Ageing Population and Healthcare Expenditure Impacts on Labour Force Participation Rate in Developing-8 Countries

Paul Anthony Mariadas[1], Shahidan Shaari[2], Muthaloo Subramaniam[3], Uma Murthy[4], Siti Nurul Munawwarah Roslan[5]

[1]Senior Lecturer, School of Accounting & Finance, Faculty of Business & Law, Taylor's University, Malaysia [Postal Address: 1, Jalan Taylors, 47500 Subang Jaya, Selangor, Malaysia], [2]Senior Lecturer, Faculty of Applied & Human Sciences, University Perlis, Malaysia, [3]Dean, Faculty of Business, Management & Information Technology, Asia Metropolitan University. Johore, Malaysia, [4]Lecturer, School of Accounting & Finance, Faculty of Business & Law, Taylor's University, Malaysia, [5]Lecturer, School of Accounting & Finance, Faculty of Business & Law, Taylor's University, Malaysia.
Email: shahidanshaari@unimap.edu.my, mutsgs@yahoo.com, murthy.uma84@gmail.com, munawwarah.roslan@taylors.edu.my
Corresponding Author Email: mpaul190782@gmail.com

Abstract
Ageing population is a global phenomenon that is mainly associated with reduced mortality rates, persistent decline in fertility rates and increased life expectancy. Of the various indicators of an ageing population, demographic changes have resulted in increasing numbers and proportions of those aged 60 years and above compared to the overall nation's population. This study investigated the impact of an ageing population and healthcare expenditure on labour force participation rate in Developing-8 (D-8) countries using panel Auto-Regressive Distributed Lag (ARDL) method and Pooled Mean Group (PMG) estimator from 2000 to 2017. The empirical findings revealed that the ageing population significantly and positively affect the labour force participation rate in D-8 countries but did not affect healthcare expenditure. Fully Modified Ordinary Least Squares and (FMOLS) and DOLS tests were employed to confirm the impact of an ageing population on labour force participation rate, whereas the latter was impeded by healthcare expenditure as reflected in its significant negative impact. These findings demonstrate the diverse impact of an ageing population and healthcare expenditure on labour force participation in D-8 countries. Therefore, policy revisions are needed to prevent the continuous rise in healthcare expenditure given the increasing ageing population across D-8 countries.

Introduction
Ageing population is a global phenomenon that is mainly associated with reduced mortality rates, persistent decline in fertility rates and increased life expectancy (Yusuf, et. al., 2020; Murthy et al., 2019a; Murthy et al., 2019b; Mahal and McPake, 2017; Vengkatesh, 2013; Harper & Leeson, 2009; Lee, Mason & Miller, 2001; Mason & Lee, 2004 & Lee & Mason, 2006). Several parameters have been used by researchers as indicators of ageing population, such as mortality risks, health conditions, type and level of activities, productivity and other socioeconomic characteristics of the older population (Baharin, & Saad, 2018; Yew & Azlan, 2014; Department of Economic & Social Affairs, 2019).

Of the various indicators of an ageing population, demographic changes have resulted in increasing numbers and proportions of those aged 60 years and above compared to the overall nation's population. As projected by the World Health Organisation (2010), the world will experience a population pattern characterised by more older people compared to young individuals. The percentage of the world's population aged 65 and above has increased from 6% in 1990 to 9% in 2019 and is expected to increase to 16% in 2050 (WHO, 2010). In 2019, the global ageing population (65 years and above) was approximately 703 million people and the figure is expected to double by 2050, which is around 1,549 million. Specifically, the ageing population in developed, developing, and least developed countries were 240.674, 462.261, 36.821 million, respectively in 2019. These figures are estimated to increase to 344.867 (43.3%), 1,203.986 (160.5%) and 119.680 (225%) million, respectively in 2050. Surprisingly, the population in developing countries was ageing rather rapidly compared to developed countries (Department of Economic & Social Affairs, United Nations, 2019). These reports highlight the need to further investigate the underlying factors for ageing populations in developing countries and the potential economic impact.

