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How Demographic and Fiscal Policy Shocks Affect Per Capita Income: Evidence from Zambia's Orthogonalized Impulse Response Analysis

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Abstract

Globally, driving socio-economic development is a primary government objective, yet various policy and demographic factors often hinder success. This paper models how demographic shifts and fiscal policy impact income-based socio-economic outcomes. Using Zambia's time-series data from 1975 to 2023, we conducted a cointegration analysis on first-order integrated variables and quantified the impact sizes using the orthogonalized impulse response functions.

The long-run analysis reveals that demographic variables, that is working-age population, life expectancy, and dependency ratio, positively affect per capita GDP. Conversely, taxation levels exert a negative long-run effect, while government expenditure is statistically insignificant. Specifically, a unit shock to the working-age population triggers a non-transitory orthogonal increase in per capita income, rising from 1.4 percent in year one to 9.2 percent by year ten. Shocks to life expectancy and the dependency ratio yield similar non-transitory gains, rising to 22.2 percent and 39.2 percent by the tenth year, respectively. In contrast, a unit shock to taxation reduces per capita income by 4.8 percent initially, worsening to a 9.1 percent decline by year ten.

Consequently, we conclude that demographic shifts and taxation are critical drivers of Zambia's per capita GDP growth, with taxation causing adverse long-run effects despite producing short-run expansionary benefits. We recommend that Zambia implement policies to sustain working-age population growth and restructure its fiscal framework, shifting government spending from consumption to investment, productive spending, to escape the developing-world underdevelopment trap.

Keywords: per capita income, demographic, socio-economic development, fiscal policy, orthogonalized impulse response.

Introduction

Demographic and fiscal shocks are critical drivers of socio-economic development. In developed countries, rapid population ageing imposes a severe fiscal burden. In developing nations, these shocks disrupt labour supply, revenue mobilization, and public expenditure paths.

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Pessimists argue that rapid population growth strains socio-economic infrastructure, leading to lower per capita income, diminished living standards, food insecurity, reduced educational attainment, wider income gaps, and poverty-threats which many African countries like Zambia, are facing. Bloom et al. (2003) noted that expanding populations require substantial infrastructure, housing, and factories, which ultimately dilutes capital per worker and stalls growth. Conversely, optimists view population growth as an economic asset. It is for this reason that highly industrialized nations have leveraged large populations to achieve fiscal sustainability, aligning with Kuznets' (1960) theory that larger societies utilize economies of scale to foster, exploit, and spread human ingenuity.

The economic impact of demographic shifts depends heavily on age structure, life expectancy, and dependency ratios. A rising share of working-age individuals yields a two-phase "demographic dividend." Apella (2021) explained that the first phase occurs when declining child dependency and peak labour-force levels boost GDP and short-term savings. The second phase emerges as these accumulated savings drive deeper investment in human and physical capital. In contrast, Coale and Hoover (1958) argued that sustained increases in youth or elderly populations divert public funds from developmental projects to non-productive consumption, raising dependency ratios and retarding growth.

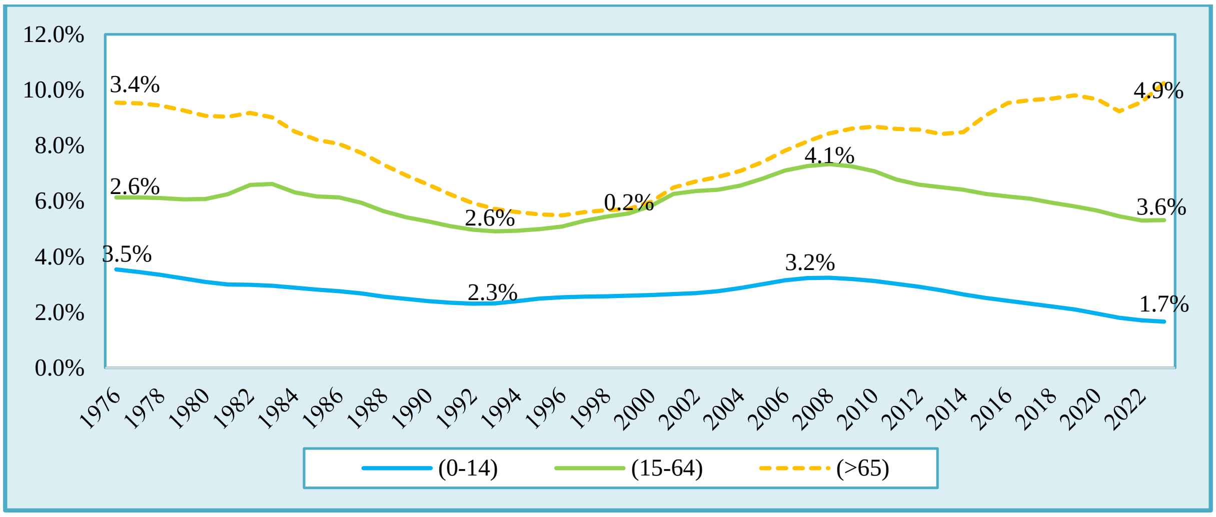
According to demographic transition theory, rising life expectancy reflects better living standards, superior healthcare, and lower morbidity, which collectively enhance national output. Butt et al. (2019) observed that longer life expectancy drives growth because healthier citizens delay retirement and remain productive longer.

