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The impact of population aging and fertility rate on economic growth in Malaysia

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Abstract

Purpose — This study aims to examine the impact of population aging and fertility rates on economic growth in Malaysia for the sample spanning from 1961 to 2020.

Method — The study uses an Autoregressive Distributed Lagged (ARDL) model to examine the relationship between economic growth, the aging population, fertility rate, capital stock, and employment rate.

Findings — The main results provide evidence of a long-run relationship between aging, fertility rate, employment, and capital stock on Malaysian economic growth. The results also show that the aging population harms economic growth in the long run, but a decline in the fertility rate has been favorable to long-term economic growth.

Implication — These findings have significant implications for the execution and formulation of national aging and demographic policies and government efforts to achieve long-term fiscal sustainability.

Originality — This study empirically investigated the link between population aging and economic development, reflecting recent demographic trends in Malaysia. This study uses current data and an Autoregressive Distributed Lagged (ARDL) technique to analyze long-term economic growth and its association with supply-side determinants.

Keywords — Aging population, ARDL model, economic growth, employment, the fertility rate

Introduction

The Sustainable Development Goals (SDG) agenda for 2030 is focused on addressing population aging and community health (SDG, 2030). However, global trends in recent years have demonstrated a rapid rise in population aging. According to the United Nations (2020), in 2020, 727 million individuals over 65 are living in the world. The United Nations (2020) anticipated that the ratio of individuals 65 and above globally will climb from 9.3 percent (2020) to roughly 16 percent (2050). Over the next 30 years, the world's elderly population is expected to grow by more than half to more than 1.5 billion people by 2050 (United Nations, 2020b). Because of the exceptional phenomena of population aging, fundamental fluctuations in population demands and capabilities are occurring, with potentially significant consequences for savings, employment, consumption, and the general state of the economy (Bloom & Luca, 2016).

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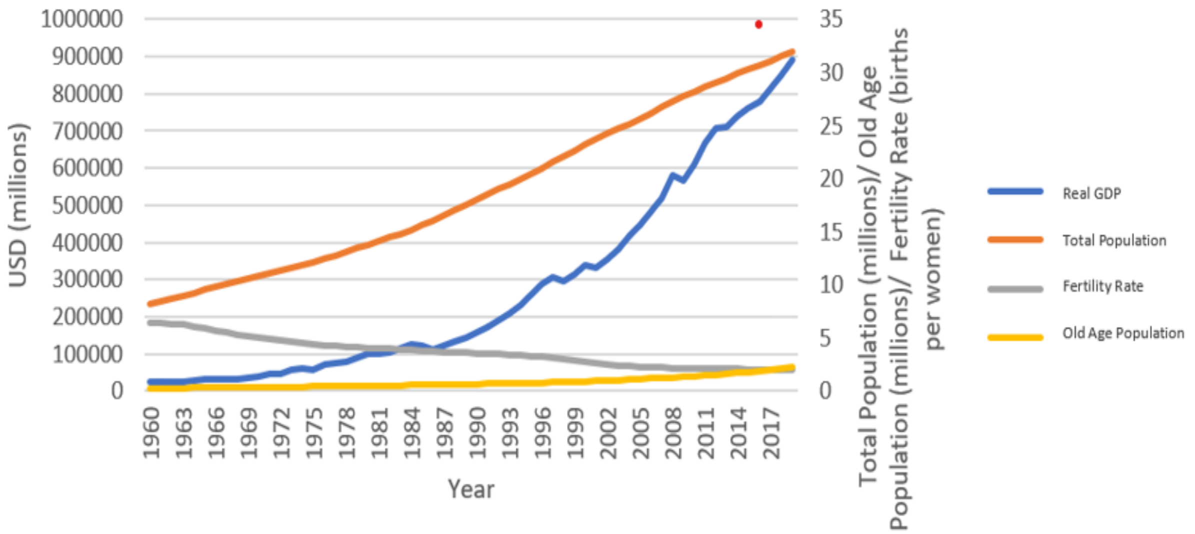
A growing percentage of the population is anticipated to be over 65 due to falling fertility and increased life expectancy. According to the United Nations (2019), a 65-year-old can expect to live an additional 17 years on average worldwide from 2015 to 2020. However, the longer life expectancy of the old population will increase to 19 years between 2045 and 2050 due to improvements in the healthcare system. In contrast, the average fertility rate worldwide in 2019 was 2.458 births per woman, a decrease of 0.41 percent from 2018 (United Nations, 2019b). In addition, the United Nations (2020a)has also projected that the global fertility rate will decline, reaching 2.2 births per woman in 2050 and 1.9 in 2100. Fertility rates vary by country; in 2019, the fertility rates in more developed nations like Japan and Europe were 1.52 and 1.36, respectively, lower than the global average. A decline in birth rates will eventually result in a smaller population overall, concerns about long-term replacement in the working-age population, and a labor shortage.

