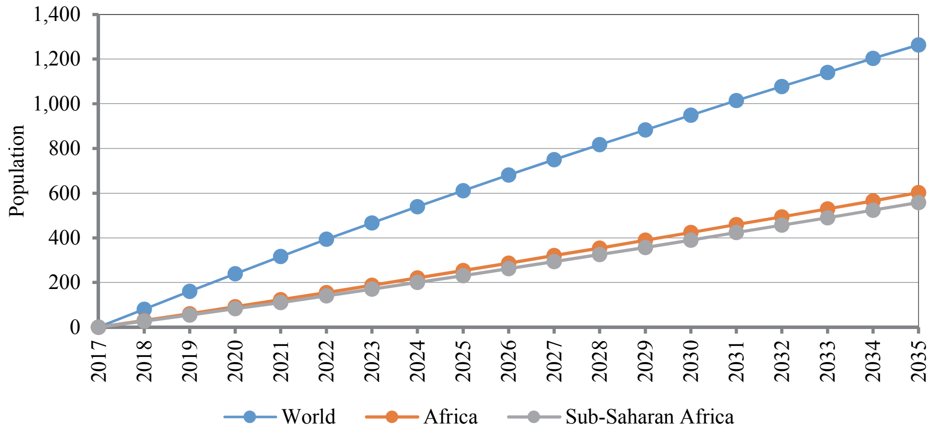
Malthus [1798], in concurrence with the arguments of current pessimists, posited that population growth is incredibly detrimental to the economic development of a state due to several socio-economic problems arising from increasing population dynamics. Population explosion, for instance, puts a strain on both open regular resources and state-provided services, such as education and health. Furthermore, as *Malthus* [1798] pointed out, population grows mathematically, whereas public (food, health, housing, and education) services grow arithmetically. The Malthus model, which addresses an offsetting of population growth in the long run, depends on this shifting relationship between population dynamics and economic growth (*Obere–Thuku–Gachanja* [2013]).

According to *Ali*, *Ali*, and *Amin* [2013], today's Malthusian pessimists expect a negative impact of population growth on economic growth. Irrevocably, the authors suggest that the government's provision would reach a cut-off point, at which there will no longer be sufficient public and natural resources to support the steadily increasing population in a developing state. Naturally, expanded population-dynamics-linked socio-economic upheavals are observable in budget deficits for health and education spending, which pose several economic development challenges (*Sheiner* [2014]).

Many developing and advanced economies are struggling with inadequate population growth. Their efforts range from supporting a healthy, productive population to cutting down crude death rates to increase the economically active workforce (*Girosi–King* [2007]). In several countries, unacceptable (crude) death rate and population ageing pose a serious challenge to the governments (*Shkolnikov et al.* [2011]). Population elements are, and will remain, the primary constraints on the pace of economic development around the globe (*Bayati–Akbarian–Kavosi* [2013]).

The African population is growing the quickest in the world and is expected to continue rising by an estimated 50%, from 1.2 billion to 1.8 billion, between 2017 and 2035. Further, it is projected to represent almost 50% of the overall population development, as shown in Figure 1 (*Institute for Security Studies* [2021]).

Figure 1. Population growth projections for the world, Africa, and Sub-Saharan Africa (millions)



In addition to confronting an expanding populace, Africa's population dynamics are portrayed by an enormous number of youngsters and young adults who represent immense financial obligations and other social challenges such as increasing income gap and poverty (*World Bank Group* [2019]). Most African governments are facing severe budget deficits caused by social spending on education, health, and transfer payments for food and housing. Likewise, governments need to provide and take advantage of skills development and create job opportunities (*World Bank Group* [2019]).

Kenya is confronting a range of difficulties related to the size and structure of its population. The rate of population growth averages 2.5% annually. The fertility rate has risen above 3.5% in recent times. The adult population's crude death rate is more than 5%, with numerous deaths related to diseases. In addition, the working age population shows a rapidly increasing trend, leading to a growing supply of productive workforce, and making it necessary to address the problem of insufficient formal and casual job opportunities. The current number of young people in Kenya has been rising. For instance, the number of young people aged 15 to 24 years has been higher than that of the 25–34-year-olds since 1950 (*Kimenyi–Mwega–Ndung'u* [2015]). In 2014, the share of the cohort aged 15–24 years was 35.2%, while the proportion of working-age population (aged 25–34 years) was 29.1%. This pattern depicts Kenya as an economy brimming with a young population, which offers a great opportunity as the number of young people aged 15 to 34 years will surpass older cohorts. However, it also places a heavy burden on the state to foster business approaches that create jobs for the expanding workforce (*Kimenyi–Mwega–Ndung'u* [2015]). As such, this burden has been slightly overbearing in recent times, as evidenced by a 2.5% increase in the annual unemployment rate (*World Bank Group* [2019]).

