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Nexus between Old Age Demographic Ratio and Economic Growth: An Empirical Analysis of Selected Developing Countries

Muhammad Ibrahim Saeed [*] Faran Ali [†] Faizan Ali [‡]

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Abstract: *The global population is ageing in all areas of the globe. First, ageing was an issue in developed countries but nowadays it is a burning research topic for developing countries. So, this study has taken selected ASIAN developing countries for investigation. This study probes the relationship between the old age demographic ratio on economic growth. Panel data has been taken for seven developing countries (India, Pakistan, China, Nepal, Bangladesh, Malaysia, and Sri Lanka) for the period 1990 to 2019 from World Development Indicators. The study uses the panel fixed effect technique for the analysis. The results of the study reveal that the old-age demographic ratio is statistically significant and has a negative impact on the economic growth of developing countries. The control variable inflation and life expectancy are statistically significant and carry a positive sign while carbon emission and remittance have a negative sign and are statistically insignificant.*

Key Words: Economic Growth, Panel Fixed Effect, Old Age Demographics

JEL Classification: J11, F43

Introduction

Researchers and policymakers have paid keen attention to population ageing in recent decades. This phenomenon has had a substantial effect on economies, especially on economic growth (Cristea et al., 2020), financial markets (Borsch-Supan, 2005), pension systems, and other areas (Borsch-Supan, 2005), (Cristea & Mitric, 2016). The global population is ageing in all areas of the globe. For the past 100 years, extraordinary advancements in science, medicine, and public hygiene have resulted in a rise in the number of people living longer than ever before. People over the age of 60 currently outnumber children under the age of five. By 2050, the percentage of people over 60 would have reached that of children under the age of 15 (Zaidi, 2015).

Life expectancy has grown steadily in recent years as a result of significant medical breakthroughs, placing a burden on social support programs. Fertility and birth rates, on the other hand, have declined significantly, as

[*]Senior Research Associate, Offices of Research, Innovation and Commercialization, University of Management and Technology, Lahore, Punjab, Pakistan.
[†]Senior Officer, University of Management & Technology, Lahore, Punjab, Pakistan.
[‡] Lecturer, Higher Education Department Punjab, Government of the Punjab, Lahore, Punjab, Pakistan.

Corresponding Author: Muhammad Ibrahim Saeed (Senior Research Associate, Offices of Research, Innovation and Commercialization, University of Management and Technology, Lahore, Punjab, Pakistan. Email: ibrahim.saeed@umt.edu.pk)

has the proportion of younger people in the overall population and also absolute numbers. As a result, the ageing of the population is caused by two demographic factors (birth rate and life expectancy) changing at the same time but in opposite directions and intensities, raising the old dependence ratio (Cristea & Mitric, 2016; Phang, 2011). The dependency ratios in all other non-OECD global economies are smaller than the OECD average. In the coming decades, though, many will face accelerated population ageing. For example, the dependency ratio in Brazil and China will rise from about 13 and 14 now to 62 and 66 in 2075, respectively (OECD, 2017).

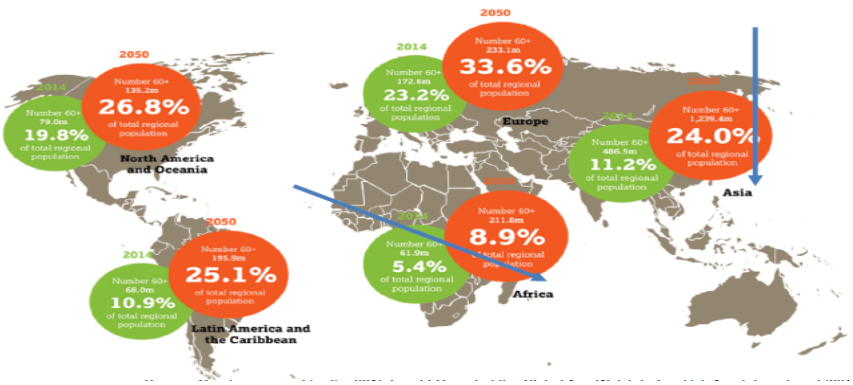
Figure 1

Speed and Scale of Population Ageing

Source: Work carried out in the ESRC's 2015-2016 Project 'Quality of Life of Older People in India, China, Bangladesh and Pakistan, with Help age International.

Figure 2

Word Wide Population Ageing



Source: Report of Global Age Watch Index Help Age International (2015)

The above figures show the population ageing throughout the world but particularly population ageing in Asia is much faster. In Pakistan, it has been projected that number of older people by 2050 might be close to 12.5 million undoubtedly an alarming situation. In 2014, the percentage is 11.2% but it is expected to increase by more than double in 2050 by approximately 24%. The region of Africa seems to be showing a smaller increase

in population ageing in terms of percentage but in terms of number the situation is alarming as in 2014 the number of old age people in Africa is 61.9 but in 2050 it will drastically increase to 211.8 million.