The positive fiscal leverage generated by a large working-age population, low dependency, and high longevity can expand per capita income through targeted public investments, sustainable social protection, and stimulated consumption. Conversely, independent fiscal shocks also alter per capita income via tax policy adjustments, government investments, and welfare spending, which reshape labour supply, investment, consumption, and production. For example, high personal income taxes can discourage labour supply, lowering personal earnings, aggregate demand, and total output.

Balasoiu et al. (2023) noted that heavy taxation creates dual labour effects: individuals either cease working or take on secondary work to maintain income levels. For corporate bodies, Shultz and Harriss (1954) argued that excessive corporate and profit taxes diminish prudent business management. Furthermore, high taxes depress corporate capital, savings, investment, and credit access (Balasoiu et al., 2023). This combined contraction of personal labour and corporate capital accumulation ultimately reduces national output and per capita income.

Zambia reflects these shifting dynamics. As presented in Figure 1 below, between 1975 and 2023, its total population grew by an annual average of 2.6 percent. During this period, the population of under 15 grew by 2.7 percent annually, while the elderly population grew by 1.9 percent. Although the working-age population led with a 3.3 percent average annual growth rate, recent trends show that elderly population growth has begun to outpace both the working-age and younger cohorts.

Figure 1: Population Growth Rates per Age Category (1975-2023)



Source: Author's graphical presentation from WDI and WEO Data Computation

On the revenue side of fiscal policy, literature establishes a strong connection between taxation levels and socio-economic development via per capita income and GDP growth, though the exact relationship remains mixed. Menescal and Alves (2023) observed that for low-income nations in the short run, increasing total taxation up to a threshold of 25 percent of GDP acts progressively regarding per capita GDP growth. This is supported by Van Dinh (2022), who argued that per capita income rises alongside the tax-to-GDP ratio up to optimal thresholds, which were calculated at 24 percent for South Africa, 10.3 percent for the USA, and 19 percent for Vietnam. Stoilova (2024) also examined 27 EU nations and concluded that the overall tax burden has a positive impact on economic growth and per capita GDP.

In contrast, İmamoğlu (2023) discovered that higher tax burdens hinder growth in low-growth economies, specifically those occupying the 10th to 50th quantiles. However, for affluent economies in the 80th and 90th quantiles, the effect reversed, with higher taxation fostering GDP growth. Utilizing disaggregated data, Alfò et al. (2023) found that high taxation levels harm per capita income, demonstrating that a 10 percent reduction in personal and corporate income taxes modestly boosts per capita income by 1.0 percent and 0.9 percent, respectively.

Regarding the expenditure side of fiscal policy, Ismail and El Houssein (2020) showed that government spending can depress per capita income, finding that a 1.0 percent increase in public expenditure caused a 1.2 percent reduction in per capita income. This contradicts the traditional expectation that expansionary spending boosts income growth. This paradox is often explained by expenditure composition: capital expenditure carries a lagged, long-run impact, whereas current expenditure yields an immediate, short-run impact. This distinction is supported by Lakat et al. (2025), who found that capital spending negatively impacted contemporary GDP and per capita GDP due to delayed returns on infrastructure investments. Conversely, Ahmad and Bhatti (2024) revealed that while capital spending drives positive long-run growth in per capita GDP, current expenditure exerts a distinctly negative long-term effect.