The growth trajectory of the population has outpaced economic development, which is evolving warily with the rapid growth of socio-economic demands. Public spending[1] on education and health has increased by an average of 40% and 15% of annual gross domestic product (GDP), respectively, in the last half of the past decade (*World Bank Group* [2019]). Consequently, exploring the present growth of Kenya's population elements and the associated economic impacts provides a fertile ground for achieving the ideal degree of manageable development through the introduction of appropriate policy strategies for population dynamics. On this basis, the present research seeks to answer the question of whether population dynamics have a positive or negative impact on economic growth in Kenya, using the PLS multivariate technique on 2000–2018 secondary data.

This study consists of five parts. The introduction above presents ideas that encompass the Malthusian pessimists' and optimists' perspectives on the impacts of population dynamics on economic growth. It provides insight into the current situation in Kenya in terms of population dynamics, economic growth, and social spending. Section 1 offers an overview and theorising of the literature on population dynamics and economic growth, in line with the Malthusian population principle. Section 2 includes data description and modelling. Section 3 presents the analysis of data and Section 4 gives a detailed explanation of the results. Section 5 contains conclusions, recommendations, limitations, and suggestions for further research.

1. Theorising population dynamics and economic growth

Population dynamics are regarded as overall changes in the structure and size of the population of a country or region over a period (*Roser–Ritchie–Ortiz-Ospina* [2013]). Economic growth refers to an increase in the final value of goods and services produced/provided in one year (*Zhang* [2018]). The current literature linking population growth dynamics and economic growth is the subject of intense debates, yet extremely different, with several studies supporting the Malthusian hypothesis of the population principle.

[1] Social expenditure and social/public spending are used as synonyms in this study.

By expanding on *Malthus*' [1798] essential suggestion about the negative effects of population growth dynamics on economic growth, a great deal of theoretical literature has emerged to the contrary. Subsequent theoretical and empirical works on the post-Malthus model and actual economic growth pose a challenge to Malthusian theory in terms of economic growth (*Kuznets* [1960]). This way of thinking features the positive economic effects of population growth dynamics. As indicated by the optimistic scholars (post-Malthus model and current development models), savings, consumption, and production involve large-scale economic activities. For example, *Kuznets* [1960] confirmed that significant population growth promotes economic growth and long-term development. Furthermore, *Kremer* [1993] empirically justified that an enormous population is associated with expanded economic growth. In addition, *Simon* [1990], agreeing with previous development models, posited that large population growth creates a huge set of fundamental skills and abilities that increase per capita income.

Given the lack of consensus among Malthusian pessimists and optimists, recent research examining the effects of population growth dynamics on economic growth in different economies, has yielded conflicting results. *Sethy* and *Sahoo* [2015] as well as *Tumwebaze* and *Ijjo* [2015] revealed a significant, positive direct impact of population increase on economic growth in India and South and East Africa. In contrast, *Yao*, *Kinugasa*, and *Hamori* [2013] observed that population growth in China has affected adversely GDP growth per capita.

Banerjee [2012] confirmed the negative effect of population growth on Australia's economic growth. In contrast, *Bucci* [2015] suggested that population growth necessitates specialisation, leading to an increase in productivity. Various scholars have observed that population growth resulting from a declining mortality rate promotes economic development, while population growth from an increased fertility rate hinders economic progress (*Mierau–Turnovsky* [2014]).

Based on time series data from 1981 to 2014, *Essien* [2016] found that population increase fostered economic growth in Nigeria. Likewise, *Musa* [2015] and *Ali et al.* [2013] observed that population growth had a positive, significant influence on India and Pakistan's economic growth. *Anudjo* [2015] also conducted a study on this subject, using 1980–2013 data from Ghana. He performed Granger causality, unit root and cointegration tests and showed that high population density had a positive impact on economic growth.