D-8 is the prevalent name for Developing-8, an organisation established among eight developing countries: Malaysia, Bangladesh, Egypt, Indonesia, Iran, Nigeria, Pakistan and Turkey. This organisation was founded to improve the participating countries' economic states through seeking opportunities and diversification in trade collaboration, collectively strengthening participation in global level economic decisions, and further advancing the standards of living (D-8 Organisation for Economic Cooperation, 2021). According to the 2013 report of the United Nations (UN) Population Division, the D-8 Secretariat highlighted that the global proportion of people aged 60 years and above has reached 8% of the total world's population, and is expected to attain around 12% by 2025 (Department of Economic & Social Affairs, United Nations, 2013). These projections were further supported by the data from the World Population Prospects: the 2015 Revision (Department of Economic & Social Affairs, United Nations, 2015). This is partly due to a decline in fertility rates (World Health Organisation, 2010) within the respective populations. Additionally, this event will increase the percentage of the future ageing population with Indonesia and Turkey expected to become the oldest populations among D-8 countries by the year 2045 (D-8 Organization for Economic Cooperation, 2014). Given these developments, initiatives by respective D-8 governments are needed to tackle the challenges associated with ageing populations. Consequently, D-8 countries have focused more on the size and quality of the labour force

participation, the operation and financial integrity of the healthcare and pension systems, housing, and the overall well-being of the ageing population. Better policies, initiatives and efforts are therefore necessary to cushion the effects of these foreseen challenges while ensuring that the ageing population receive adequate care alongside all the other population.

Besides being among the most crucial aspects of achieving economic diversification and a developed economic status, the healthcare system and labour force are significantly affected by an ageing population (Cristea et al., 2020a). A well-balanced workforce of young and older people is the core aspect of sustainable economic development (Cristea et al., 2020b). An imbalance sets in as the population shifts in favour of aged individuals, thereby affecting productivity and increased demands from healthcare services. In fact, ageing populations put more pressure on healthcare expenditure spending on old-age supporting facilities (United Nations, 2015; Fredrik, 2013; Ogawa et al., 2009; Colombier, 2017) and some of the consequences include constraints on public finances and healthcare facilities and diminished economic growth (Cristea et al., 2020a). The working-age population faces heightened pressure, particularly those between 55 and 64 years old, as the demographic structures shift towards an ageing population (Andor, 2012; Bengtsson & Qi, 2018). Therefore, issues relating to healthcare expenditure on aged individuals should be prioritized, especially in developing countries where the ageing population is growing at an alarming rate.

The impact of an ageing population on the availability of the labour force and indirect effects on health facilities and support systems remain unclear in developing countries. Whereas some researchers reported that the labour and financial markets, and healthcare delivery will be better off with improved longevity (Harper, 2014; Aiyar & Ebeke, 2016), others posited that labour force participation is reduced with an increase in the proportion of aged population and healthcare spending (Maestas et. al., 2016). Intensive debates continue to arise regarding the relationships between population ageing and increased healthcare costs (Breyer et al., 2010; Bosch-Farré et al., 2018), as well as their implications for labour productivity. These events have raised pertinent questions regarding the actual impact of the ageing population on labour participation and healthcare expenditure in D-8 countries.

To date, no empirical study has been conducted to assess how ageing populations affect these important indicators of economic growth in D-8 countries. Resultantly, this study aimed to estimate the impact of ageing populations and healthcare expenditure on labour participation in these countries. This study was designed to enrich the literature with an updated and integrative evaluation of the associations between the ageing phenomenon, healthcare expenditure and labour force participation rate. Different econometric methods were applied to ensure accurate and robust outcomes for the basis of the conclusions and policy recommendations proposed in this study. The findings will improve the current body of knowledge and understanding of the relationship between the variables and strategies to address the issues or potential challenges in these countries.

Apart from the aforementioned research gap, we chose to conduct this study among the D-8 c given the homogeneous characteristics of the ageing population and economic development relationship among the countries. Thus, holistic and specific strategies could be tailored for each country to rethink the approach of catering for the healthcare needs of the older population. The dataset utilised in this study covers the period between 2000 and 2017,

considering the availability of ageing indicators, as well as labour force participation and healthcare expenditure variables.