The rapid demographic change compelled policy maker to scrutinize the old-age demographic ratio. According to Zaidi (2008), the increasing trend of the ageing population should consider an achievement rather considering as a potential threat. Though we are living longer life this does not mean that our health will allow us to work for additional years, for example, usually older people become victims of Dementia and are left dependent throughout their life. So, there is a dire need to determine the connection between the dependent i.e. demographic ratio and the independent variable i.e. economic growth. Much of the literature on age demographic ratio focuses on developed countries but very little work has been done on developing countries. Moreover, this study uses a unique set of control variables which might be a novel contribution to the existing literature on this domain.

The major goal of the study is to empirically probe the impact of the old age demographic ratio on the economic growth of Bangladesh, Malaysia, China, Nepal, Pakistan, India and Sri Lanka. Further, the study highlights the following questions; what impact old age demographic ratio has on the growth of economics? Does the link between life expectancy and economic growth is positive and significant? Do control variables significantly affect economic growth?

The second section is based on the literature review; the third section consists of data, methodology and model; results are discussed in section four while the last section concludes and recommends policies.

Review of Literature & Theoretical Background

Economic growth and development can be affected by the ageing population in several ways. The impact can come from public sector expenditures, the concupmti9ons pattern of the society, source and income levels, inflation and general prices trend and demographic changes etc. while its magnitude is debatable and varies between developed and developing regions. (Alders and Broer 2004; Bakshi and Chen 1994; de Meijer et al. 2013; Elmeskov 2004; Lee and Mason 2007; Nagarajan et al. 2016; Tosun 2003). Bloom et al. (2015) examined that the flexibility of policies & institutions and individual freedom in developed countries permits them to stifle the adverse impacts of an ageing population. Researchers further argued that the ageing population of the developing world did not seem to negatively affect economic growth because of their low proportion of the population and higher proportion of the working-age population. Although, in a longer period of time, the increased migration from developing to developed countries and decreasing fertility rate would shrink the working-age population proportion and affects negatively the process of growth and development.

Lar and Taguchi (2020) argue on the dependency ratio and per capita GDP growth relationship. The data runs from 1970 to 2018 for the country Myanmar. The methodology they used was vector autoregressive models for analysis purposes. Their results reveal that the variable of interest i.e. old-age dependency ratio carries a positive sign indicating a positive relationship between the economic growth of Myanmar. Zaidi and Um (2019) propose a new Asian Active Ageing Index (AAI) that calculates the range in which families and societies are being contributed by older people.

The results of the study reveal that old people are competent both mentally and physically, despite low pension incomes, which explains their high levels of informal assistance and job rates in two ASEAN countries, Thailand and Indonesia. Similarly, Brendan and Sek (2016) put forward the link between the ageing of the population and the growth of economics. The study has taken annual data from 1970 to 2014 for seven Asian countries. They used ARDL bound testing approach put forward by Pesaran et al (2001)

for the regression purpose. The results of their study reveal old age demographic ratio and economic growth are significantly negatively related to each other. Munir, et al (2020) determine both the long and short-run relationship between factors of demographic and economic growth in South Asian countries. A negative and significant relationship has been observed between the old-age dependency ratio and economic growth. The other way around, the fertility rate and the role of expectancy of life are positive with economic growth. In spite of the fact of a positive relationship exists between the dependency ratio and GDP as per the literature described above there are some other variables too that have a significant impact on GDP growth positively and negatively, among which inflation plays a significant role. The rising inflation can have negative effects on economic growth and this relationship is explored by Barrow (1995) for the year 1960 to 1996 for 100 countries. The results of the study revealed 10 per cent increase in inflation causes GDP per capita to decrease by 1% by using Seemingly Unrelated Regression (SUR) for the panel model and categorising the counties under the colonial and non-colonial systems. Akinsola and Odhiambo (2017) also support the negative impact of inflation on the growth of economics in developed and developing countries.

Fayissa & Nsiah (2010) explore the relationship of remittances with economic growth in 36 African nations from 1980 to 2004. The outcome shows a positive and significant relationship. Meyer and Shera (2017) probe the link between remittances and economic growth, and their results also support the positive link between economic growth and remittances in six high-receiving remittances countries. He and Li (2020) determine the link between the expectancy of life and economic growth in 65 countries. The study uses the panel integration method for the regression outcome. The data is divided into younger and older groups and find the unidirectional relationship between GDP and life expectancy in both groups. The theory behind the model comes from the work of Ehrlich 1968; Malthus 1978; and Williamson 1998 who argue that population growth affects economic growth. This relationship only exists when the dependent and working-age populations are increasing at different rates.