With a shrinking population and increasing number of elderly citizens, governments are concerned about ensuring that the country's productive human resources are available to meet its future needs. As the older population grows, the cost of providing pensions, healthcare facilities, and care centers for the elderly will rise. Although voluminous studies have examined the impact of population aging on economic growth in developed countries, the findings still need clarification. Several economists such as Auerbach and Kotlikoff (1987), Hviding and Mérette (1998), and Miles (1999) first proposed hypotheses that a rapidly growing aging population would lead to lower national savings rates and lower real per capita production.

According to government forecasts, Malaysia's population will reach 32.7 million people in 2021, with a rise in elderly persons from 7 percent to 7.4 percent from the previous year (Department of Statistics Malaysia, 2021). Figure 1 depicts the overall relationship between Malaysia's population, elderly population, fertility rate, and accurate Gross Domestic Product (GDP). The graph shows that from 1960 to 2019, Malaysia's population grew steadily with real GDP, demonstrating a positive relationship between total population and real GDP. As this has been happening, Malaysia's fertility rate has been steadily declining, suggesting a negative correlation between fertility rates and real GDP. The overall population is growing despite a declining fertility rate because of the rise in life expectancy. The Department of Statistics Malaysia or DOSM (2021) forecasts a decline in the younger age group in 2021, from 23.3 percent in 2020 to 23.0 percent in 2021, but a significant increase in the elderly age group, as people have expected to live longer. This is due to the low fertility rate and higher life expectancy. Malaysia is expected to grow gradually to 20% by 2056, designating Malaysia as a "super-aged" nation. However, the combination of low fertility rates and an increasing elderly population raises concerns about the possibility that Malaysia will be the next super-aging country.



Source: World Bank

Figure 1: Total population, old age population, fertility rates, and real GDP in Malaysia

According to forecasts by the United Nations in 2009, Malaysia would become an old country by 2030, with 15% of the total population being 60 or older. The government of Malaysia took early action to address the issue of population aging by passing the National Policy for the Aged in 1995 and the National Policy for Older People (NPOP) in 2011. This number recognizes that Malaysia will soon face an aging population. By offering services geared towards the elderly and fostering circumstances that promote old-age well-being, these policies have strongly emphasized empowering individuals, families, and communities. The government supports projects to enhance care and infrastructure for the elderly under the 11th Malaysia Plan. The government supports active aging by providing additional opportunities for the elderly to keep studying and gaining knowledge and skills in collaboration with universities, community colleges, and the Senior Citizen Activity Center. Also, social awareness initiatives on volunteering will encourage retired professionals to contribute their knowledge, expertise, and experience to the community.

On the other hand, the government aspires to reach a population of 70 million by 2100, as stated in the Population Policy Malaysia vision. The goal of reaching 70 million people is to create a market and demand for domestic manufacturing goods. This forecast of future population increase significantly depends on the course of future fertility. When projected across decades, variations in fertility patterns might cause significant population differences. Raising two important aspects of the population is necessary to achieve this goal: the gross birth rate and the fertility rate. With the fertility rate, the United Nations estimates Malaysia's population will reach only 40 million by 2100, or under half of the original goal (United Nations, 2019a). Malaysia has 32.37 million people overall as of 2020, and its average fertility rate was 1.98 births per woman (World Bank, 2019). By increasing the number of people who are working age, lowering the dependence ratio among the elderly, and minimizing the possibility of a long-term labor shortage, among other things, higher fertility and birth rates may also help to lessen the adverse consequences of population aging.

