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THE IMPACT OF POPULATION AGING ON THE SOUTH AFRICAN ECONOMY: A CASE OF THE KING CETSHWAYO DISTRICT MUNICIPALITY

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ABSTRACT
Population aging presents numerous challenges, such as a reduced fiscal balance, changes in the savings patterns of households, and higher age dependency ratios. These consequences are evident for older individuals, the government, and the economy at large. This study examined the impact of population aging on the economic growth of South Africa, studying the King Cetshwayo District Municipality specifically. A panel data set for the period 2002-2020 by Quantec Easy Data was used for the study. A FE regression model was used to examine the relationship between economic growth (GDP per capita), population aging, savings, education, and other independent variables. The findings from the panel data analysis revealed that population aging negatively affects economic growth only in the short run but not in the long run. Also, other factors like education, savings, and income affected economic growth in the King Cetshwayo District Municipality. This study recommends a transformation in the country's savings by educating the population about the importance of savings in order to improve GDP per capita and the economic wellbeing of the people.

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1. Introduction.

Aging is inevitable (Nelson and Masel, 2018), and the issues related to population aging have become central in every country. Global demographic projections suggest that population aging is likely to rise across the world, meaning that all countries will have to be prepared for this demographic transformation. The aging of the population has many economic consequences that may affect different aspects of the economy, from labour supply to the rate of savings, as well as changes in the economic decisions older people make (Goodrick, 2013). Population aging is a challenge not only to those within the golden age range of sixty and above but also to the younger generations, who must invest time and resources in catering for the elderly (Chaka and Adanlawo, 2023. The phenomenon of population aging places pressure on the government to increase budgets for health care and infrastructure.

The consequences of population aging differ with the level of development that a country has, and this makes it difficult for developing countries to apply the policy recommendations that are given in studies that are conducted in developed countries. Studies by Muggeridge (2015) and Jayawardhana et al. (2023) confirm that the impact of population aging on the economy may vary depending on the level of development in a country or region. Most researchers focus on the impact of population aging on developed countries. The existing literature is solely focused on addressing the consequences faced by nations that are well developed. It remains difficult for developing countries to benefit from those research findings because they age at a different pace than developed countries.

There must be differences in how to approach this population-aging problem depending on a country's level of development. Most research, like the study by Chang et al. (2014), looks at aspects of population growth (increased births), but this study examines the impact of population aging on the economy. This study focuses on the King Cetshwayo district, which has highly ranked municipalities in terms of dependency (older people and children than a working population). This study aims to determine how population aging affects economic growth as measured by the GDP per capita in South Africa (the real GDP per capita of King Cetshwayo District). The main objective of the study is to evaluate whether the relationship between population aging and economic growth is short-term, long-term, or causal. The study tends to provide an answer to the set research question:

RQ1: *What is the impact of population aging on GDP per capita?*

2. Empirical literature review.

Different authors use different methodologies to study causality and the relationship between economic growth and population aging. Literature reveals that several authors arrive at similar conclusions about this phenomenon. Bloom et al. (2010) found that the relationship between population aging and economic growth is negative, but only in the short run. Lee et al. (2017) also found that population aging has a negative effect on economic growth both in the short run and the long run when they used a sample of 142 countries to study this phenomenon. Maestas et al. (2016) and Adanlawo and Nkomo (2023) also concluded that population aging does decrease the growth rate of GDP per capita.

Pham and Vo (2019) examined the effect of population aging on economic growth based on the data for 84 developing countries for the period 1971 to 2015. The findings indicate that aging can have a variety of effects on economic growth, including a positive long-run relationship between economic performance and the proportion of the population aged 65 and older. Dao (2012) used panel data regression to investigate the relationship between population aging and economic growth. The study revealed that the connection between population aging and economic growth is a negative one. Using the latter autoregressive distributed lag framework, Ogunjimi and Oladipupo's (2018) study concluded that population aging has no effect on economic growth. There are contradictory findings in the literature; some studies depict that it is possible for the relationship between economic growth and population aging to differ from the short run to the long run. Several researchers state that the impact of population aging on the economy of a particular country depends on the level of development in that country.

