THE EFFECTS OF AGEING ON THE ECONOMIC GROWTH OF SOUTH EAST ASIA AND EUROPE

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ABSTRACT: *In this study, we empirically analyze the effects of population ageing in two groups of countries, namely South East Asia and Europe. We also study the spillover effects of population ageing of South East Asia on the economic growth of high-income countries in Europe. The effects of ageing are represented by the old-aged and the youth dependency ratio respectively. We model this through an autoregressive distributed lag (ARDL) method and estimate the model using pooled mean group (PMG) method. Our results reveal that the old aged cohort does not have a significant effect on the economy where as the youth cohort imposes a negative effect on all groups. We conclude that the South East Asian population is still in a relatively "young" phase, as the old age dependency ratio has yet to affect the Asian economy. Active ageing policies are suggested to counter the eventual negative effects of ageing.*

Keywords: Population Ageing, South East Asia, Dependency Ratio, Pooled Mean Group

1. INTRODUCTION

The combined effect of declining fertility rates, increasing life expectancies and various factors lead to an increasing rate of population ageing in recent years. According to the United Nations projections, the world population aged 60 and above will achieve 2 billion by the year 2050, drastically increasing the share of retirees to workers, otherwise known as the old age dependency ratio.

This scenario is already evident, as seen in Figure 1, where the percentage of old-aged individuals (65 years old and above) shows an increasing trend throughout the years in the South East Asian countries. Figure 2 however, shows that the percentage of youths (0 to 14 years old) depict a decreasing trend, implying a situation of declining fertility rates. Although a decrease in the percentage of youths indicates the following increase in working-aged population (15 to 64 years old), the decreasing trend of youths would eventually lead to a discouraging number of working-aged individuals. It is important to note that the old-aged population are more prone towards a tax-consuming nature, as compared to the revenue-generating working-aged population. Since the needs and productive capacities of individuals vary according to age, this increase adversely affects a nation's economic growth.

We specifically focus on countries in South East Asia as a form of interest in emerging markets and developing nations. According to Coulmas [1] there are three types of society based on the proportion of elderly: (1) Ageing society if 7% – 14% of the population is 65 years or older, (2) Aged society if 14% – 20% of the population is 65 years or older and, (3) Hyper-aged society if 21% or more of the population is 65 years or older. The countries in this group are selected based on their display of the highest relative percentages of old-age shares to the overall population. The European countries, however, have long reached the level of "aged society" with a few already at the status of "hyper-aged society" and rest rapidly moving towards the same direction. Hence, this research instead considers the top 10 highest income in Europe. The effects of ageing in each group will be studied individually, before focusing on the effects of ageing in South East Asia on Europe, to account for possible spillover effects in acknowledgement of open trade and migration policies in modern times.

The effects of ageing will be represented by the old-age dependency ratio, which measures the burden of an increasing amount of elderly, where the number tax consumers (those aged 65 and over) are supported by tax contributors (those aged between 15 to 64) and the youth dependency ratio, where like the old age, are tax consumers, as the state funds them through education policies and such.

The following sections will proceed as follows: section 2 provides a literature review on related background studies; section 3 explains the data and empirical methodology applied; section 4 discusses the results and section 5 concludes the findings.

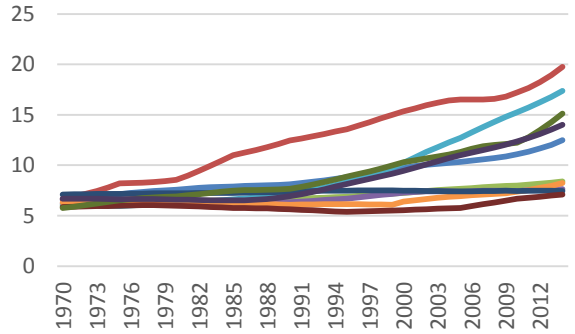

Figure. 1: Percentage of individuals above 65 years old of South East Asian countries