Empirical studies on sectoral public spending also reveal highly diverse outcomes. Gök and Ünlüoğlu (2026), Odetola et al. (2025), and Alam et al. (2022) all established that sectoral government spending significantly affects per capita GDP and economic growth. Evaluating education and healthcare, Gök and Ünlüoğlu (2026) found positive impacts across African Union (AU) nations but negative impacts within European Union (EU) nations. Odetola et al. (2025) determined that both capital and recurrent expenditures on education positively influence per capita GDP. However, only capital health expenditure yielded positive returns, while recurrent health spending had a negative impact. These negative health spending effects are partially echoed by Alam et al. (2022), who found that overall health expenditures drag down economic outcomes, though they confirmed that overall education spending remains highly growth-progressive.

In summary, existing literature yields highly divergent conclusions regarding how demographic transformations and fiscal policies shape per capita income. These mixed empirical findings highlight deep methodological and contextual gaps in the literature. Such discrepancies necessitate deeper, localized investigation, particularly within developing countries such as Zambia.

Data and Methods

Data

In this study, we employed time series data covering the period 1975 to 2023. The main sources of this dataset included the World Economic Outlook (WEO), World Bank's world development indicators, Ministry of Finance, Zambia, and Zambia Revenue Authority.

Empirical Model

Our empirical model was built on the following structural equation:

$$PCI_t = \lambda_0 + \lambda_1 PWP_t + \lambda_2 LXP_t + \lambda_3 PDR_t + \lambda_4 TAR_t + \lambda_5 GXP_t + \omega_t \quad (1)$$

Where; PCI_t, per capita income, PWP_t is the ratio of the population aged between 15 and 64 years to total population, LXP_t is life expectancy at birth in years, PDR_t is the total population dependency, measured as the number of under 15 years population and over 64 years to the working population. TAR_t is the tax-to-GDP ratio, and GXP_t is government expenditure measured as a percentage of GDP. λ measures the elasticity of per capita income to growth in the independent variables. ω_t is the stochastic term.

For the effect size, we used the orthogonalized impulse response to ascertain how much a unit shock applied to the variable affects the response of the dependent variable, in this case per capita GDP. The general impulse response function is derived from Ross (2004) and is given as;

$$y_{t+n} = \sum_{i=0}^{\infty} \psi_t \epsilon_{t+n-i} \quad (2)$$

And the Orthogonalized impulse response function derived from the general impulse response function is given as in Ross (2004) as;

$$\frac{\partial y_{it+n}}{\partial u_{jt}} = \{\psi_i A\}_{ij} \quad (3)$$

Where u_{jt} is the shock to the economic relation of the ith term, and y_{t+n} is the one-time response to impulse in y_t at time t.

Results and Analysis

Cointegration Analysis

The first step in our analysis was to establish stationarity and the order of integration of the series. Augmented Dick Fuller (ADF) test was employed in the unit root test. Based on Wooldridge (2020), our unit root was estimated as;

$$\Delta y_t = \alpha + \delta t + \rho y_{t-1} + \rho_i \sum_{i=1}^{k-1} \Delta y_{t-k} + \varepsilon_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (4)$$

Where; y_t and y_{t-1} are the series of interest at time "t" and "t-1" respectively, Δy_{t-k} is the lagged value of y at lag k, where k is the number of lags. δt is the time trend of the series. This test is such that $\rho = 1$. The ADF results are summarised in

Table 1.

Table 1: ADF Test Summary Results

S/No	Variable Name	PV at Level	PV at 1st Diff	Conclusion
1.	LPC	0.7403	0.0001	I(1)
2.	PWP	0.1992	0.0012	I(1)
3.	TAR	0.0567	0.0000	I(1)
4.	GXP	0.4343	0.0022	I(1)
5.	LXP	0.9881	0.0005	I(1)
6.	PDR	0.9963	0.0048	I(1)

Source: Extracts of Stata Output of the Analysis of the Time Series Data

Our test showed that all variables were integrated of order one I(1) and exhibited possible cointegration in line with Gujarati (2012).