In terms of population aging and savings rate, Nkomo and Adanlawo (2023) used the gross savings of South Africa from 1995 to 2017 to investigate the relationship that exists between the aging population and the savings rate in South Africa. Their findings revealed that an increase in old-age dependency does not cause the level of savings to decline but will rather lead to an increase in savings. Tshabalala et al. (2018) applied the Panel Autoregressive Distributed Lag model (PARDL model) together with the Autoregressive Distributed Lag (ARDL) model to analyse the effects of age structure on savings. The result showed evidence contrary to the predictions of the famous LCH, since increased elderly dependency was associated with higher household savings.

3. Research methodology.

This study uses a panel data model to examine the relationship between population aging and economic growth per capita.

3.1 Panel data.

The panel data for this study is sourced from Quantec Research (Pty) Ltd.'s Easy Data which is a South African based consultancy offering databases covering macro, regional socio economic and international trade data. The data is a balanced panel of annual observations from the five local municipalities under the King Cetshwayo District Municipality for the period 2002 to 2020. The time frame for this research is chosen according to data availability.

3.2 Model specification.

Panel data have become available to developing countries and have gained momentum in economic research. Panel data are suitable for this study on the different sub municipalities under the king Cetshwayo district, which are observed over a period of time.

The general model is given by:

$$y_{it} = \alpha_0 + \beta_x X_{it} + \varepsilon_{it} \tag{1}$$

where Y_{it} is the dependent variable, X_{it} is the k-dimensional vector of independent variables and ε_{it} is the error term. This paper will use a log- log model because of the non-linearity in the independent variables.

The log-log model is as follows:

$$\ln Pgdp_{it} = \beta_0 + \beta_{1pop_{it}} + \beta_2 lneduc_{it} + \beta_3 lninc_{it} + \beta_4 lnsav_{it} + \beta_5 lifexp_{it} + \varepsilon_{it} \tag{2}$$

where i=1……5 represents the number of regions and t = 2002…2020 denotes the time periods.

List of variables for panel data model.

Variable abbreviation	Variable name	Explanation
Pgdp	Per capita GDP	Dependent variable, real per Capita GDP per local municipality.
Pop	Population aging	Share of population aged 60 and above in each local municipality.
Educ	Education	Education levels as measured by Literature levels of aged population.
Inc	Income	Disposable income as measuring the ability to pay for health care.
Sav	Savings	Household savings as a percentage of the GDP in each municipality.
Lifexp	Life expectancy	Life expectancy in years, measured by the health adjusted life expectancy of individuals aged 60+

This study applies the Augmented DF to test for a unit root in the individual variables. The Pesaran (2007) augmented the standard Dickey Fuller (DF) regressions with the cross-sectional averages of lagged levels and first differences of the individual series. More so, the Wooldridge test for auto correlation is used because it uses the residuals from regression but in first difference, and this test will be performed using the STATA software (Wooldridge, 2002). To avoid inconsistent results, the White test is used to test for heteroscedasticity because it helps to establish whether the variance of the error term is constant or not by allowing testing for when there is no estimated heteroscedasticity model (Astivia and Zumbo, 2019). This study also employed econometric models which are the FE and a RE models. The Hausman test is used to determine the model best fit for the data. The Hausman test compares the FE model (FE) against the RE model (RE) in order to find a model that best suits the dataset.

4. Empirical results.

Table 2. Summary statistics of the variables.