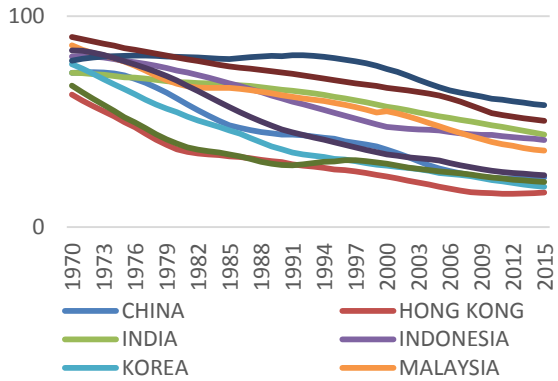

Figure. 2: Percentage of individuals below the age of 15 years old of South East Asian countries

2. LITERATURE REVIEW

Empirical research by Lindh and Malmberg [2] and Hondroyiannis, and Papapetrou [3] showed that the age group of 65 and above would have a negative effect on the economic growth that will be exhibited in the long run. In a panel of 20 OECD countries, Bloom [4] and Huang [5] found the share of retirees to have a negative effect on GDP.

The young age dependency ratio is arguably [6] an effective tool in identifying the growth pattern of the young age and to a certain extent, allows the prediction of the future workforce. A large number of empirical studies have ended with ambiguous results. An empirical research based on the Solow-Swan model by Xu, Bengston and Enflo [7] found the old age dependency ratio to be negative but insignificant. Furthermore, it was found that a more negative and significant relationship was exhibited by the child dependency ratio. A study by Fahruqee and Muhleisen [8] argue that a longer lifespan and working life, along with a decreasing amount of dependent youths would balance off the effects of population ageing. A regression analysis by Prettner [9] showed that population ageing would only have a negative effect on the Asian economy in the short run due to the offsetting effects dynamics of female labour force participation as fertility declines, savings, and education. However, they admitted that the effect of ageing on economic growth will be ambiguous, due to different behavioural responses. This is supported by Osterholm [10] who through a theoretical method of endogenous growth models found that the effects of ageing may vary depending on the extents of the rate of mortality.

Considering the rapid change in labour force and hence the labour market, it is found in recent years that effects of ageing are no longer limited within the confines of a country. Karahan and Rhee [11] argue that a growing share of middle-aged workers causes firms to recruit more from the local labor market and may hire from other locations. Mai [12] found that labour reforms in Germany have a positive spillover effect on other members of the Euro area.

It is important to note that the active aging policy in the European Union has increased the employment of the elderly and extended the retirement age. Such actions shift the burden of ageing from the future generations to the older section of the labour market. The average age of the European labour market has been increasing for the past decades, as their experiences and productivity gain a greater importance for the labour market, as argued by Pedroni [13]. An and Jeon [14] Found a U-shaped relationship between economic growth and demographic changes, where economic growth is impeded when the old age dependency ratio has risen to a certain level. There have been extensive empirical and theoretical results proving that aging negatively affects savings, a proxy of economic growth as seen found by Mark and Sul [15], Kao and Chiange [16], Higgins [17], Im, Pesaran and Shin [18], Mogdiliani and Cao [19], Choudry and Elhorst [6].

However, empirical studies on the relationship between ageing and economic growth or Gross Domestic Product (GDP) as a whole is lacking. As of now, the relationship between population ageing and the economic activity of the elderly is still ambiguous and requires deeper analysis [20]. Most studies on the relationship between population ageing and the economic growth of European nations have been focusing mainly on theoretical methods. Empirical studies that do exist focus information dated before the 2007-2008 economic crises and utilize projected data, which tend to overlook relationships between population ageing and economic growth. According to Baek and Brock [21], the linear approach to causality testing has low power in detecting certain nonlinear relationships. This study takes the above ambiguity and contradictions in previous studies as a starting point and thus aims to examine both the linear and nonlinear relationship of population ageing and economic growth of Asian nations

The objective of this study is to prove that the long run relationship discussed above would apply within the context of South East Asia, and its possible spillover effects on Europe. In order to reduce pre-test biases, we apply the 'Auto-Regressive Distributed Lag' (ARDL) instead of the conventional cointegrating tests.

3. DATA AND EMPIRICAL METHODOLOGY

In this study, we focus on two different panels of data from different countries: 10 South East Asian countries with the highest old-age dependency ratios and 10 highest income European countries. European countries. Table 1 presents the list of countries used in this study.