This research article was divided into various sections. The first section introduced the issues regarding the ageing population, healthcare expenditure and labour force participation in D-8 countries. The next section focused on structural reviews and empirical discussions to establish suggestions towards relevant ways of tackling the challenges identified in the introduction. Thereafter, a brief literature review of the study variables was performed emphasising labour force participation and how it is influenced by the ageing population and healthcare expenditure. The approaches and statistical tests, Auto-Regressive Distributed Lag (ARDL) method with the help of Pooled Mean Group (PMG) estimator, employed in the analysis were presented in the next section. Upon completing the analysis, the empirical results were documented and discussed before proceeding to conclusions with relevant suggestions regarding the necessary policies to address the gaps discovered from the empirical research findings.

Literature Review
Ageing population is an astounding phenomenon that affects labour force participation and healthcare expenditure in diverse ways in various countries. It is a longevity revolution and a transition currently experienced by most countries worldwide. A review of existing literature depicts the emergence of new views regarding the contribution of the older population to the labour force. While some argue that people belonging to the aged group need to participate in the labour force, others posited that they have to be protected after retirement.

Available information reflects that 20% of the population in 17 countries fall with in the older group, and by 2100, 61% of the population in 155 countries are projected to be older people (Department of Economic & Social Affairs, 2019). This improved longevity means that older people will live longer and could continue working while contributing economically and socially for themselves. Additionally, they also contribute indirectly to the demand for goods and services, labour and financial markets, health facilities and support systems, thereby impacting positively on national economic growth (Harper, 2014; Aiyar & Ebeke, 2016; Yusuf, et. al., 2020; Department of Economic and Social Affairs, United Nation, 2019). Other researchers reported that increasing ageing populations had resulted in the decline in labour force participation, labour productivity, and further slows down the economic growth (Maestas et. al., 2016; Maciulyte-Sniukience, et. al., 2019). These claims were supported by a 5.7% decline in the growth rate in GDP per capita following a 10% rise in the fragment of the population aged 60 and above (Maciulyte-Sniukience, et. al., 2019; Wang & Kim, 2014). According to Angeloni and Borgonovi (2016), labour force participation and availability are expected to occur in the period between 2015 and 2035 when *baby boomers* born after World War II begin to retire. Another argument is that labour force participation by older people might affect the job opportunities of the working-age younger population. However, no evidence of any research has supported such claims but rather a few studies revealed that older labour participation further promotes younger labour participation (Gruber and Wise, 2010; Organisation for Economic Cooperation and Development, 2018).

Notably, ageing population will put increased financial or specifically healthcare expenditure spending pressures on old-age support systems (United Nations, 2015; Fredrik, 2013; Ogawa et al., 2009; Colombier, 2017). Issues on healthcare expenditure on aged people should be of concern to all parties, especially the government who is responsible for establishing related policies. Therefore, healthcare expenditure is set to increase including pension liability (Ibrahim, 2012) when the population of aged people experiences an increasing trend (Eiras & Niepelt, 2012; Phan & Duong, 2021). It is indisputable that healthcare expenditure does provide boosts for economic growth (Wang 2011; Braendle et al., 2016; Murthy et al., 2016; Lopreite and Mauro, 2017; Lopreite and Zhu, 2020), which in turn improves life expectancy and further contribute towards the increased ageing population (Werblow et al., 2007; Harper, 2014). This appeared to correlate well with the cyclical impacts of healthcare expenditure within various countries. As the healthcare expenditure improves life longevity, healthy aged people may potentially be the viable group to continue participating in the labour force. Besides improving pension plans, this will also expand the tax revenues as earning continues (Wheaton and Crimmins, 2012). Working after old age improves mental and physical health (Reynolds et al. 2012; Wahrendorf et al., 2017; Zainuddin et al. 2022) and this is believed to impact positively healthcare support systems and decline in healthcare expenditure.