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP per capita	95	0.033	0.030	0.003	0.124
populationaged60	95	13190.4	5937.44	6244.1	27793.1
Education	95	6.09	1.52	3.29	916.73
Savings	95	10183	158.91	2.283	925.88
Income	95	4580.57	5129.31	408.41	21683.9
Life expectancy	95	53.05	5.09	45.22	61.43

Table 2 shows the descriptive statistics of the variables featured in the panel data model. The number of variables is 95 as the research covers 5 local municipalities in the 2002 to 2020 period, due to the unavailability of data for the main independent variable. The population aged 60+ variable comprises an average of 13 190.48 people over 60, with the minimum number of people aged 60+ being 6 244.1, and the maximum number of the share of the population aged 60+, being 27 793.11.

The average education (mean years of schooling) in the King Cetshwayo District is 6.09 years, while the mean minimum years of schooling is 3.2879 and the maximum is 9.17 years. The gap between the minimum and maximum years of schooling shows the level of inequality in education amongst the different local municipalities. The average savings in the district is R101.83 with the minimum value of savings being R2.28 and the maximum value of savings being R925.87.

Table 3. CD test based on the Pesaran test.

CD test for cross-sectional dependence	
Variable	**CD Test**
GDP log	13.75 ***
populationaged60 log	3.78 ***
Education log	13.78 ***
Savings log	13.77 ***
Income log	13.78 ***
Life expectancy log	13.78 ***

Note: *** denotes statistical significance at 1% level of significance.

The results above show that there is cross-sectional interdependence amongst the different municipalities observed in this study as the P values of all the variables are found to be statistically significant.

FE/RE model for regression.

The panel data analysis allows us to choose the model best fit for the data between the FE model and the RE model. Table 4 below shows the regression outputs of both the FE and the RE regression models.

Table 4. FE and RE regression models.

VARIABLES	FE	RE
Population Log	-0.727***	0.341***
	-0.073	-0.114
Life exp. Log	0.134	1.304***
	-0.161	-0.289
Income Log	0.964***	-0.204**
	-0.041	-0.079
Savings Log	-0.000	0.016
	-0.005	-0.023
Education Log	0.631***	3.363***
	-0.152	-0.147
Constant	-6.287***	-16.58***
	-0.509	-1.477
Observations	95	95
R-squared	0.995	
Number of municip	5	5

Note: ***, **, * denotes statistical significance at 1%, 5% and 10% level of significance. Standard errors reported in parenthesis.

The Hausman Test of specification.

The Hausman test will be used to determine the model best fit for the data. The Hausman test compares the FE model to the RE model to determine the model best fit for the data. The Hausman test basically tests whether the unique errors are correlated with the regressors. The RE model violates the Gauss Markov assumption of exogeneity if the regressors are correlated with the error term. The following hypothesis will be used for the Hausman test of specification:

H0: The RE model is consistent.

H1: The FE model is efficient.

Table 5. Hausman test results.

	Coef.
Chi-square test value	85.44
P-value	0.000

Coefficients

	(b) Fixed	**(B) Random**	**(b-B) Difference**	**sqrt (diag(V_b V_B)) S.E.**
population log	-0.726	0.340	-1.067	0.338
education log	0.631	3.363	-2.732	0.729
savings logs	-0.000	0.016	-0.016	0.004
income log	0.964	-0.204	-0.168	0.186
Lifeexpectancy_log	0.134	1.304	-1.169	0.735

The results of the Hausman test in Table 5 above shows a p-value of 0.00 which is less than 0.05. Based on these results, we reject the null hypothesis and conclude that the FE model is efficient for this analysis. This is shown by the p-value that is statistically significant at 1% level of significance.

Therefore, the FE model will be used for this study, but the diagnostic tests will have to be run first to ensure that the data is fit for the model.

Unit root tests.

The presence of cross-sectional dependence stated above shows that the unit root tests for the data should be estimated using the second generation of unit root tests. The Fisher test (based on the Augmented Dickey Fuller test) will be used for this estimation, since it allows for the estimation of unit roots in unbalanced panel data sets.

Table 6. Unit root tests at levels and at first difference based on Augmented Dickey Fuller test.