Table 1: Panel of Countries

Panel	Countries
South East Asia	China, Hong Kong, Singapore, Malaysia, Thailand, Pakistan, Philippines, Korea, India, Indonesia
Europe	Finland, Austria, Denmark, Great Britain, Iceland, Netherlands, Canada, Sweden, Norway, Germany

These consists of annual data from 1970 to 2014 where the Gross Domestic Product (GDP) is extracted from World Bank's database, World Development Indicators. As for the total population by age, the data is derived from the World Population Prospects: The 2012 Revision [22]. Population ageing (OLD) is represented by the old age dependency ratio, calculated manually as the number of persons 65 years and older, per the number of persons 15 to 64 years. The Youth dependency ratio (YOUTH) calculated manually as the number of individuals below the age of 15, over the number of persons between 15 to 64 years. All the data are transformed into the natural log form for the purpose of the efficiency of analysis.

We formulate our model based on previous literature (Bloom and Williamson [23]; Kelley and Schimdt [24]; Choudury and Elhorst [6]). Variables on education, or by extension, human capital were removed in accordance to Kelley and Schmidt (2005) which argue that these will lose its significance when demographic factors are accounted for.

Hence the model is as such:

$$Growth = \{OLD, YOUTH\} \quad (1)$$

Where

$$OLD = \frac{Number\ of\ individuals\ 65\ years\ and\ older}{Number\ of\ individuals\ aged\ 15\ to\ 64} \quad (2)$$

$$YOUTH = \frac{Number\ of\ individuals\ aged\ 0\ to\ 14\ years\ old}{number\ of\ individuals\ aged\ 15\ to\ 64} \quad (3)$$

The Autoregressive distributed lag (ARDL) model with p lags of Y and q lags of X, ARDL (p,q):

$$y_{i,t} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{p} \delta'_{ij},\ X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (4)$$

Where: $y_{i,t} =$ variable for economic growth (GDP)

$i = 1,2,\dots,N$

$t = 1,2,\dots,T;$

$x_{it}\ is\ a\ k \times 1$ vector of explanatory variables for countries i;

λ_{ij} are scalars

μ_i is the group specific effect

ε_{it} is a disturbance term

Equation (4) expressed into an error correction model:

$$\Delta y_{i,t} = \Phi_i y_{i,t-1} + X_i \gamma'_{i,t-1} + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij},\ \Delta X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (5)$$

Where

Φ = scalar coefficient of the lagged dependent variable

$\gamma' = k \times 1$ of coefficients on explanatory variables

$\lambda^*_{ij} = k \times 1$ of coefficients on the first differenced lagged dependent variable

$\delta_{ij} = k \times 1$ of coefficients on the first differenced lagged explanatory variable

The unrestricted specification for the ARDL system of equations for t = 1, 2, …, T, time periods and i = 1,…,N countries for the dependent variable Y is:

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=1}^{q} \gamma_{ij} x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (6)$$

Where

$X_{i,t-j}$ is the (k × 1) vector of explanatory variables for group i and u_i represents fixed effect

The model can be reparametrized as a VECM system:

$$\Delta y_{it} = \theta_i (y_{i,t-1} - \beta_1^{'} x_{i,t-1}) + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=1}^{q-1} \gamma_{ij}^{'} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (7)$$

Where

the β_i is the long-run parameters and θ_i are the equilibrium (or error)-correction parameters.

The PMG restriction is that the elements of β are common across countries:

$$\Delta y_{it} = \theta_i (y_{i,t-1} - \beta^{'} x_{i,t-1}) + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=1}^{q-1} \gamma_{ij}^{'} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (8)$$

All the dynamics and the ECM terms are free to vary in PMG. Under some regularity assumptions, the parameter estimates of the PMG model are consistent and asymptotically normal for both stationary and non-stationary regressors. In the selection of lag length, both MG and PMG estimations require selecting the appropriate lag length for the individual country equations. The selection is made using the Akaike Information Criterion (AIC).

According to Baek and Brock [21], the error correction term indicates the speed adjustment to restore equilibrium in the dynamic model. The error correction coefficient shows how quickly variables converge/diverge to equilibrium and it should have a statically significant coefficient with a negative/positive sign. The highly significant Error Correction Term further confirms the existence of a stable long-run relationship.