Nonetheless, other researchers reported contradicting outcomes as ageing populations triggered increased healthcare expenditure, thereby affecting the labour force participation among the aged group (References). Townsend (2016) and Breyer and Lorenz (2020) were uncertain to some greater extent if public expenditure, including healthcare expenditure, would result in a proportional increase in the ageing population. The researchers were also sceptical about the related policies that could be established to respond to the said uncertainties. A study conducted in Japan showed that where healthcare spending was not affected by the increasing aged population (Ikeda et al., 2011). A similar result was reported by Seshamani and Gray (2004), where healthcare expenditure was higher for young people compared to the ageing population in England. While investigating the impact of ageing population on labour participation, Chomik et al (2016) found that fiscal plans were not affected by an increase in the population of older people. Furthermore, the authors posited that labour-related problems could be overcome with adequate economic participation of aged people who are capable of continuing working. Therefore, sufficient and appropriate policies such as healthcare expenditure relating to post-retirement are considerably pertinent for the aged population.

A critical review of previous literature showed variables relating to ageing population has been studied separately but there is limited data on the empirical relationships. This empirical study provides unique insights to the body of knowledge by incorporating data from D-8 countries, representing the developing countries.

Methodology
Data
Secondary data collected between 2000 and 2017 were used in this study. The data on labour force participation rate (LFPR), population ages of 65 and above, per cent of the total ageing population (AP) and healthcare expenditure as per cent of GDP (HE) were gathered from the World Bank website and The Global Economy.

Model Specification

In this study, pool cross-sectional data were employed to investigate the relationships between LFPR, ageing population and healthcare expenditure as shown in the following equation:

$$LFPR = f(AP, HE) \qquad (1)$$

Where LFPR denotes labour force participation rate, AP denotes ageing population, and HE denotes healthcare expenditure as per cent of GDP. These variables were selected based on data accessibility from 2000 to 2017 involving D-8 countries: Malaysia, Indonesia, Bangladesh, Nigeria, Egypt, Iran, Pakistan, and Turkey. Furthermore, a panel data analysis and several tests such as panel unit root tests and dynamic heterogeneous panel estimations, which comprised mean group (MG), pooled mean group (PMG), and dynamic fixed-effect (DFE) were performed in this study. Next, the model specification is expressed as follows:

$$LFPR_{it} = \beta_0 + \beta_1 AP_{it} + \beta_2 HE_{it} + \varepsilon_{it} \qquad (2)$$

Where LFPR, AP, and HE are defined and expressed as presented in Equation (1). Based on the model above, β_0 = constant term, β_1 and β_2 = model's estimated parameters, i = cross-sectional data for the selected countries, t = time span of years, and ε_{it} = error term.

Panel Unit Root Tests

Panel unit root tests were performed on all the chosen variables to assure no likelihood of spurious regression when the panel data are used to solve the low power issue upon applying the Augmented Dickey-Fuller (ADF). It is possible to challenge the accuracy of the estimation's reliability owing to the unit root test's low power if the applied time-series studies are fewer than 50 observations (Ramirez, 2007; Campbell and Perron, 1991). This can be resolved by using panel unit root tests because other than having more power, it also has the standard asymptotic distribution. Hence, as opposed to the unit root tests in time series, the unit root tests of LLC (Levin, Lin, and Chu) and IPS (IM, Pesaran, and Shin) were chosen in this study as they are more effective.

Panel Estimation

The PMG estimator may have a short-term estimate to be heterogeneous, which also includes the intercept, the adjustment speed and the error variance while the long-term slope coefficient is supposedly homogenous. This method is efficient and more consistent in capturing a long-term relationship; however, the coefficient of the error correction term must be negative and lower than two. Besides, it also requires a critical assumption of the estimation consistency, hence causing no serial correlation that can be found in the residual of the error correction model and exogeneity that exists in the explanatory variables. Subsequently, once the lags (p,q) are integrated with the direction of the dependent (p) and independent (q) variables, the conditions are deemed fulfilled. This method also requires large sizes of T and N, whereby T is supposed to be greater than N. Meanwhile, as asserted by Pesaran and Smith (1995), MG will be the second estimator. This estimator allows for separate regressions of each country and the coefficients. Other than being slightly different from PMG because it is not circumscribed to the estimators' procedures; this estimator can also yield heterogeneous coefficients for each country in both the long run and the short run.