Fisher Type Unit Root Test Results		
Variable name	**Augmented Dickey Fuller Test**	**ADF test (First Differences)**
GDP Log	1.296	18.723 ***
Life exp. Log	0.664	27.889 ***
Population aged 60 Log	1.469	4.787
Income Log	67.609 ***	2.598
Education Log	28.905 ***	0.243
Savings Log	6.073	39.762 ***

Note: *** denotes statistical significance at 1% level of significance.

The results in Table 6 above show that most variables are stationary at first difference while two independent variables are stationary at only levels. The dependent variable (GDP log) is stationary at first difference and as a result the log variables will be first differenced for the sake of the regression model. Only the population aged 60+ variable was not stationary at level and at first difference.

Table 7. Heteroscedasticity test results.

	White test
Chi-square test	71.10
P-value	0.0000

Table 7 above, shows the results of the White test for heteroscedasticity. The p-value of the test is less than 5% and as a result we reject the null hypothesis which says that there is homoscedasticity in the data. The regression model will have to correct for the heteroscedasticity effect to avoid biased results, the model uses robust standard errors in order to correct for the presence of heteroscedasticity in the data.

Regression output.

The diagnostic tests above show that there is cross-sectional dependence and heteroscedasticity in the data and, as a result, the FE model as determined by the Hausman test will have to account for all that in order to avoid biased estimates. The robust standard errors will be used to correct for such errors. The regression is estimated based on the differenced log levels of the data, as the dependent variable was found to be stationary at first difference and was statistically significant.

Table 8 shows the regression outputs of the FE (with robust standard errors). This research uses the FE model, and the interpretation is based on that model. Robust standard errors are useful in panel data because the errors can have heteroscedasticity or auto correlation, and it is important to use clustered errors to handle such issues. The robust standard errors lead to improved results and more significant coefficients and are, therefore, preferred for this study.

Table 8. FE model.

VARIABLES	FE with robust errors
Population Log	-1.254***
	(0.121)
Life exp. Log	0.166
	(0.210)
Income Log	0.651***
	(0.047)
Savings Log	0.005*
	(0.002)
Education Log	1.440**
	(0.366)
Constant	0.012*
	(0.004)
Observations	90
R-squared	0.656
Number of municipalities.	5

Note: ***, **, * denotes statistical significance at 1%, 5% and 10% level of significance. Standard errors reported in parenthesis.

Estimation results.

The results shown in Table 8 that the population aged 60+ variable as well as the income variable were found to be statistically significant at 1% level of significance. Only the education variable was found to be statistically significant at 5% level of significance. The savings variable was found to be statistically significant at the 10% level of significance. The R-squared value of 0.656 means that 65.6% of the variation in the dependent variable is explained by the independent variables. The R-squared shows that 65% of the data fits the regression model.

Westerlund test of long-term relationship.

The Westerlund test of co-integration determines whether error correction exists for individual panel members or for the panel as a whole. The test is preferred because it allows for even the largest degrees of heterogeneity both in long-run co-integrating relationships and short-term dynamics. The Westerlund test of co-integration was used to estimate whether there is a long-run relationship between the population aged 60+ variable and the GDP per capita. The following hypothesis were used for the Westerlund test:

H0: No co-integration.

H1: Some panels are co-integrated.

Table 9. Co-integration test results.

Statistic	Value	Z-value	P-value
Gt	0.895	9.052	1.000
Ga	2.626	4.882	1.000
Pt	-0.832	4.533	1.000
Pa	-6.907	0.766	0.778

Table 9 above shows the results of the Westerlund test for co-integration. The (Pt) and (Pa) statistics are the two panel statistics through which the hypothesis will be tested. The two panel statistics are statistically insignificant and as a result they give evidence that we cannot reject the null hypothesis of no co-integration. The results above show that there is no co-integration or long-run relationship between the share of the population aged 60+ and GDP per capita. The test rejects the existence of co-integration between the two variables, and thus we have to rely on the FE model determined by the Hausman test to define the relationship between population aging and GDP per capita.

Testing for causality between population aging and GDP per capita.

