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Population Aging and Ineffectiveness of Monetary Policy in Developing Economies

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Short Report

Keywords: Cointegration, Demography, Economic Growth, Migration, Monetary Policy

Posted Date: November 5th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11225243/v1

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Additional Declarations: No competing interests reported.

Abstract

Recent strands of literature have argued that population aging diminishes the effectiveness of monetary policies. It is not only the OECD countries but also the developing economies that are currently experiencing a declining demographic dividend. The impact of population aging on the effectiveness of conventional monetary policies in developing economies remains underexplored. Using country-level panel data this is the first scholarly attempt to test the hypothesis that population aging diminishes the effectiveness of monetary policies in 15 developing economies. The results of the first-difference fixed-effects estimators with Driscoll-Kraay Covariance strongly support the hypothesis. The policy implications are discussed.

JEL Classification Codes: E52, E58, J11

I. Introduction

When the fertility rate drops and the life expectancy increases at the same time, the proportion of elderly in total population and the old-age dependency ratio, which is the proportion of elderly in working-age population, would increase over time. An increase in the proportion of elderly in both total population and working-age population would lead to an increase in social expenditures and a decrease in tax revenues (as percentages of GDP) for the governments. There could be negative effects on the national saving and investment rates, foreign capital inflows, and per-capita real GDP. In order to meet the rising social expenditures of the government on pension and healthcare for the elderly, the tax burden on the working-age population would increase. It is not only in the advanced economies but also in the developing (emerging) economies in which the proportion of elderly in working-age and total population is increasing. Table 1 shows the increase in the old age dependency ratio in 15 developing economies from 1995 until 2021.

Table 1
Proportion of Elderly in Population

	Old Age Dependency Ratio (% of working-age population)	
	1995	**2021**
Argentina	15.04	18.38
Bangladesh	6.06	9.19
Brazil	7.40	14.24
China	9.10	19.08
India	7.16	9.69
Indonesia	7.21	9.87
Malaysia	6.09	9.99
Mexico	7.55	11.36
Nepal	6.71	9.47
Pakistan	6.61	6.94
Philippines	5.12	7.49
South Africa	7.18	9.28
Thailand	7.02	19.08
Turkiye	8.23	13.78
Vietnam	9.54	11.61
Source: World Development Indicators, World Bank Group		

Recent studies by Imam (2013), Kara and Thadden (2016), Yoshino and Miyamoto (2017, 2019), Wong (2019), Aksoy et al. (2019), Papapetrou and Tsalaporta (2020), Vlieghe (2022), and Chen et. al. (2025), amongst others, have documented how a demographic shift toward older population may significantly diminish the effectiveness of conventional monetary policies for economic growth through the interest rate channel and labor market dynamics. A shrinking workforce would lead to reduced labor supply and labor shortage in key industries, as a result of which aggregate output, consumption, and investment would decrease. Reductions in the labor force participation rate and labor productivity due to population aging may slowdown economic growth in developed economies (Acemoglu and Restrepo, 2017). Aggregate demand for goods and aggregate supply of goods would both decrease. If aggregate demand is less than aggregate supply, then an excess supply of goods result in a deflationary effect; consequently, interest rate would fall. Furthermore, as discussed in Hansen (1939), Summers (2013),

and Acemoglu and Restrepo (2017), since the elderly accumulate savings before retirement, an increase in savings relative to investment would put a downward pressure on interest rates. As interest rates fall and approach the zero-lower bound, the space for monetary easing in a low-interest environment in the event of an economic downturn would be significantly reduced. In the event of a low-output liquidity trap, conventional monetary policies would most likely cease to be effective in stimulating spending and output. Therefore, the regulatory effect of an expansionary monetary policy, i.e., an increase in money supply (% of GDP) will be weaker as the proportion of elderly in total and working-age population increases over time.

Studies that have investigated the ineffectiveness of monetary policies for economic growth in aging economies have focused on select OECD economies. To our best knowledge, only Chen et al. (2025) has focused on a developing economy, China, in their study. The impact of population aging on the effectiveness of conventional monetary policies in developing economies remains underexplored. This study fills the major gap in the literature.

II. Data and the Model

Data

The study uses panel data from 1995–2021 on 15 developing economies that are experiencing a declining demographic dividend, namely, Argentina, Bangladesh, Brazil, China, India, Indonesia, Malaysia, Mexico, Nepal, Pakistan, Philippines, South Africa, Thailand, Turkiye, and Vietnam. The dependent variable is GDP per capita (2015 USD), indexed GDP. The regressors are (1) broad money (% of GDP), indexed BM; (2) old-age dependency ratio, indexed AGE, calculated as the total number of individuals 65 years and above divided by the working age population; (3) gross fixed capital formation (% of GDP), indexed GCF; (4) the total labor force participation rate (% of total population ages 15–64), indexed LF. We introduce a centered interaction term $\left[\left(AGE_{it}-\bar{A}\right)\left(BM_{it}-\bar{BM}\right)\right]$, the coefficient of which gives the effect of an increase in money supply as the proportion of elderly in working-age population increases over time. Annual data on the variables are obtained from the World Development Indicators of the World Bank Group.

Model

We combine a Cobb-Douglas aggregate production function with a Solow growth model. In order to test the hypothesis that population aging weakens the effectiveness of monetary policy, we modify the base model and propose a panel regression of the form

$$(1)\ \Delta\, lnGDP_{it} = \beta_1 \Delta\, GCF_{it} + \beta_2 \Delta\, LF_{it} + \beta_3 \Delta\, AGE_{it} + \beta_4 \Delta\, BM_{it} + \beta_5 \Delta \left[\left(AGE_{it}-\bar{A}\right)\left(BM_{it}-\bar{BM}\right)\right] + \alpha_i + \lambda_t + \epsilon_{it}$$

In Eq. (1), the parameters λ_t and α_i are the time fixed effects and country fixed effects, respectively. The errors ϵ_{it} are independently and identically distributed.