Given that the variables were integrated of the same order, I(1), we tested for cointegration with Johansen test. This tests for the existence of the long run relationship between variables and was built on the Vector Error Correction of the form in line with Johansen (1988) and Hjalmarsson & Österholm (2007) expressed as;

$$\Delta y_t = v_t + \pi y_{(t-1)} + \sum_{i=1}^{\rho-1} \Gamma_i \Delta y_{(t-1)} + \epsilon_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (5)$$

Where; Δy_t is vector of first differences of variables at time "t", v_t is vector of deterministic term which depends on the assumed properties of the data, π is long-run coefficient matrix, $y_{(t-1)}$ is the vector of the lagged level variables such that $\pi y_{(t-1)}$ is the error correctional term which captures the speed of adjustment of the short-term model to long term equilibrium, Γ_i is the short-run coefficient matrices which capture the short-term adjustments among the variables, and $\varepsilon_{(t)}$ is vector of the random error term.

Our test results for cointegration are summarised in Table 2.

Table 2: Johansen Cointegration Test Analysis

Johansen tests for cointegration

Trend: constant — Number of obs = 47

Sample: 1977 - 2023 — Lags = 2

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value	1% critical value
0	42	689.50904		125.5124	94.15	103.18
1	53	717.86952	0.70086	68.7914*1	68.52	76.07
2	62	731.66679	0.44407	41.1969*5	47.21	54.46
3	69	743.68633	0.40039	17.1578	29.68	35.65
4	74	748.74048	0.19351	7.0495	15.41	20.04
5	77	750.90884	0.08814	2.7128	3.76	6.65
6	78	752.26523	0.05608			

maximum rank	parms	LL	eigenvalue	max statistic	5% critical value	1% critical value
0	42	689.50904		56.7210	39.37	45.10
1	53	717.86952	0.70086	27.5945	33.46	38.77
2	62	731.66679	0.44407	24.0391	27.07	32.24
3	69	743.68633	0.40039	10.1083	20.97	25.52
4	74	748.74048	0.19351	4.3367	14.07	18.63
5	77	750.90884	0.08814	2.7128	3.76	6.65
6	78	752.26523	0.05608			

Source: Stata Output of the Analysis of the Time Series Data

With trace statistics under the null hypothesis of no cointegration at a given ranks, the decision is to reject the null hypothesis when the trace statistic is less than the critical value of a desired significance level. This method can be interpreted according to Winarmo, et al., (2021) as a test of whether the rank of the matrix Π is r0. When using the maximum statistics, we reject the null hypothesis when the maximum eigenvalue statistics is less than the critical value. The intuition behind the maximum eigenvalue test is that it examines whether the largest eigenvalue is zero against the alternative that the next largest eigenvalue is zero (Winarmo, et al., 2021). The first test, we tested whether the rank of the matrix Π is zero under the null hypothesis that rank (Π) is equal to 0 and the alternative hypothesis that rank (Π) is greater than 1 in line with Johansen (1988).

Given the trace statistics results, we rejected the null hypothesis at rank 2. This means that there was evidence of the existence of the long run equilibrium relationship between the dependent and the independent variables. This is true at 5 percent while at 1 percent level of significance, cointegration was established at rank 1. Additionally, the maximum eigenvalue test also confirms these results at rank 2 at 5 percent level of significance.

Since variables were found to have a long run equilibrium relationship, we estimated a VEC model. The VEC models according to Stata (2025) are used to model the stationary relationships between multiple time series that contain unit roots. The model produces both long run and short run equations. We present the results of the long run cointegration test in Table 3.

Table 3: Long Run Cointegration Equation

Johansen normalization restriction imposed

beta	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_ce1						
LPC	1	.	.	.	.	.
PWP	-85.69965	20.21642	-4.24	0.000	-125.3231	-46.07619
LXP	-.1460823	.0106105	-13.77	0.000	-.1668785	-.1252861
PDR	-25.07706	5.846844	-4.29	0.000	-36.53667	-13.61746
TAR	18.20257	1.459112	12.48	0.000	15.34276	21.06238
GXP	-.7482816	.40356	-1.85	0.064	-1.539245	.0426814
_cons	66.31113	.	.	.	.	.

Source: Stata Output of the Analysis of the Time Series Data

Our findings indicated that in the long run, all variables, except government expenditure, are statistically significant in explaining the long run equilibrium in the per capita income. Specifically, we found a positive long run impact of population proportion for age category 15 to 64 years on per capita income. Further, we found a positive significant impact of population dependency ratio, and life expectancy on per capita income. On the impact of taxation levels on per capita income, we found that increasing taxation has negative significant impact on per capita income, while government expenditure was found to have no long run effect on per capita GDP.