Given this context, the study aims to investigate the impact of Malaysia's aging population and low birth rate on the country's economic development. The results of this study are relevant to both the body of knowledge and policymakers in the following ways: first, by demonstrating how the relationship between the old age population and fertility rate in national economic growth affects policymakers' ability to implement government policies, particularly the Malaysian Population Policy and the National Senior Citizens Policy (DWEN). With the most recent statistics, policymakers can update the Malaysian Population Policy and the National Senior Citizens Policy (DWEN) to reflect the most recent demographic trends. The study also adds to the corpus of knowledge in the following ways from earlier research. Second, this study uses recent data and an ARDL technique to model Malaysia's economic growth while considering the aging population and fertility rate. To further understand how the supply-side determinants reflect long-run economic growth, this study uses the supply-side model to analyze the growth empirics in Malaysia, considering the roles of capital stock and productive labor (employed).

The three most essential economic growth theories are the classical, neo-classical, and modern. Domar (1946), Harrod (1939), Solow (1956), Swan (1956) (neo-classical growth), and Adam Smith (classical growth) were the most significant proponents of economic growth theory (modern growth). According to classical economists like Adam Smith (1776) and David Ricardo, understanding how economies expand and contract helps shed light on the relevance of economic growth. Neo-classical theorists like Solow and Swan emphasize that how people interact with the economy within a framework necessary for growth is important. The modern perspective emphasizes that overcoming the fundamental economic issue of supplying unending needs with finite resources leads to growth. It is also suggested that information is essential to development throughout the conversation. Adam Smith and David Ricardo are generally regarded as having had the most significant intellectual influence on the advancement of the conventional theory of economic growth. They suggested that population growth reaches a point after which, if it continues, the economy's wealth diminishes.

Romer (1994) developed a different endogenous growth model that suggests investments in knowledge and human capital are important drivers of economic progress. According to a study by Peterson (2017), high-income countries with slow population growth are more likely to experience social and economic issues. On the other hand, it has been anticipated that rapid population growth in low-income countries will stifle progress. Although many people are against it, international migration might help to reduce these discrepancies. In addition, he argues that fewer people migrating and slower population growth will likely lead to greater economic inequality on a national and international scale in the future.

Even though the link between population aging and economic development has been widely investigated in the previous literature, the conclusions are quite equivocal, with a combination of positive and negative results reported. The neoclassical growth model developed by Solow (1956) gives a theoretical clarification for the adverse relationship between population increase and per capita production growth in the United States. The model is referred to as the exogenous growth in certain circles. According to this model, rapid population growth leads to less capital per worker and slower economic advancement (Bucci, 2015). Besides, Mankiw et al. (1992) have extended Solow's model to include human capital accumulation, and they have shown that greater population growth rates are associated with lower steady-state economic growth rates.

Between 2006 and 2030, it is anticipated that the number of elderly persons in less developed nations will grow by 140 percent, compared to a 51% increase in more developed countries over the same period (Krug et al., 2002). According to their research, Powell and Cook (2009) also specified that if the worldwide population aging patterns continue to climb, the number of elderly people worldwide will surpass the number of young people in 2050. Four-generation households may become increasingly widespread as life expectancy increases and the total of persons aged 85 and above increases. According to relatively recent research by Huang et al. (2019), an aging workforce significantly influences economic growth. On the other hand, the old-age dependency fraction has a statistically substantial negative impact on economic development. They concluded that human capital is critical for total factor productivity (TFP) advance and that population aging significantly impacts productivity via TFP. Increases in longevity positively influence per capita production growth, but reductions in fertility have a negative impact, according to Prettner's (2013) research using endogenous growth models.

In addition, according to Fougère and Mérette (1999), population aging may provide chances for future generations to engage in human capital development, encouraging economic growth and mitigating the negative effect of aging on production per capita. In Japan, the population aged 70-74 increased and connected with a drop in economic growth. However, a rise in the number of people aged 75 and older has increased economic growth (Oliver, 2015). Beaudry and Collard (2003) noted that in 18 countries, including Japan, a strong systematic relationship exists between the growth rate of the 15-64 age group and economic success. Mee (2019) made the case that population aging might raise fiscal spending by increasing social welfare spending and spending on the young and old.