Estimation Method

Preceding to model specification, several diagnostic assessments determined model selection. The Pesaran CD test indicates significant cross-sectional dependence in the residuals, the Wooldridge test presents first-order serial correlation, and the modified Wald test confirm groupwise heteroskedasticity (Pesaran, 2004; Wooldridge, 2002). A Hausman test prefers fixed effects over random effects (Hausman, 1978). Panel unit-root tests deliver combined indications on the order of integration, with no indication of I(2) behavior, but Westerlund cointegration analysis find no vigorous long-run connection among specifications. Such findings support assessing the model in first-differences (Westerlund, 2007).

Given the mixed integration order in short-run and long-run effects, the baseline specification applies the Pooled Mean Group (PMG) estimator within an Error-Correction Model framework (Pesaran, Shin, & Smith, 1999). The baseline equation regresses the first-difference of log real GDP per capita on the first differences of GCF, labor-force participation, the age dependency ratio, broad money, and the centered interaction term, with country and time fixed effects included.

Because cross-sectional dependence was detected, results are cross-checked using multiple robustness estimators. The Fixed-Effects Driscoll-Kraay (FE-DK) estimator, which produces standard errors robust to heteroskedasticity, autocorrelation, and cross-sectional dependence, is applied across several lag truncations (0–3) to confirm that inference on the interaction term does not hinge on lag choice. A dynamic FE-DK specification encompassing a lagged dependent variable is also estimated to consider for persistence (Driscoll & Kraay, 1998). Lastly, Common Correlated Effects (CCE) Mean Group and Pooled estimators, with different lag structures for cross-sectional means, are employed to consider unobserved common factors, providing a more conservative assessment of the robustness of the interaction effect. It is true that macroeconomic variables may face endogeneity concerns. Our dynamic panel approach, incorporating an error-correction structure, country and time effects, lagged variables, and alternative estimators such as Driscoll–Kraay and CCE, mitigates potential endogeneity and cross-sectional dependence.

III. Main Results and Discussion

The results of preliminary diagnostic tests and model selection are reported in Table 2. The results of pooled mean group estimators are reported in Table 3.

Table 2
Preliminary Diagnostics and Model Selection

Diagnostic issue	Test	Result		Implication
		Test Statistic	p-value	
Cross-sectional dependence	Pesaran CD Test (residuals)	CD = -3.193	0.0014	Cross-sectional dependence remains
Serial correlation	Wooldridge Test	F(1,14) = 8.518	0.0112	First-order serial correlation
Heteroskedasticity	Modified Wald Test	$\chi^2(15)$ = 135.50	< 0.001	Groupwise heteroskedasticity
FE vs. RE	Hausman Test	$\chi^2(5)$ = 27.19	0.0001	Fixed effects preferred
Cointegration	Westerlund ECM Tests	Not robust across specifications		No stable evidence of cointegration
Integration order	Pesaran CADF/CIPS-type Tests	Mixed/sensitive I(0)/I(1); no convincing I(2)		First differences are defensible

Table 3
Pooled Mean Group Estimates

Long-Run Parameters		
variable	coefficient	p-value
ΔGCF	0.0737***	0.0000
ΔLF	0.0416**	0.0200
ΔAGE	0.0042	0.9260
ΔBM	-0.0001	0.9590
Δ(AGE × BM)	-0.0043***	0.0020
Short-Run Dynamics		
ECM	-0.0261**	0.0140
ΔGCF	0.0082***	0.0000
ΔLF	0.0024	0.2310
ΔAGE	-0.0152	0.7360
ΔBM	-0.0069	0.1180
Δ(AGE x BM)	-0.0030**	0.0350
CON	0.1164***	0.0030

*** and ** indicate significant at 1% and 5% significance level, respectively.

An increase in gross fixed capital formation (% of GDP) has significant positive effects on per-capita real GDP in both short-run and long-run. An increase in labor force participation rate also has a significant positive effect on per-capita real GDP in the long-run. But the coefficient of the mean-centered age-broad money interaction term is negative and significant. Although an increase in money supply which would be reflected in an increase in broad money (% of GDP) may have a significant positive effect on per-capital real GDP, the significant negative coefficient of the mean-centered age-broad money interaction term implies that population aging would significantly weaken the regulatory effect of quantitative monetary policy. One plausible explanation for the small interaction term coefficient could be that, although the 15 developing economies are beginning to experience the problem of population aging, the proportion of elderly in working-age population in those countries is small compared to many advanced OECD member countries. Second, population aging occurs very slowly over time with no significant short-run variability. The ECM coefficient has the expected negative sign and is statistically significant, indicating rapid adjustment toward long-run equilibrium. The results are robust to robust to heteroskedasticity, autocorrelation, and cross-sectional dependence.

IV. Concluding Remarks and Policy Implications

Population aging is found to significantly weaken the impact of an increase in money supply (% of GDP) on per-capita real GDP in 15 developing economies that are experiencing a declining demographic dividend. The interest rate channel and the labor supply dynamics through which population aging may weaken the effectiveness of monetary policies have been discussed. Unconventional monetary policies such as quantitative easing and negative interest rate policies along with investment in automation may mitigate the aging-led monetary policy ineffectiveness in developing economies, the examination of which provides future research directions as an extension of this study.

Declarations

Author Contribution

Rajarshi Mitra wrote the main manuscript. Mohanad Ismael did the data analysis.

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