The results above confirm that there is no long-run relationship between population aging and economic growth. The next step is to determine whether population aging causes economic growth or vice versa. The Granger non-causality was used to test whether population aging causes GDP per capita or not. This causality test was adopted to test for heterogeneous panels. The following hypothesis were used for the Granger causality test:

H0: Population aging does not Granger cause GDP per capita

H1: Population aging does Granger cause GDP per capita

Table 10. Causality test results.

Dumitrescu and Hurlin (2012) Granger non-causality test		
Lag order	= ²	
W-bar	=0.595	
Z-bar	=-0.639	(P-value= 0.522)
Z-bar tilde	=-0.677	(p-value= 0.497)

The results above show that both the Z-bar and the Z-bar tilde statistics are statistically insignificant, as the P-values are above 0.05. These results confirm that the share of the population aged 60 and above does not cause economic growth as measured by GDP per capita. The results give evidence that the null hypothesis cannot be rejected. The test above concludes that population aging does not cause GDP per capita and leads to the ultimate conclusion that there is no causal relationship between population aging and GDP per capita.

Discussion.

The population aged 60+ variable is found to negatively affect economic growth per capita. A 1% increase in the share of the population aged 60 and above leads to a 1.25% decrease in economic growth as measured by GDP per capita. These findings confirm findings by Dao (2012) as well as studies by Ogunjimi and Oladipupo (2018), who concluded that there is a negative relationship between population aging and economic growth. The life expectancy variable is not statistically significant, and, as a result, we cannot rely on the positive effect that life expectancy has on economic growth. The results of the life expectancy variable confirm findings by Barro (2013), who found that the life expectancy variable is positive but not statistically significant when explaining the variation in GDP per capita. An increase in the level of education is associated with an increase in economic growth. An additional year of schooling leads to a 1.44% increase in economic growth as measured by GDP per capita. These findings confirm findings by Barro (2013), who found that an increase in the mean years of schooling positively affects the growth of GDP per capita.

The rate of savings was found to positively affect the growth of per capita GDP. A 1% increase in the rate of savings leads to a 0.0045% increase in economic growth as measured by GDP per capita. These results are aligned with findings by Misztal (2011), who found a positive and causal relationship between the rate of savings and economic growth. The disposable income variable was positively associated with economic growth, with a 1% increase in disposable income leading to a 0.65% increase in economic growth as measured by GDP per capita. The regression model found that population aging has a negative impact on GDP per capita, thereby addressing the aim of this research, which was to determine how population aging is related to economic growth. The results conclude that population aging negatively affects GDP per capita in the King Cetshwayo District Municipality.

Conclusions and recommendations.

This study reveals that population aging (share of population aged 60+) only affects economic growth in the King Cetshwayo District Municipality in the short run. Of the respondents, 79.3% reported that they had no savings, which shows the importance of teaching the older population about the concept of saving. The level of education and the level of savings were found to positively affect GDP per capita. This study recommends Investing in educating the older population about the issue of population aging would go a long way toward improving the economic growth per capita as well as the economic wellbeing of the older people in the district municipality. This study posits a transformation in the country's savings by educating the population about the importance of saving in order to improve GDP per capita and the economic wellbeing of the people. The retirement policies, health care infrastructure, and education initiatives currently in place in South Africa need to be aligned with the findings of relevant literature like this study. Research shows that factors such as education, income, and savings lead to increased GDP per capita, and as a result, policy interventions will have to ensure improved education, infrastructure, and a higher income generated for the district in order to have higher economic growth.

Data limitations have been the greatest setback for this research. The panel data analysis only focused on one district municipality for the period 2002–2020. The data also excludes the Ntambanana local municipality, as this municipality was split between two districts. It would be interesting to explore the impact of population aging on different districts by comparing the findings of this study with the impact that population aging may have on another district municipality in the KZN province. Further research could be done to study the impact population aging has on South Africa by employing a panel data set of all the district municipalities in the country.