Data, Methodology and Model

Data

Panel data has been taken for seven developing countries (India, Pakistan, China, Nepal, Bangladesh, Malaysia and Sri Lanka) for the period 1990 to 2019. The secondary data source is World Development Indicators.

Table 1

Description of the Variables

Variable	Abbreviation
Life expectancy at birth, total (years)	LOGLIFE
Age Demographic ratio, old (% of working-age population)	LOGAGE
Inflation as a consumer price index	INF
CO_2 emissions (kt)	LOGCO
Personal remittances, received (current US$)	LOGREM
GDP Growth	GDPG

Methodology

We begin with the descriptive approach which gives a crystal clear view of the normality, Skewness, mean, and standard deviation of the data so that it would be used in the regression model. The present study determines correlation to see the link between

The variables. Correlation analysis helps to detect the problem of multicollinearity. The panel cross-sectional dependency test is then used to search for dependency within an

equation's residuals. Following that, based on the outcome of the Hausman (1978) test, this panel analysis would use either a fixed effect or a Random effect model.

Model

The Functional form of the Model

Economic Growth = f (age demographic ratio, life expectancy, inflation, remittance, carbon emission)

Stochastic Form

$$GDP_{it} = \beta 0 + \beta_1 LOGAGE_{it} + \beta_2 LOGCO_{it} + \beta_3 INF_{it} + \beta_4 LOGLIFE_{it} + \beta_5 LOGREM_{it} + \varepsilon_{it}$$

Results and Interpretation

Table 2

Descriptive Statistics

	LOGAGE	LOGCO	LOGLIFE	LOGREM	INF	GDP
Mean	8.381113	5.051272	4.222060	21.73230	5.650522	5.854421
Median	7.632634	5.083259	4.237730	21.78025	4.729467	5.578318
Maximum	16.62273	7.061229	4.356889	25.14610	24.25698	14.23086
Minimum	5.739068	2.890647	3.996438	17.60333	-1.401474	-7.359415
Std. Dev.	2.116046	1.068113	0.081186	1.740128	4.219095	2.709995
Skewness	1.690421	0.123422	-0.472583	-0.257769	1.418367	-0.175978
Kurtosis	6.112280	2.057359	2.375192	2.637400	5.910870	6.074271
Observations	210	210	210	210	210	210

The above Table 2 shows descriptive statistics of the variables. The skewness value of the gross domestic product, remittance, life expectancy and CO_2 emission is near zero indicating normal distribution. While old age demographic ratio and inflation show a tale that is tilted toward the right indicating a distribution that is positively skewed. The K-value of GDP, inflation and old age demographic are leptokurtic (thin) in nature. While life expectancy, CO_2 and remittance are platykurtic (flat) in nature. Moreover, the difference in max and minimum values is small showing no issue of outlier.

Table 3

Correlation Matrix

	LOGAGE	LOGCO	LOGLIFE	LOGREM	INF
LOGAGE	1				
LOGCO	0.228806	1			
LOGLIFE	0.641405	0.255648	1		
LOGREM	0.342824	0.512095	0.230011	1	
INF	-0.03622	-0.304	-0.1801	-0.09096	1

Table 3 shows the low intercorrelations between the independent variables which indicate that there is no reason to suspect a serious multicollinearity problem. In the next table diagnostic test is also applied for the multicollinearity.

Table 4

VIF Matrix

	LOGAGE	LOGCO	LOGLIFE	LOGREM	INF
LOGAGE	1				
LOGCO	1.055244	1			
LOGLIFE	1.698949	1.069926	1		

	LOGAGE	LOGCO	LOGLIFE	LOGREM	INF
LOGREM	1.133181	1.355457	1.05586	1	
INF	1.001314	1.101828	1.033524	1.008343	1

To check the problem of multicollinearity among the regressors we estimated the VIF matrix. The results of the VIF matrix show that all the calculated values of the regressors have the values < than 10 which confirms that the model is free from multicollinearity.

Table 5

Hausman Test

Correlated Random Effects - Hausman Test			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	33.419611	5	0.0000

To determine the association between regressor and unique errors the study applies the Hausman test. According to Padachi (2006) fixed effect model is appropriate if the null hypothesis is rejected, so the results of the study rejected the null hypothesis.