Specifically, our findings indicate that in the long run a percentage point increase in the proportion of the working-age population will ceteris paribus, increase the per capita income by 85.7 percent. The results indicate that as the proportion of working-age grows, there is significant growth in the per capita income. The positive long run effect of the working-age population is consistent with our priori expectation on the contribution of the stock of the working-age. Our findings also confirm the economic importance of the working-age population, if supported by baby boom, should give enough impetus for the increased national output. And while this is true, we suggest that the growth in the proportion of the working-age population be supported by improvements in the education systems so that this proportion will not just be quantity of labour supply but quality of labour supply. The results are consistent with the findings by Brakman, et al., (2024) who found that that a 1.0 percent increase in this share of working-age population correlates with a 0.173 percentage points rise in income growth rate, and Islam & Roy (2024) who, on the contribution of the first demographic dividend on the growth rate of real GDP per capita in Bangladesh, found that demographic dividend positively impacts GDP per capita growth at 4.47 percent.

Our results on life expectancy indicate that in the long run, an increase in life expectancy by one year will result in 0.15 percent increase in per capita income, holding other variables constant. Again, these findings are consistent with our priori expectation that increase in life expectancy has a positive effect on growth in per capita income. Notably, increase in life expectancy signifies improvements in health of the citizens and hence, enhanced productivity. The concern of the country is to have a healthy and vibrant working-age population which is expected to trickle down to increased productivity. The increased life expectancy is also expected to increase the working-age profile of the citizens, and hence reduce age-dependency of the country. Our findings are consistent with those by Swift (2011), that showed that 1.0 percent increase in life expectancy in the long run results in an average, 6.0 percent increase in total GDP and 5.0 percent increase in GDP per capita. Similarly, the findings are consistent with Neofytidou & Fountas (2020) who found that life expectancy (total, male, and female), had significant positive effect on GDP and GDP per capita.

On total dependency ratio, we found that in the long run a percentage point increase in the dependency ratio will on average increase per capita income by 25.1 percent. The outcome is against our priori expectation that the increase in the population dependency ratio is expected to take toil on per capita income. However, the existence of the positive long run relationship can be attributed to increased life expectancy and the increase in the retirement age. As this is total dependency, our results point to the evidence of a baby-boom, which coupled with longevity, is expected to yield positive outcome on per capita income. While we, and Ahmad & Ali-Shah (2021) found a positive significant long run relationship between population dependency and per capita income, Brahma (2021), and Bădicioiu & Jianu (2025), found a negative relationship between per capita income and age dependency ratio. However, the contradiction in the outcome could be explained by different focus of the studies as Brahma (2021), and Bădicioiu & Jianu (2025) focused on old-age dependency while we focused on total population dependency which captures the baby-boom and old-age.

Overall, on the demographic shifts in terms of changes in population composition and structure (proportion of working-age, life expectancy, and dependency ratio), we found significant positive long run impact on per capita income.

On fiscal policy, we established that a percentage point increase in the taxation level (as a percentage of GDP) in the long run, is associated with a reduction in per capita GDP by an average of 18.2 percent, and that a percentage point increase in the government expenditure (as a percentage of GDP) will result in an average of 0.74 percent increase in per capita income, ceteris paribus, though this effect is statistically insignificant. These findings support the findings by Vassilios (2021) who, using data for Greece, Germany, Italy, and Portugal over the period 1995 to 2018 with disaggregated tax revenues, found that for Germany, raising direct and indirect taxes as percentage of GDP has a negative impact on the GDP per capita growth rate. And on Italy, he found that raising any tax as percentage of GDP lowers the GDP per capita growth rate. He further found that for Portugal, increasing direct taxes as a percentage of GDP lowers the GDP per capita growth rate. For Greece, Vassilios (2021) found that increasing direct taxes had a countereffect on growth of per capita GDP. Our findings are also consistent with those by Alfò, et al., (2023) which showed that for Germany, Spain and the US, increasing the tax-to-GDP ratio will negatively affect per capita GDP.