Adewole [2012] also examined the impact of population growth. He carried out quantitative evaluation, ordinary least squares estimation, trend analysis, and the Phillips-Perron stationarity test to study the endogenous characteristics of Nigerian times series data from 1981 to 2007. The analysis revealed that population growth had a positive and significant impact on economic sustainability proxied as GDP and per capita income, and propelled higher demands for food and healthcare needs. Similarly, *Ewugi* and *Yakubu* [2012] investigated the Malthusian population suggestions using a Nigerian economic dataset. They found negative consequences of population development: greater food demand, population emergencies, poverty scourges, severe and tribal contentions, and infectious ailments, such as human immunodeficiency virus/acquired immunodeficiency syndrome. According to their conclusion, the state should allocate budget to address the adverse effects of population growth (illnesses, literacy and poverty problems, etc.).

Klasen and *Lawson* [2007] studied the relationship between Uganda's demographic expansion and economic development (GDP growth per capita). The researchers used panel data to justify, both theoretically and statistically, that population growth made economic growth slower in Uganda. In the context of Kenya, *Obere*, *Thuku*, and *Gachanja* [2013] analysed secondary data from 1963 to 2009. They applied a combination of Granger-causality correlations and vector autoregressive estimation to examine the impact of population growth on Kenyan economic growth. The results indicate a negative correlation between the two. According to the authors, the tight public social spending in Kenya has accelerated the growth of population-related difficulties such as inadequate health services and extreme poverty, which plunged the country.

In light of the reviewed theoretical and empirical findings of the literature, there is no consensus among Malthusian pessimists and optimists regarding population growth and economic growth. The results of optimists support that population growth has huge benefits for economic growth and development, whereas those of pessimists show negative impacts on economic growth. This may be due to various sample sizes, techniques of the authors and the different geographic areas, populations and economic growth of the countries examined. These discrepancies provide a basis for this study to contribute to the ongoing intense debate on the subject. To achieve this goal, we will use a Kenyan population dynamic, economic growth and social spending time series dataset for the period of 2000–2018, and perform a multivariate method, the PLS path analysis.

2. Description of data and methodology

This section contains a description of our variables and explains how population and social expenditure variables interact with economic growth, based on the PLS estimation technique. The main variables of the study are population dynamics (defined by death rate per 1,000 live births, death rate of the adult population [aged 15 to 64], birth rate per 1,000 persons, growth rate of the adult population [aged 15 to 64], dependency ratio for population aged 15 to 64, and the old-age-dependency ratio [for aged 65 and over]), social [health and education] expenditure, and economic growth [estimated on the basis of annual GDP growth rate and annual GDP per capita growth rate]). The study uses a dataset from the World Bank, the Kenya National Bureau of Statistics, and the United Nations Development Program, with a sample of 19-year primary/secondary data from 2000 to 2018.

The secondary dataset was obtained and coded primarily by percentage growth rates. The constructs used to measure the GDP and per capita GDP growth rates were coded as follows: 1 – growth rate below 1.0%, 2 – growth rate between 1.0–3.0%, 3 – growth rate between 3.1–5.0%, 4 – growth rate between 5.1–7.0%, and 5 – growth rate of more than 7.0%. For social expenditure measurement constructs, the coding was as follows: 1 – growth rate between 0.0–3.0%, 2 – growth rate between 3.1–5.0%, 3 – growth rate between 5.1–7.0%, 4 – growth rate between 7.1–10.0%, and 5 – growth rate of more than 10%. Population dynamics measurement constructs were coded as follows: 1 – growth rate below 1.0%, 2 – growth rate between 1.0–2.0%, 3 – growth rate between 2.1–3.0%, 4 – growth rate between 3.1–4.0%, and 5 – growth rate of more than 4.0%.

Table 1

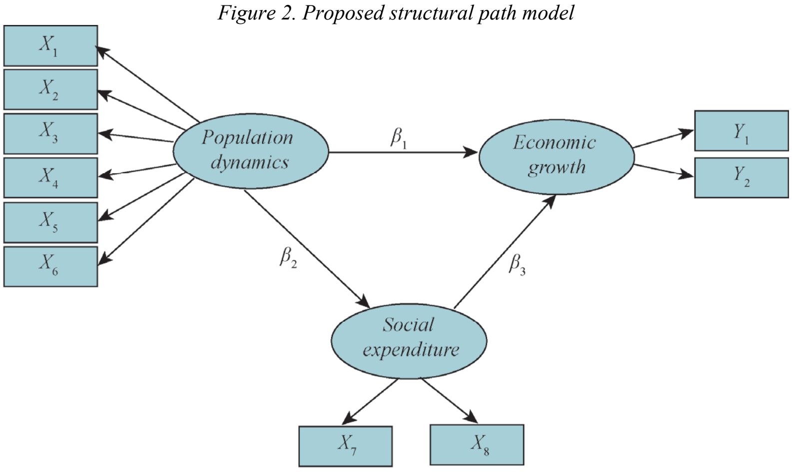
Latent and associated construct variables