Table 6

Fixed Effect Results

Dependent Variable: GDPGRO				
Method: Panel Least Squares				
White Covariance and Standard Errors (Diagonal), (corrected degree of freedom)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGAGE	-0.352841	0.128720	-2.741158	0.0067
INF	0.070732	0.040321	1.754197	0.0809
LOGLIFE	19.50106	8.684960	2.245383	0.0258
LOGCO	-1.806414	1.816955	-0.994199	0.3213
LOGREM	-0.163380	0.285914	-0.571431	0.5684
C	-61.24737	26.93567	-2.273839	0.0240
The Effects of Specification				
Fixed Cross Sections as dummy variables				
R-squared	0.385206	Mean dependent var		5.854421
Adjusted R-squared	0.351050	S.D. dependent var		2.709995
S.E. of regression	2.183102	Akaike info criterion		4.454816
Sum squared resid	943.6547	Schwarz criterion		4.646079
Log likelihood	-455.7556	Hannan-Quinn criter.		4.532136
F-statistic	11.27808	Durbin-Watson stat		1.607804
Prob(F-statistic)	0.000000			

Results of Table 6 reveal that the coefficient of the old age demographic ratio has a negative relationship with economic growth which is statistically significant. This indicates that a decline is observed in economic growth if the old-age demographic ratio increases. The results are supported by Brendan and Sek (2016) who found a negative and significant impact of the old age demographic ratio on the economic growth of India. Moreover, according to Moreira Whelan Zaidi (2010) increasing demands on expenditures for pensions, housing, and long-term care are both contributing to the raising old-age dependence ratio, which is causing significant problems for the public finances.

Since suppliers can sell at higher rates due to inflation, the industry can make higher

profits. Investors and entrepreneurs are praised for engaging in profitable ventures, resulting in better investment gains. Production would increase. In our study inflation is positive and statistically significant indicating that inflation impacts economic growth positively in the case of selected Asian countries. For a positive relationship between inflation and the growth of economics (see, for instance, Kryeziu and Durguti (2019). The coefficient of another control variable i.e., life expectancy is positive and significant indicating that life expectancy increases the economic growth of selected Asian countries for a positive impact of expectancy of life on economic growth (see; McMillan and Wacziarg 2008; Lorentzen, Cervellati and Sunde 2009). The coefficient of remittance is negative and statistically insignificant. This show that remittance and the dependent variable have no relationship (see for instance Chami et al., 2003). Another variable which is insignificant and has a negative sign is carbon emission. The work of Gul et al (2015) showed that in developed countries like USA and Japan, CO_2 emission has a positive impact on economic growth but in the case of developing countries like India CO_2 emission has a negative impact. The Durbin-Watson value is 1.6 which indicates no serial correlation in the model. In the above table, the Durbin-Watson values lie inside the tolerance level showing no signs of serial correlation.

Table 7

Cross-Section Residuals (Dependence Test)

Null hypothesis: No Residual Dependence of Cross Sections (correlation)			
Removed Cross Section Residual's effects During Estimation			
Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	24.07040	21	0.2897
Pesaran scaled LM	-0.606350		0.5443
Bias-corrected scaled LM	-0.727040		0.4672
Pesaran CD	2.395860		0.0166

Table 7 shows the result of the cross-section dependence test. If the probability value is > then 0.05, the null hypothesis of the test states that no cross-section dependency occurs. In our study, all the tests show no problem with the cross-section dependency test except the Pesaran CD test. Hence, we prefer the Breusch-Pagan LM test because in our study the time period is greater than the cross sections.

Conclusion and Policy Recommendation

The global population is ageing in all areas of the globe. For the past 100 years, extraordinary advancements in science, medicine, and public hygiene have resulted in a rise in the number of people living longer than ever before. People over the age of 60 currently outnumber children under the age of five. By 2050, the percentage of people over 60 would have reached that of children under the age of 15 (Zaidi, 2015). This study empirically examines the impact of the old-age demographic ratio on economic growth. Panel data has been taken for seven developing countries (India, Pakistan, China, Nepal, Bangladesh, Malaysia and Sri Lanka) ranging from 1990 to 2019 from World Development Indicators (WDI). The study used a panel fixed effect technique for the analysis. The results of the study revealed that the old age demographic ratio is statistically significant and affects economic growth negatively in the case of selected developing countries. The control variable inflation and life expectancy are statistically significant and carry a positive sign while carbon emission and remittance have a negative sign and are statistically insignificant. In order to make old aged people more productive in the economy the government should implement Active Ageing strategies. Moreover, the active ageing index should be given high priority and awareness must be given by the government to older

people, particularly those who are alone. Life expectancy is increasing which is a good indicator of health but it is indicating that people are living longer lives and at the same time idle or depending on others. The government should develop and encourage such old people by proving their families and themselves with some financial incentives or benefits. Furthermore, it is important to re-estimate the role of remittance and carbon emission in Pakistan as both variables are insignificant in our study.

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