We see the long run negative effect to be emanating from the possible choking-effect that higher taxation has on individuals as well as firms. Higher taxation negatively affects the individuals by altering their consumption behaviour and may substitute labour for leisure or earn below the set taxable threshold, which then reduces their average income. On the part of the firms, higher taxes reduce their profitability and hence motivates business to reduce their investment and production in order to pay less taxes or pay low wages to workers. The combined effect is thus, a fall in per capita GDP of the country.

The positive impact of government expenditure on per capita GDP could be attributed to the trickle-down effect that government expenditure has in improving socio-economic development. These findings are consistent with the findings by Ngo & Phung (2024) who, with disaggregated government expenditure, found that government capital expenditure had a positive correlation with local GDP per capita, and Owusu-Mensah, et al., (2023), who found that government spending had a positive impact on both short- and long-term economic growth as measured by per capita income.

In the short run as captured by the Error Correction Term (ECT) in

Table 4, we found that only lagged values of GDP per capita, dependency ratio and taxation levels have impact on current per capita GDP.

Table 4: Vector Error Correction Model

Vector error-correction model

Sample: 1977 - 2023		Number of obs	= 47
		AIC	= -28.29232
Log likelihood = 717.8695		HQIC	= -27.50722
Det(Sigma_ml) = 2.18e-21		SBIC	= -26.20598

Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_LPC	8	.16677	0.2863	15.64218	0.0478
D_PWP	8	.001062	0.8310	191.7971	0.0000
D_LXP	8	.60382	0.5737	52.49388	0.0000
D_PDR	8	.001079	0.9856	2676.178	0.0000
D_TAR	8	.016077	0.2621	13.8553	0.0856
D_GXP	8	.07204	0.1508	6.92362	0.5449

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_LPC						
_ce1						
L1.	-.4678833	.1423102	-3.29	0.001	-.7468062	-.1889604
LPC						
LD.	.4250597	.1552913	2.74	0.006	.1206943	.729425
PWP						
LD.	14.49636	28.13392	0.52	0.606	-40.64511	69.63784
LXP						
LD.	.0171348	.0343021	0.50	0.617	-.050096	.0843657
PDR						
LD.	29.85698	11.98288	2.49	0.013	6.370962	53.343
TAR						
LD.	4.287953	1.884557	2.28	0.023	.5942894	7.981616
GXP						
LD.	-.3946023	.3448276	-1.14	0.252	-1.070452	.2812474
_cons	-.0422762	.0423246	-1.00	0.318	-.1252308	.0406784

Source: Stata Output of the Analysis of the Time Series Data

Interestingly, the sign on the taxation levels in short run is opposite to the sign in the long run model. This outcome can be attributed to increase in expenditure on direct social services such as raising sufficient revenue to fund social cash transfers and other social security programmes like food security programmes, and increased allocation to other targeted consumption related programmes. The other reason could be that in the short-term, increasing taxation levels does not immediately affect firms due to time lag when firms and households will have to make economic decisions, adjust spending, and undertake tax planning to cope with increased taxation levels. Such undertaking can only manifest in the long run in which higher taxations may result in capital and labour mobilities. Our short run results are consistent with the findings by Vassilios (2021) on; Greece, Portugal, Germany and Italy, in which GDP per capita growth increased with increased indirect taxes. However, they contradict Riba (2016) on South Africa who found that in the short run, increasing all taxes had an adverse effect on economic growth, though his findings were not on per capita income but overall economic growth.

The positive short run effect of dependency ratio on per capita income indicate that the direction of the effect is the same, both in the short run and long run. This could be attribute to increase in government transfers, including pension payments especially to the aged. We further find these results to signify the return that accrue to the population category of above 64 years. When the return is higher, this age category continues to record earnings relatively comparable to the working-age and this will enhance per capita income of this age category. The results are however contrary to priori expectation as increased dependency ratio is expected to reduce resources for investment, hence affecting earnings.

Further, the importance of the lagged values of per capita income cannot be overemphasised. The higher past values of the capita income indicate improvements in the social and economic infrastructure of the country. The state of this infrastructure will act as a catalyst for the future production capacity of the country. We note that high past values of per capita income entail sufficiency of resources to enable individuals to invest and increase future earnings. Thus, the findings are in line with our priori expectation of long run convergence.

We further found that annually, the short run dynamics adjust back to the long run equilibrium state at the rate of 47 percent. Given the adjustment rate of 47 percent of the model, we found the adjustment rate to be moderately fast as it is almost equal to 50 percent. Thus, all deviations in the short run are adjusted towards the long run at the rate of 47 percent.