REFERENCES

1. Adanlawo, E.F. and Nkomo, N.Y. (2023). The implications of population aging on local health care expenditure: A 22-year panel data analysis. *International Journal of Innovative Technologies in Social Science*, 3(39).
2. Astivia, O.L.L. and Zumbo, B.D. (2019). Heteroscedasticity in multiple regression analysis: what it is, how to detect it and how to solve it with application in R and SPSS. *Practical assessment, Research and Evaluation*, 24(1): ISSN 1531-7714.
3. Barro, R.J. (2013). Education and economic growth, CEMA Working papers 571. China Economics and Management Academy, Central University of Finance and Economics.
4. Bloom, D.E., Canning, D. and Fink, G. (2010). Implications of population aging for economic growth. *Oxford review of economic policy*, 4: 583-612.
5. Chaka, M. and Adanlawo, E.F., (2023). The Impact of Communication Management on National Development Plan: A South African Case Study. *Journal of African Films and Diaspora Studies*, *6*(2).
6. Chang, T., Chu, H-P., Deale, F.W. & Gupta, R. (2014). The relationship between population growth and economic growth over 1870-2013: Evidence from a bootstrapped panel-granger causality test. *Working paper* 2014-31.
7. Dao, M.Q. (2012). Population and economic growth in developing countries. *International Journal of Academic Research in Business and Social Sciences*, 2(1): 6-17.
8. Goodrick, W.F. (2013). Policy implications and challenges of population ageing in South Africa. Doctoral dissertation, University of the Free State.
9. Jayawardhana, T., Anuththara, S., Nimnadi, T., Karadanaarachchi, R., Jayathilaka, R. and Galappaththi, K., (2023). Asian ageing: The relationship between the elderly population and economic growth in the Asian context. *Plos one*, *18*(4), p.e0284895.
10. Lee, H,-H., Shin, K., Park, D. (2017). Population aging and its impact on economic growth: implications for Korea. *Economic Analysis*, ESRI 196,156-178.
11. Maestas, N., Mullen, K.J. and Powell, D. (2016).The effect of population aging on economic growth, the labour force and productivity. Rand Labour and Population.
12. Misztal, P., (2011). The Relationship between Savings and Economic Growth in Countries with Different Level of Economic Development. *Internetowy e-Finanse*, *7*(2), pp.17-29.
13. Muggeridge, P.E. (2015). The implications of population aging for economic growth: regional comparative study. Honors Thesis. Duke University.
14. Nelson, P. and Masel, J. (2018). Aging is still inevitable. Reply to Mitteldorf and Fahy: Aging is still inevitable.
15. Proceedings of the National Academy of Sciences, 115(4):201720890. DOI: 10.1073/pnas.1720890115.

16. Nkomo, N.Y. & Adanlawo, E.F. (2023). The implications of population aging on savings rates. Management and Entrepreneurship: Trends of Development, 2(24), 8-16. DOI 10.26661/2522-1566/2023-2/24-01.
17. Ogunjimi, J.A. and Oladipupo, D.O. (2018). Dynamics of demographic structure and economic growth in Nigeria.
18. MPRA Paper no. 94988. Available at: https://mpra.ubiuni-muenchen.de/94988/.
19. Pesaran, M.H. (2007). A simple panel unit root test in the presence of cross section dependence. *Journal of Applied Econometrics*, 22: 265-312.
20. Pham, J.N.& Vo, D.H. (2019). Ageing population and economic growth in developing countries: A quantile regression approach. Business and Economics Research Group, Ho Chi Minh City Open University, Vietnam. MPRA paper no. 103279.
21. Tshabalala, N., Simo-Kengne, B.D. and Dikgang, J. (2018). The impact of demographic structure on saving and the current account in South Africa. *Journal of Macroeconomics*, 46: 147-159.
22. Wooldridge, J.M. (2002). *Econometric analysis of cross section and panel data.* Cambridge: The MIT Press.