Latent variable	Construct measure
Population dynamics	Birth rate (per 1,000 persons; *Popu_DBs*)
	Death rate (per 1,000 live births; *Popu_DM*)
	Growth rate of adult population (aged 15 to 64 years; *Popu_DAs*)
	Death rate of adult population (aged 15 to 64 years; *Popu_DADs*)
	Dependency ratio (aged 15 to 64 years; *Popu_DDRs*)
	Old-age-dependency ratio (aged 65 years and older; *Popu_DDRo*)
Social expenditure	Education public spending (% of the annual GDP growth rate; *Policy_GE*)
	Health public spending (% of the annual GDP growth rate; *Policy_GH*)
Economic growth	GDP growth rate (annual, %, *EconomicG*)
	GDP per capita growth rate (annual, %, *GDP_pca*)

Note. The construct measure names are abbreviated in parentheses.

The PLS path modelling consists of regression and factor estimates that are run simultaneously, consequently pointing to indirect and direct effects of latent constructs. This technique has been adopted as a vital fragment of the demonstration as a result of its good adaptability to both small and large sample sizes and non-normally distributed data sets of variables (*Hair et al.* [2012]). The PLS method supports the determination of the relationship between the associated indicators of variables and constructs. It also helps to specify the structural paths between the construct measures of variables. The inner reliability of the PLS model is evaluated by the composite reliability (*CR*) test, while its convergence validity is examined by means of discriminant validity (based on the average variance explained [*AVE*]) and indicator reliability. The coefficient of determination (R^2) and the correlation coefficient (R) are used to study the explanatory power of the structural model, which estimates the variance that is explained in each of the endogenous constructs, and f^2 denotes the effect size of the variables.

Figure 2. Proposed structural path model



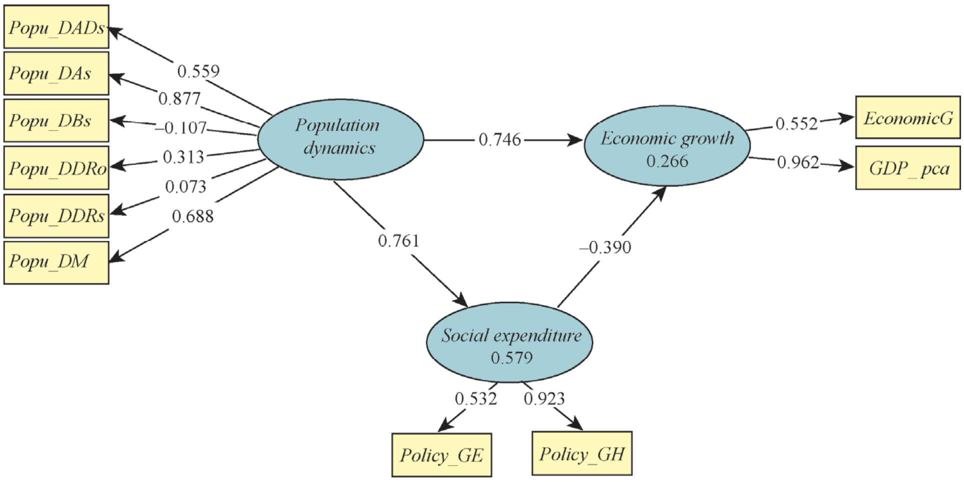
Based on the connections shown in Figure 2, variables X_1–X_8 and Y_1–Y_2 are the manifest or construct variables. The path coefficients (β) reflect the causal linkages between the key study variables.

3. Analysis of data

PLS estimations help to evaluate the cause-effect relationship between a variable construct and its related indicators and to decide the structural path between variable constructs. R^2 is used – as it was already mentioned – to assess the validity of the structural path modelling. It estimates changes in the variable explained by the independent variables. Thus, it represents the quality of the adjusted path model.

Our analysis demonstrates that 26.6% of the variation is predicted by the economic growth variable and 57.9% by the social expenditure variable. (See Figure 3.) In accordance with *Cohen*'s [1988] classification of the effect size, R^2 values are as follows: $R^2 < 0.02$ – very weak, $0.02 \leq R^2 < 0.13$ – weak, $0.13 \leq R^2 < 0.26$ – moderate, and $R^2 \geq 0.26$ – substantial. These results thus justify that the endogenous latent variables, economic growth and social expenditure substantially influence the model.