On the other hand, using data from OECD nations, Lindh and Malmberg (1999) demonstrate that employees aged 50-64 significantly improve productivity, but workers aged 65 years and older negatively influence production. However, Aiyar and Ebeke (2016) discovered that an increasing share of the workforce aged 55-64 years results in a considerable decrease in overall output. On the other hand, the ratios of old-age reliance and young-age dependency do not affect the situation. Furthermore, Manabu and Hosoyama (2004) found that population aging reduces the growth rate of the workforce and capital stock and that this demographic shock leads to an increase in the financial burden in the form of taxes and pensions, a reduction in economic welfare, and a significant decrease in the growth rate of the economy. Miles (1999) further indicates that the population's aging will significantly negatively impact national saving rates and real production per capita over the next several decades.

In contrast, Feyrer (2007) discovered that the 15-39 age group is linked with poorer productivity, but the 40-49 age group is associated with better productivity after examining the share of the workforce by age group in 19 OECD nations over the years 1990-1995. Furthermore, it was shown that being above the age of 50 was connected with decreased production than being between the ages of 40 and 49. According to Lisenkova et al. (2012), through the aging population, the individual labor productivity level should be lowered since the physical capability of the workforce diminishes with time. On the other hand, Göbel and Zwick (2012) discovered no statistically significant variations in the age-productivity relationship between the manufacturing and services sectors.

Another topic that has recently gained the attention of researchers is the link between health and economic development. Positive cross-country correlations between health and economic development are widely documented. Nevertheless, the underlying processes are complicated to identify between one nation and another because determining causality and quantifying it is empirically difficult, the relationship changes as economic development progresses, and many aspects of health may have additional economic implications (Bloom et al., 2018). Barro (1996, 2013) suggests that health status is essential to economic growth and is a more significant predictor of eventual economic development than initial education. Aside from that, excellent health has been shown to contribute significantly to economic development, both short and long-term (Boachie, 2017). Adult survival rates (ASR), a measure of health status used by Bhargava et al. (2001), correlate positively with GDP growth rates in low-income countries. Furthermore, Lorentzen et al. (2008) demonstrate that declining adult mortality promotes lower risk-taking behavior, lower fertility, more significant investments in physical capital, and higher economic growth. Additionally, Weil (2007) proves that health is a crucial factor in cross-country data that affects how much income varies.

There needs to be more research looking at how population increase, population aging, and health status affect economic growth in Malaysia. Prior research only addressed the population problem. For instance, Nor (2018) discovered that Malaysia's rising aging trend is brought on by reducing fertility by women delaying marriage or getting married later in life and population growth in terms of education, health, and life expectancy. Ismail et al. (2015) examined the impact of aging on economic development using data from 1970 to 2013. Based on the findings, only the fertility rate has a statistically meaningful long-run link and is associated with stronger economic development in Malaysia. They concluded that, notwithstanding Malaysia's aging population, stabilizing economic development would be achieved by increasing investments in human capital. In a recent study, (Taasim, 2020) examined how the aging population impacted economic development between 1990 and 2017. He connected population aging, education spending, and long-term economic growth. As a result, he recommended that the government enhance spending in the education sector to develop a better human capital potential and address the aging phenomenon simultaneously.

Methods

Data Description

The study utilizes the World Bank Open Data and Penn World Table Database, which covered the years 1961 through 2019. The factors taken into account include the real Gross Domestic Product (RGDP) on the expenditure side, the capital stock (CAP), the labor force (EMP), the elderly population (AGING), and the fertility rate (FR). While other explanatory variables are expressed in percentage terms (%), RGDP and CAP are in log form. Table 1 summarises the variables employed in the investigation.

Table 1. Dependent and Independent Variables

Abbreviation	Variables	Unit of Measurement	Expected Sign
RGDP	Expenditure-side real GDP at chained PPPs	Millions 2017 USD	
CAP	Capital Stock at current PPPs	Millions 2017 USD	Positive
EMP	Labour Employed	Millions	Positive
AGING	Old Age Group Population	Percent of total population (%)	Negative
FR	Fertility Rate	Total (births per woman)	Negative

Empirical Model

An Autoregressive Distributed Lag (ARDL) model, as proposed by Pesaran et al. (1999, 2001) is employed to examine the relationship between economic growth and the aging population and fertility rate, capital stock, and employment rate. First, we investigate the cointegration among variables using the bound testing technique, which is as follows:

$$\Delta LRGDP_t = \alpha + \beta_1 LRGDP_{t-1} + \beta_2 LCAP_{t-1} + \beta_3 LEMP_{t-1} + \beta_4 AGING_{t-1} + \beta_5 FR_{t-1} + \sum_{i=1}^{p} \theta_1 \Delta LRGDP_{t-1} + \sum_{i=1}^{q} \theta_2 \Delta LCAP_{t-1} + \sum_{i=1}^{r} \theta_3 \Delta LEMP_{t-1} + \sum_{i=1}^{s} \theta_4 \Delta AGING_{t-1} + \sum_{i=1}^{t} \theta_5 \Delta FR_{t-1} + \varepsilon_t \quad (1)$$