Finally, the dynamic fixed effect (DFE) is the third estimator, which is similar to the PMG. Generally, this estimator places limits on the coefficient of vector co-integration, which should be similar among all of the long-term panels besides limiting the adjustment speed. The DFE, therefore, yields the same short-term coefficient and allows for the specific panel coefficient. The following expression entails the MG long-term relationship models:

$$\text{LFPR}_{it} = \theta_i + \delta_{0i}\text{LFPR}_{t-1} + \delta_{1i}\text{AP}_{it} + \delta_{2i}\text{HE}_{it} + \varepsilon_{it}$$
(3)

Where the long-run relationship models of PMG and DFE are expressed as follows:

$$\text{LFPR}_{it} = \mu_i + \sum_{j=1}^{p} \lambda_{ij}\text{LFPR}_{t-j} + \sum_{j=1}^{q} \delta_{1ij}\text{AP}_{it-j} + \sum_{j=1}^{q} \delta_{2ij}\text{HE}_{it-j} + \varepsilon_{it}$$
(4)

Where i denotes the countries (1, 2, 3….8), t denotes the time (2000 to 2017), j denotes the optimum time lag and μ_i denotes the fixed effect.

The following expression depicts the short-term association with the error correction models:

$$\Delta\text{LFPR}_{it} = \mu_i + \varphi_i(\text{LFPR}_{t-1} - \lambda_1\text{AP}_{it} - \lambda_2\text{HE}_{it} + \sum_{j=1}^{p} \lambda_{ij}\text{LFPR}_{t-j} + \sum_{j=1}^{q} \delta_{1ij}\ln\text{AP}_{it-j} +$$

$$\sum_{j=1}^{q} \delta_{2ij}\text{HE}_{it-j} + \mu_{it}$$
(5)

Hausman Test
　　　The Hausman test used in this study is essential in choosing either PMG or MG and PMG or DFE. If the null hypothesis between PMG and MG is accepted, PMG is therefore preferred over MG owing to its efficiency. On the other hand, MG is favoured over PMG if the null hypothesis is rejected. The same principle applies to the hypothesis between PMG and DFE.

Result and Discussion
　　　Unit root tests were conducted at level and the first difference was used to check the stationarity of the data analysed in this study. LLC, PP, and ADF are examples of several approaches that could be employed. Nevertheless, the LLC and ADF tests were used in this study and the results are reported in Table 1. The LLC results showed that all the variables were not stationary at level except for lnHE. which was significant at the level of 5%. However, at the first difference, all the variables were stationary. The ADF results revealed that all the variables including lnHE were not stationary at level but stationary at first difference. Therefore, the panel ARDL can be employed to examine the impacts of ageing population growth and healthcare expenditure on labour force participation rate in the D-8 countries.

Table 1
Unit Root Results

Variable	LLC		ADF	
	Level	1st Difference	Level	1st Difference
lnLFPR	-0.0452	-4.6051***	13.907	62.4322***
lnAP	3.6170	-2.0426**	3.0521	24.7558*
lnHE	-2.0252**	8.2413*	-1.4513	26.9710**

Note: ***, ** and * indicate the significance levels of 1%, 5% and 10%, respectively

Table 2 shows the results of the three estimators: PMG, MG and DFE. The Hausman test results indicated that the PMG estimator was better than the MG estimator in examining the impacts of ageing population growth and health expenditure on labour force participation. Similarly, the PMG estimator performed better than the DFE estimator. The overall results of all of the estimators consistently showed that ageing population growth significantly and positively affects the labour force participation rate in D-8 countries.

The PMG recorded a coefficient value of 1.0252 which was significant at 1%, indicating that a 1% increase in the ageing population in the D-8 countries can trigger a 1.03% rise in the number of people in the labour force. For the MG, a significant coefficient value of 0.7172 was obtained. This suggests that if the ageing population in the D-8 countries rise by 1%, the number of people in the labour force will escalate by 0.71%, resulting in a decline in the labour force participation rate. A similar outcome was demonstrated for the DFE as the coefficient value was 0.5876. These findings are consistent with previous studies reporting positive associations between the ageing population and labour force participation (Reddy, 2016; Aiyar and Ebeke, 2016). However, the results of the three estimators showed that there was no significant effect of health expenditure on the labour force participation rate in the D-8 countries.