Figure 3. Model depicting the path analysis and the interactive relationships of variables



Note. For the abbreviations, see Table 1.

Table 2 shows that the predictive validity of the explained latent economic variable (Q^2) is 0.393 and that of social expenditure is 0.772; both are higher than 0. This confirms the predictive validity of the model.

The findings also indicate that the value of f^2 used to assess the significance of construct variables when adjusting the model, implies medium effect size for the population dynamics latent construct variable (0.320) and large for social expenditure (1.376).

Table 2

Predictive validity and effect size of the model

Latent variable	Q^2	f^2
Economic growth	0.393	–
Population dynamics	–	0.320
Social expenditure	0.772	1.376

These results demonstrate that the population dynamics and economic growth variables may play a significant role in a model change, consistent with *Hair et al.*'s [2014] assessment standards: Q^2 values should be larger than 0, while f^2 values higher than 0.02, 0.15, and 0.35 depict small, medium, and large effect sizes, respectively.

CR, R^2, and *AVE* are used to evaluate the model's adjustment quality. *CR* measures the internal consistency (construct reliability) and *AVE* shows a construct's convergent validity. The *CR* values in Table 3 are greater than 0.7 and the *AVE* values exceed the 0.5 threshold, except for population dynamics, hence considered satisfactory. These findings provide justification for the sufficiency of the construct variables in the model adjustment, in accordance with *Hair et al.* [2009].

Table 3

Indicators evaluating the model adjustment quality

Latent variable	*AVE*	*CR*	R^2
Economic growth	0.615	0.748	0.266
Population dynamics	0.278**	0.572**	–
Social expenditure	0.568	0.710	0.579

** $p < 0.01$.

Fornell and *Larcker* [1981] proposed a discriminant validity assessment of models (the evaluation of the extent to which a construct is empirically distinct from other constructs). The authors suggested that the square root of *AVE* for each latent construct factor should be larger than the construct factors' highest correlation with any other variables. The discriminant values have been obtained by calculating the square root of *AVE* of the latent construct variables, shown on the diagonal of Table 4, and comparing it with the *R* in every sectional column. Furthermore, cross-loadings have been also checked for discriminant validity, that is, whether each item loading on a construct factor is higher than all its cross-loadings with other construct factors. The data confirm that there is no issue aside from the populace elements variable and, consequently, the discriminant validity of the model holds.

Table 4

Fornell-Larcker criterion analysis for checking the discriminant validity of the model

Latent variable	Discriminant value		
	Economic growth	*Population dynamics*	*Social expenditure*
Economic growth	0.784		
Population dynamics	0.450	0.527*	
Social expenditure	0.178	0.761	0.753

* $p < 0.05$.

The significance of path coefficients has been assessed by bootstrapping calculations. The number of sub-examples is 5,000 based on the presumptions posited by *Hair*, *Ringle*, and *Sarstedt* [2011]. The results included in Table 5 show that the population dynamics construct variable has a positive, significant impact on economic growth and the social expenditure construct variables ($\beta = 0.746$, $p = 0.037 < 0.050$; $\beta = 0.761$, $p = 0.00 < 0.050$), while public social spending has a significant, negative impact on economic growth ($\beta = -0.390$, $p = 0.015 < 0.050$). (See Figure 3.)

Table 5

Bootstrapping results

Causal relationship	β (original sample)	Sample mean	Standard deviation	Test statistics	p-value
Population dynamics → economic growth	0.746	0.315	0.848	0.880	0.037
Population dynamics → social expenditure	0.761	0.703	0.200	3.801	0.000
Social expenditure → economic growth	–0.390	0.064	0.664	0.587	0.015

Our analysis has also explored positive total direct effects of population dynamics on economic growth ($\beta = 0.450$) and social expenditure ($\beta = 0.791$) and a negative total direct effect of social expenditure on economic growth ($\beta = -0.390$).

Table 6

Total effects and significance test statistics of the model

Causal relationship	β (original sample)	Sample mean	Standard deviation	Test statistics	p-value
Population dynamics → economic growth	0.450	0.367	0.463	0.971	0.032
Population dynamics → social expenditure	0.791	0.703	0.200	3.801	0.000
Social expenditure → economic growth	–0.390	0.064	0.664	0.587	0.011

We have also examined the indirect effect produced by population dynamics on economic growth ($\beta = -0.297$, $p = 0.029 < 0.050$), which arises from the direct effect of population dynamics on social expenditure and that of social expenditure on economic growth.