In equation [1], LRGDP stands for the log of Gross Domestic Product, LCAP for the log of capital stock, LEMP for the log of labor employed, AGING for the percentage of the population over 65 years old, FR for fertility rates (average birth rate per woman), and (p,q,r,s,t) for the best lag length determined by the Akaike Information Criterion (AIC) or Bayesian Criterion (BIC).

Wald test (joint test or F test) is used to determine whether or not cointegration exists. Wald test calculated from equation [1] must be compared to the critical value (usually for case III) suggested by Pesaran et al. (2001). If the calculated F-statistics are more significant than the critical value's upper bound, the null hypothesis of no cointegration is rejected. Similarly, if the estimated F statistics are smaller than the lower bound, the null hypothesis cannot be rejected. The result is inclusive if the projected value falls within the critical value band. The following hypothesis is used to determine whether or not cointegration exists:

$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ (there is no cointegration amongst the variables)
$H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$ (there is cointegration amongst the variables)

In the second step, when cointegration has been established, the long-run model of economic growth is estimated using the long-run ARDL (p,q,r,s,t) model as follows:

$$LRGDP_t = \alpha + \sum_{i=1}^{p} \theta_1 LRGDP_{t-1} + \sum_{i=1}^{q} \theta_2 LCAP_{t-1} + \sum_{i=1}^{r} \theta_3 LEMP_{t-1} + \sum_{i=1}^{s} \theta_4 AGING_{t-1} + \sum_{i=1}^{t} \theta_5 FR_{t-1} + \varepsilon_t \quad (2)$$

The long-run model in equations [2] is required to derive the error correction term that will be used as an explanatory variable in the short-run model as follows:

$$\Delta LRGDP_t = \alpha + \sum_{i=1}^{p} \theta_1 \Delta LRGDP_{t-1} + \sum_{i=1}^{q} \theta_2 \Delta LCAP_{t-1} + \sum_{i=1}^{r} \theta_3 \Delta LEMP_{t-1} + \sum_{i=1}^{s} \theta_4 \Delta AGING_{t-1} + \sum_{i=1}^{t} \theta_5 \Delta FR_{t-1} + \phi ECT_{t-1} + \varepsilon_t \quad (3)$$

In equation [3], ECT is an error correction term and ϕ is the speed of adjustment that measures how long the disequilibrium in the short run will be corrected until it converges to the long-run equilibrium.

In addition, the cumulative sum of recursive residuals (CUSUMQ) is used to test the model's structural stability, as Brown et al. (1975) recommended. If the CUSUMQ plot stays inside the critical limit at a 5% significance level, the coefficients and the error correction model are stable and cannot be rejected. Similarly, if the two lines intersect, the null hypothesis of coefficient constancy may be rejected at 5%.

Results and Discussions

The unit root test can be used to show that there is no second difference or I(2) series among the variables, even though the ARDL cointegration technique does not require it. Only the I(0) and I(1) series are suitable for use with the ARDL approach. For this reason, the order of integration of each variable is determined using four methods: Augmented Dickey-Fuller, Phillips-Perron (PP), Kwiatkowski-Phillips-Schmidt-Shin (KPSS), and the breakpoint unit root test. The unit root test results from the ADF, PP, KPSS, and breakpoint test methods demonstrated a mixture of I(0) and I(1) integration of underlying variables, as shown in Tables 2 and 3. Thus, with no I(2) series available, the ARDL technique advanced by Pesaran et al. (2001) may be utilized to examine the long-term connection among the variables.