Effect size Estimation

Having tested the model for autocorrelation, normality and stability, our next step was to estimate the effect size based on the impulse response, which measures the magnitude of the effect on the dependent variable, of applying a shock or one standard deviation to the target or explanatory variable. Parker (2017) defines impulse response function as a measure of the dynamic marginal effects of each shock on all of the variables over time. According to Pesaran & Shin (1997), impulse response function measures the time profile of the effect of shocks at a given point in time on the (expected) future values of variables in a dynamical system (Pesaran & Shin, 1997). In this model, we adopted the orthogonalized impulse response which according to Stata (2025), measures the effect of an orthogonalized shock to an endogenous variable on itself or another endogenous variable in a specified order (Stata, 2025). The results of the orthogonalized response function over a ten-year period are given in Table 5.

Table 5: Cumulative Orthogonalized Impulse Response

step	(1) coirf	(2) coirf	(3) coirf	(4) coirf	(5) coirf
0	0	0	0	0	0
1	.014819	.035966	.039117	-.048288	-.003164
2	.018216	.079595	.095233	-.148648	-.003926
3	.022349	.112536	.148947	-.263539	-.003576
4	.030028	.132066	.19269	-.367657	-.004092
5	.039445	.145939	.229807	-.461546	-.0041
6	.049498	.159787	.264496	-.552136	-.003623
7	.059806	.17475	.298094	-.64249	-.003
8	.070425	.190408	.330598	-.732751	-.002377
9	.081406	.206415	.36191	-.82253	-.001776
10	.092724	.222702	.392105	-.911733	-.001175

(1) irfname = vecirf, impulse = PWP, and response = LPC
(2) irfname = vecirf, impulse = LXP, and response = LPC
(3) irfname = vecirf, impulse = PDR, and response = LPC
(4) irfname = vecirf, impulse = TAR, and response = LPC
(5) irfname = vecirf, impulse = GXP, and response = LPC

Source: Stata Output of the Analysis of the Time Series Data

Given these results, we found that that a unit shock applied to the working-age population has an effect on per capita income of 1.4 percent in year one which keeps increasing steadily with an additional year and yields an effect of 9.2 percent in year 10. Similarly, a unit shock applied to life expectancy has an effect of 3.6 percent, which tends to increase for each additional year, yielding 22.2 percent in the 10th year. In terms of a shock to dependency ratio, the study found that a shock in the first period has an effect of 3.9 percent, which like the effect of working-age population and life expectancy, increases and in the 10th year, this effect is 39.2 percent. On the other hand, we found negative effect on per capita income of a unit shock applied to taxation levels. This effect starts of at around 4.8 percent, and the magnitude of the negative effect increases to 9.1 percent in the 10th year while we found the impulse of government expenditure to be close to zero, signifying a no relationship with per capita GDP.

Notably, we found the effect on demographic shifts, that is proportion of working-age, life expectancy, and dependency ratio to be non-transitory. This means that in the long run, these effects are significant in influencing per capita income permanently. Similarly, the effect of taxation was found to be non-transitory as there was no evidence of reversion to zero. However, the effect of government expenditure was negligible and transitory in nature as it meandered around the origin. These results indicate that the effect may just exist in the short term and is negligible.

Conclusion and Recommendations

Our findings demonstrate that the working-age population, dependency ratio, and life expectancy are critical drivers of GDP per capita growth in Zambia. Crucially, expanding the working-age population does more than boost per capita income; it stabilizes the national social security framework. Currently, Zambia enjoys a demographic cushion where 42 active workers support a single pensioner. However, due to an ageing population and slowing workforce growth, this support ratio is projected to collapse to just 3 to 1 within the next 30 years.

Regarding fiscal policy, the data reveals a temporal trade-off: expansionary policies driven by taxation to stimulate GDP per capita in the short run, but harm growth over the long term.

To safeguard Zambia's economic future, we offer two main recommendations:

- **Sustain demographic growth:** Implement targeted policies to maintain a high ratio of active, working-age citizens.
- **Reform fiscal spending:** Re-evaluate the national expenditure framework to aggressively prioritize long-term, investment-oriented projects over immediate consumption expenditure.

Shifting toward these strategic investments is essential to breaking the cycle of socio-economic underdevelopment common to emerging economies.

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