Table 7

Indirect effects and significance test statistics of the model

Causal relationship	β (original sample)	Sample mean	Standard deviation	Test statistics	p-value
Population dynamics → economic growth	–0.297	0.052	0.549	0.541	0.029
Population dynamics → social expenditure	–	0.000	0.000	–	–
Social expenditure → economic growth	–	0.000	0.000	–	–

4. Discussion of the results

The main purpose of this study was to explore the causal relationship between Kenyan population dynamics and economic growth based on time series data from 2000 to 2018.

PLS-SEM estimation was used to confirm the hypothetical framework. (See Figure 2.) Construct reliability (internal consistency) and convergent validity were checked by *CR* and *AVE* for all latent variables. The *AVE* values presented in Table 3 are higher than the 0.5 threshold, while the *CR* values exceed 0.7 (except for population dynamics), thus, evidencing acceptable composite reliability and convergent validity of the model, as presented in *Hair et al.* [2009] study. A discriminant validity assessment has also been carried out to ensure that the reflective constructs have the strongest relationships with their own indicators in comparison with other constructs (i.e. they are empirically distinct from other constructs in the model). To this end, on the one hand, *Fornell* and *Larcker*'s [1981] method was applied. The findings presented in Table 4 demonstrate that the square root values of *AVE* calculated for the economic growth and social expenditure construct variables are greater than these constructs' highest correlation with any other variables. On the other hand, discriminant validity has also been established by the assessment of cross-loadings, that is, the items load more highly to the construct they are required to reflect than to other constructs.

The strength of the relationship between variables has been assessed by the effect size f^2, and the model's predictive accuracy has been evaluated by Q^2. The social expenditure and economic growth latent construct variables have larger Q^2 values than 0, indicating high predictive validity of the model for these constructs. The effect size of the population dynamics latent construct variable factors is medium in the suggested underlying path estimation model, while that of the social expenditure latent construct variable factors is large as shown by f^2 values of 0.320 and 1.376, respectively. (See Table 2.) The model's explanatory power has been measured by R^2. The results show that 26.6% of the variance in the economic growth latent variable is explained by population dynamics and social expenditure latent variables, while 57.9% of the changes in social expenditure by population dynamics.

According to the bootstrapping results, the population dynamics construct variable has significant, positive relationships with economic growth and social expenditure latent variables ($\beta = 0.746$, $p = 0.037 < 0.050$; $\beta = 0.761$, $p = 0.000 < 0.050$, respectively). Concurrently, the social expenditure construct variable significantly and adversely influences economic growth ($\beta = -0.390$, $p = 0.015 < 0.050$). (See Table 5.) The total effect of social expenditure on economic growth is significant and negative ($\beta = -0.390$, $p = 0.011 < 0.050$), while that of population dynamics elements on social expenditure and economic growth is significant and positive ($\beta = 0.791$, $p = 0.000 < 0.050$; $\beta = 0.450$, $p = 0.032 < 0.050$, respectively). Besides its direct effect, the population dynamics construct variable also has a significant indirect effect upon economic growth, which, however, is negative ($\beta = -0.297$, $p = 0.029 < 0.050$). (See Table 7.)

5. Conclusion and policy suggestions

This study endeavoured to evaluate the impact of population growth elements on economic growth by using the PLS-SEM estimation model. By means of this technique, the connection between different elements of population growth, social expenditure, and economic growth has been examined. Population dynamics has been described by birth rate per 1,000 persons, death rate per 1,000 live births, growth rate of the adult population, death rate of the adult population, working-age dependency ratio, and old-age-dependency ratio. Public spending on health and education has been categorised as social expenditure elements, and economic growth has been represented by GDP growth rate and GDP per capita growth rate.

According to the results, population dynamics have both direct and indirect effects on economic growth, however, they are contradictory. A large part of Kenya's population is of working age and has valuable skills acquired through education and training. Yet, there are many who are not part of the workforce, which is coupled with increasing social spending to meet education and healthcare needs, as well as declining long-term economic development.

The findings confirm that Kenyan public authorities need to adopt policies that aim at increasing the healthy, educated and productive working age population. Thus, we suggest that the country's government implement such education and welfare policies which ensure appropriate population dynamics (i.e. demographic composition, population size), supporting the economic development of Kenya.

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