Table 2. Unit Root Test using ADF (Augmented Dickey-Fuller) and Phillips-Perron (PP)

Variable	Augmented Dickey-Fuller				Phillips-Perron Test Equation			
	Level		First Difference		Level		First Difference	
	Constant	Constant with Trend	Constant	Constant with Trend	Constant	Constant with Trend	Constant	Constant with Trend
LRGDP	-0.74	-1.75	-7.43***	-7.46***	-0.76	-1.97	-7.43***	-7.46***
LCAP	-0.27	-3.30*	-3.43***	-3.38*	0.03	-2.27	-2.67	-2.61
EMP	4.13	-0.78	-5.35***	-6.73 ***	3.90	-0.81	-5.52***	-6.69***
AGING	2.95	2.17	0.74	-1.38	9.88	4.31	4.31	-1.40
FR	-3.94***	-8.71***	-6.17***	-7.73***	-3.43***	-1.23	-1.91	-3.23*

Note: ***, **, and * indicate significance at 1%, 5%, and 10% significance levels, respectively.

Table 3. Unit Root Test using KPSS and Break Test

KPSS Unit Root Test				
Variable	At Level I (0)		First Difference I (I)	
	Constant	Constant with Trend	Constant	Constant with Trend
LRGDP	0.95	0.14**	0.12***	0.08***
LCAP	0.96	0.10*	0.09***	0.09***
EMP	0.93	0.23	0.72***	0.03***
AGING	0.78	0.21	0.72***	0.21
FR	0.93	0.17***	0.47***	0.08***

Unit Root with Break Test						
Variable	At Level I (0)			First Difference I (I)		
	Constant	Constant with Trend	Trend	Constant	Constant with Trend	Trend
LRGDP	-2.00	-3.08	-3.09	-8.46***	-8.77***	-7.69***
LCAP	-1.91	-4.56	-3.87	-3.86	-4.87	-3.92
EMP	1.38	-3.43	-1.98	-7.31***	-9.63***	-6.88***
AGING	0.81	-3.16	-1.92	-3.43	-4.38	-4.55**
FR	-8.84***	-6.84***	-5.37***	-4.30*	-3.57	-3.57

Note: ***, **, and * indicate significance at 1%, 5%, and 10% significance levels, respectively.

The results of the Bound tests used to look for the long-term association (cointegration) between LRGPD, LCAP, EMP, AGING, and FR are shown in Table 4. The findings demonstrate that the regression's F-statistics were higher than those for the upper bound's I(1) critical value at a 1% significance level. These results suggest that economic growth fluctuates over the long term depending on the movement of capital stock, employment, aging, and fertility rate. These results show that Malaysian economic development and the explanatory factors have a long-term relationship (cointegration), rejecting the null hypothesis.

Table 4. Bound Tests Cointegration Results

Estimates of Cointegration Bounds Test		Null Hypothesis: No levels of relationship		
Test Statistic	Value	Significance Level.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	6.8564	10%	2.45	3.52
k	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06

Table 5 summarizes The long-run elasticity of all explanatory factors concerning economic growth. At a 5% significance level, the long-run coefficient is statistically significant. According to conventional economic theory, the stock of capital and employment benefit economic growth (supply-side economy). For instance, over time, a 1% increase in capital stock results in an increase of 0.18% in Malaysia's economic growth. Malaysia's economic growth will be increased by 0.10% with an additional 1% of employed labor. These results suggest that both supply-side variables are essential for long-term economic growth. However, the aging population and the fertility rate significantly impact long-term economic growth in Malaysia. Economic growth is reduced by 0.07% for every percentage point rise in the population that is getting older. These results indicate that the older population will negatively impact economic growth since they are unproductive (not working) members of society. According to Manabu and Hosoyama (2004) population aging slows the expansion of the labor force and capital stock, and this demographic shock results in higher taxes and pension costs, worse economic welfare, and a sharp decline in the economy's growth rate. Moreover, Lisenkova et al. (2012) stated that as the population ages, labor output declines due to the workforce's deteriorating physical abilities.

Table 5: Long-Run Elasticity

ARDL (p,q,r,s) Dependent variable: D(LRGDP)	Coefficient
LCAP	0.176** (0.099)
EMP	0.105*** (0.028)
AGEING	-0.073** (0.036)
FR	-0.496*** (0.047)

Note: Numbers in parentheses are standard errors.
***, **, and * indicate significance at 1%, 5%, and 10% significance levels, respectively.