4. RESULTS AND DISCUSSIONS

Our unit-root tests (Levin, Lin and Chu (LLC) test, Im, Pesaran & Shin (IPS) test and Fisher ADF test) show that for all groups, the Gross domestic product (GDP) variable is not able to reject the null hypothesis of unit-root at 5% level. However, the old-aged and youth dependency ratios are found to be a mix of I(0) and I(1), justifying the usage of the ARDL method.

For the good specification of the ARDL model, we perform the optimal lag length criterion by limiting the comparisons of multiple combinations of ARDL(p,q,r) up to lag one. This is because for the small sample that less than 100 observations, lag one is sufficient to be used in the ARDL model. Applying the Akaike Info criterion (AIC) test, our results suggest the best model fit for the ARDL models to be ARDL (1,0,0) for all groups of data.

The ARDL models, estimated by the Pooled Mean Group method are summarized in Table 2 below:

Table 2: PMG Estimated results

Variable	Countries ADRL (1,0,0)		
	Asia	Europe	Asia to Europe
OLD	-0.01721	-0.9954	-0.01721
YOUTH	-0.7109***	-3.5893***	-0.7109***
$\Delta GDP(-1)$	0.2474***	-0.3876***	0.2473***
ΔOLD	1.1580	0.8854	1.1581
$\Delta YOUTH$	0.0153	1.8430	0.0153
ECT	-0.2033***	-0.3444***	-0.2033***
Constant	0.4176	6.5557***	2.2172***

Based on the results above, the error correction term (ECT) is negative and significant, revealing a long run relationship between economic growth and the ageing variables across all panels. All panels display a relatively similar and consistent

result in terms of the variable signs and significance. Furthermore, we find that there exists a spillover effect of ageing in South East Asia on the economy of Europe. In terms of the short run relationships, we find that none of the variables is significant. This is both intuitive and in accordance with the literature, as ageing is an effect that happens over time and age cohorts tend to have gaps in between.

The youth negative dependency ratio depicts a negative and significant effect on the economic growth in all panels. The inverse relationship between the youth dependency ratio and economic growth is explained by the fact that a decreasing youth cohort (as seen in Figure 2) leads to an increasing working-age cohort which actively contributes to the economy.

The old-age dependency ratio shows a negative but insignificant effect on the economy. This implies that the old-age cohort in South East Asia has yet to reach a significant number to influence the economy. Comparing Figure 1 and 2, it is evident that there exists a gap between the percentage sizes of the old-aged cohort as compared to the youth cohort.

On average the old age dependency ratio at 2015 is found to be approximately at 11.75% whereas the youth dependency is approximately at 33.45%. The increasing cohort of old individuals coupled with the decreasing cohort of youths shows that the old age dependency ratio can be expected to impose a more significant negative effect in the near future.

5. CONCLUSIONS

We conduct empirical analyses to reveal the long run relationship between a gross domestic product with the old dependency ratio and the youth dependency ratio. Applying the ARDL method, we estimate both the short run and long run relationships through the Pooled Mean Group estimator. We find that the old age dependency ratio is showing a negative, but insignificant effect across panels, whereas the youth dependency ration displays a negative and significant effect across panels.

The mixed results obtained, that is, the significant negative effect of the growing number of youths in Asia and the non-significant effect of the old-aged dependency ratio is a sign of the South East Asian countries being relatively "young", since the older cohort of individuals have not grown to a significant amount to be able to affect the economy as compared to the number of youths. In recent years, the effects of the old-aged cohort may not necessarily behave in an expected manner, as economic activities become less labour intensive. An older workforce also means a more experienced workforce, which has shown an increasing value to the modern economy. This negative effect would eventually lead to a positive effect in the near future since a growing cohort of young implies a strong entry into the labour force in the future.

Considering further that spillover effects exist, corresponding policy responses, i.e. Active Ageing policies that employ the elderly into the workforce need to be mobilized, as seen in most of the older nations, i.e. the Silver Human Resource Centre in Japan, to cushion the negative effect of ageing. South East Asian countries are thus advised to follow suit.

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