Table 2
Long-run Estimation Results

Variable	PMG		MG		DFE	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
lnAP	1.0252***	0.000	0.7172***	0.008	0.5876**	0.000
lnHE	-0.0108	0.455	0.0303	0.840	0.0743	0.421
Hausman	1.13	0.5673			0.02	0.9920

Note: *** and **indicate the significance levels of 1% and 5%

To confirm the aforementioned results, FMOLS and DOLS tests were also conducted. As shown in Table 3, the ageing population growth in the D-8 countries had a significant and positive impact on the labour force participation rate. This implies that a rise in the ageing population would lead to a higher number of people in the labour force. Mushtaq et al (2013) investigated the determinants of short and long-term labour force participation in Pakistan

and found that a 1% increase in infant mortality rate resulted in a decrease of labour force participation rate by 0.653% in the long run. However, the outcomes were inverted in the short run. This is consistent with the present findings as an increase in infant mortality rate depicts a decline in the proportion of those attaining the aged population. Health expenditures also had a significant and positive impact on labour force participation rate in the short-run but the result was absent in the long run (Mushtaq et al., 2013).

Similarly, the corresponding results for healthcare expenditure in this study among the D-8 countries consistently indicated that healthcare expenditure has a significant and negative impact on the labour force participation rate. Thus, an increase in healthcare expenditure on health will reduce the availability of labour and labour force participation rate. The finding corroborates the reports by Cristea et al (2020a) in which developing countries are faced with poor labour performance despite the substantial amount spent on healthcare systems.

Table 3
Robustness Checks Results

Variable	FMOLS		DOLS	
	Coefficient	Prob.	Coefficient	Prob.
lnAP	0.7578***	0.0000	0.8076***	0.0000
lnHE	-0.0675**	0.0179	-0.0782**	0.0227

Note: *** and **indicate the significance levels of 1% and 5%

Overall, these findings have diverse implications for the economic growth in D-8 countries. For instance, a recent study by Mohd et al (2021) found that an increase in the ageing population in Malaysia had a significant negative impact on economic growth, however, the control variables such as labour participation impacted positively on economic growth. Besides identifying labour participation as one of the most important predictors of GDP growth in Malaysia, the researchers are recommended that the policymakers should adopt active ageing policies where the aged population are recruited into the workforce based on their experience and guidance for future generations.

Conclusion and Policy Recommendations
This study evaluates the impact of the ageing population and healthcare expenditure on labour force participation in D-8 countries. The empirical findings revealed that an increase in the ageing population had a significant and positive effect on the labour force participation rate in D-8 countries. These results were further confirmed by the FMOLS and DOLS, whereas the healthcare expenditure impacted negatively on the labour force participation rate in these countries. Thus, a rise in the ageing population is expected to increase the number of people in the labour force while healthcare expenditure will induce an opposite effect.

These results have some important implications on how the government of D-8 countries could revise existing policies to effectively reduce healthcare expenditure in the future. First, a collaboration between the public and private sectors is required to increase the labour force participation rate. Besides increasing the population in the labour force, this

strategy will facilitate those participating in the labour force to support a higher proportion of the ageing population. Second, the retirement age could be raised and the benefits will be reflected in the expansion of tax revenue and consumer spending. These policies will assist in reducing government healthcare expenditure, as the older population will be able to proceed with their employment and minimise their reliance on social welfare. Nevertheless, the main problem with this policy is that it will be highly unpopular, especially among those approaching the retirement age. Third, the government should encourage private pensions and make them compulsory for their employees. Alternatively, they could provide more generous tax breaks for those having private pensions. This is a practical strategy of reducing the government's pension burden and the ageing population can rely on themselves. Additionally, future studies should focus on other economic regions of the world to examine the impact of the ageing population and health expenditure on labour participation.

Acknowledgements

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