Table 6: Short Run Model and Diagnostic Checkings

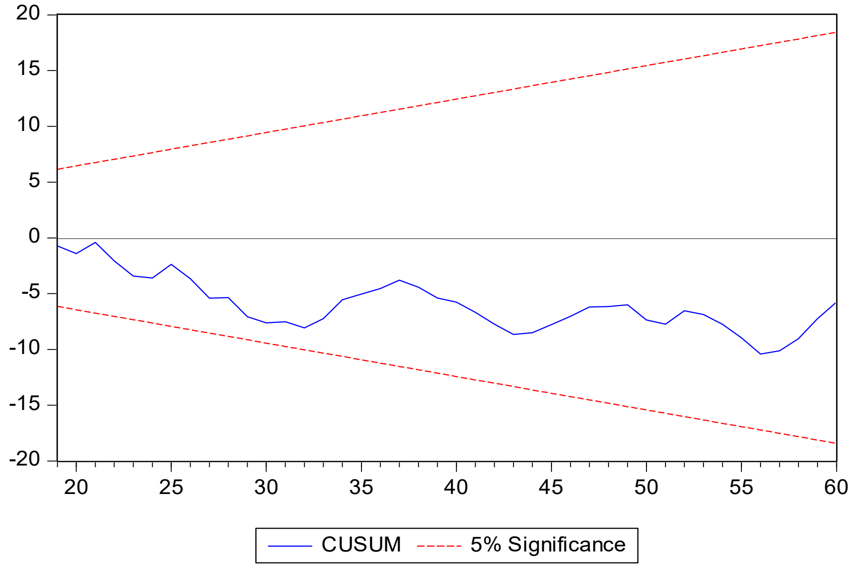
Panel A: Estimated Model						
Dependent Variable	Selected Model ARDL	Independent Variable				
		D(LCAP)	D(EMP)	D(AGING)	D(FR)	ECT
D(LRGDP)	(2,2,2,2)	1.693 (4.076) ***	-0.013 (-0.069)	-0.211 (-0.792)	0.190 (-0.049)	-1.119 (-6.128) ***
Panel B: Diagnostic Testing						
Serial Correlation					[1.775]	
Normality Test					[-0.186] 2.682	
Heteroscedasticity Test					[1.042]	

Note: Numbers in parentheses are t-statistics.
***, **, and * indicate significance at 1%, 5%, and 10% significance levels, respectively. Wald Test is utilized to test the significance of each independent variable.

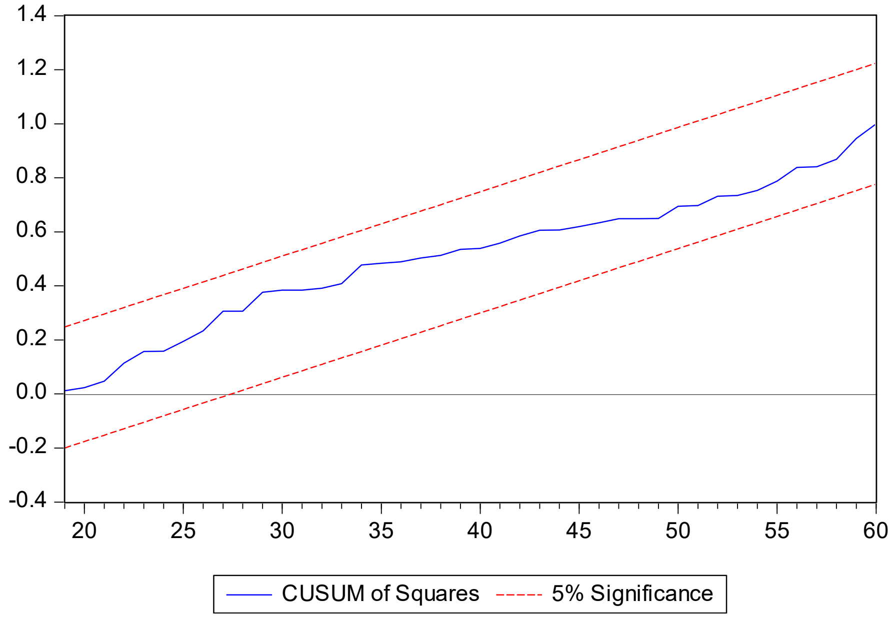
The findings also indicate that the fertility rate negatively impacts Malaysia's economic growth. Given that Malaysia's fertility rate is declining, our country's economic growth has been boosted by the decline in fertility. The findings support Prettner's (2013) findings that lower fertility rates were associated with greater economic growth. Furthermore, the low fertility rate is connected to the rise in female labor force involvement (Bloom & Finlay, 2009). Many working women marry later and may not want many children because it is assumed that they will stop working to care for their children. As the baby boomer generation increases, the senior population will soon outweigh working persons. As the baby boomer generation increases, the senior population will soon outweigh working persons, and the dependency ratio will greatly impact the country's economic development. Moreover, Huang et al. (2019)prove that the old-age dependence ratio hinders economic growth.

Table 6 (Panel A) summarises the results of the short-run study utilizing the ARDL error correcting model (ECM). The results show that capital stock significantly impacts short-term and long-term economic growth. Apart from capital stock, factors like the labor force, elderly population, and fertility rate have little impact on economic growth in the short term. At a 1% significance level, the error correction terms (ECT) coefficient is statistically significant, suggesting that all explanatory factors have a long-term causal effect on economic growth. According to the speed of adjustment (1/ECT = 0.98), it will take 0.98 years, or 10.7 months, to correct the disequilibrium brought on by the shock from the previous year and converge to long-run equilibrium growth.

Several diagnostic tests have been performed to ensure that the model is reliable. No evidence of serial correlation or heteroscedasticity influence in terms of disturbance is seen in Table 6 (Panel B). The model also passed the Jarque-Bera normality test, which shows that the errors are distributed regularly. The structural stability is subsequently evaluated using the CUSUM and CUSUM square tests. Both results exhibit structural stability in the intercept and variance of the residual, as shown in Figure 2.



CUSUM Test



CUSUM of Squares

Figure 2.CUSUM Test dan CUSUM of Squares

Conclusion

Future human capital development in Malaysia is in danger due to a considerable rise in the elderly population and declining fertility rates. Thus, policymakers need to comprehend how Malaysia's aging population and fertility rate can affect the country's economic growth to develop a suitable demographic policy. This study employs annual data from 1960 to 2019 and the ARDL model to empirically analyze this topic by analyzing the long- and short-term effects of population aging, fertility rate, capital stock, and employment on economic growth in Malaysia.

The major findings showed that while the stock of capital and employment favorably impacted economic growth in Malaysia, the old-age population (aging) and fertility rate had a negative impact. Older individuals do not immediately impact the economic development of the nation. Due to decreasing productivity brought on by an increase in the older population, which slows down labor and capital stock growth, will undoubtedly have a substantial long-term influence on Malaysia's economic growth (Manabu & Hosoyama, 2004). Moreover, the fertility rate has a negative long-term impact on the nation's economic growth. Low reproduction rates are usually linked to higher female labor force participation and later marriage, which are detrimental to economic growth. However, concerns about an excessive old-dependency ratio in the near future are raised by a dropping birth rate coupled with an aging population. In low-fertility countries like Malaysia, further fertility losses would eventually lead to a labor shortage as well.

Capital stock substantially impacts economic growth in the short and long term, indicating the importance of adopting an effective strategy to promote capital accumulation through domestic and foreign direct investment (FDI). Long-term economic growth is also significantly influenced by employment, suggesting that increasing the number of people actively employed is preferable to accelerate long-term growth by increasing aggregate expenditure, particularly aggregate consumption.

For policymakers, this study has some significant ramifications. Authorities must have a suitable succession plan in place to counteract the rise in the elderly population because it undermines economic growth in the long run (unproductive resources). This can be accomplished by strengthening the labor force participation rate of the economy and increasing the working-age population (productive resource). Policymakers should also encourage older people to participate in the economy (productive aging) as a workforce, motivators or actively engage as volunteers because the aging population has a wealth of experience and skill in many disciplines. Second, even though a decline in the fertility rate has boosted economic growth, the government should not restrict population expansion.

The inverse association between fertility and economic growth is typically associated with late marriage and higher female labor force participation. Therefore, policymakers may offer special incentives like tax breaks and childbearing incentives and upgrade the rules and legislation regarding maternity and paternity leave to encourage a quicker population increase. Finally, governments must encourage household savings and investments to promote capital stock accumulation because Malaysia's economic growth depends on the capital stock and the labor force. A high household savings rate promotes capital formation and, over time, can speed up economic growth. Lastly, since employment significantly impacts growth, policymakers should prioritize their strategy to increase job opportunities by fostering a favorable business climate and resolving the labor market mismatch in the economy by enhancing education and training standards.

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