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DEMOGRAPHIC TRENDS AND ECONOMIC PERFORMANCE: ANALYSING MALAYSIA'S GROWTH TRAJECTORY

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Abstract

This study explores the relationship between demographic trends and economic performance in Malaysia, a Southeast Asian country with a population of over 34 million as of 2023. Despite significant economic growth and high GDP per capita, the nation faces challenges due to an ageing population and declining fertility rate (2.2 children per woman in 2022). These trends could lead to series of issues like smaller working-age population, reduced savings, and consumption, lower productivity, and higher social security costs, possibly harming future economic growth without early policy interventions. Covering 1970 – 2022, the study used data from World Bank, Malaysia's Department of statistics, United Nations, and Macrotrends. Descriptive statistics, boxplots, cointegration tests, and ARDL/ECM techniques were employed to explore the interplay between the variables of the study with the aid of EViews software. Analysis findings indicates that population growth rate, past GDP values, inflation, foreign direct investment, unemployment, and labour force participation significantly impact GDP value at different times. This study concludes by recommending that policymakers in Malaysia, incorporate changes in demographic trends/population dynamics impacts into economic strategies, promote long-run equilibrium to ensure that economy is self-correcting and can withstand shocks in the short-run, control inflation in a balanced and prudent manner, attract stable domestic and foreign direct investments, and enact job creation and training policies to ensure inclusive and sustainable economic growth and resilient to short-term shocks.

Keywords: Demographic Trends, Economic Performance, Malaysia, ARDL ECM Analysis, Impacts.

1.0. INTRODUCTION

Malaysia, a Southeast Asian multi-ethnic and multi-religious country, had a population of over 33.6 million people as of 2021 and over 34.0 million as of 2023. The diverse population includes Bumiputera (69%), Chinese (23%), Indians (7%), and other minorities. The Bumiputera group encompasses Malays and indigenous peoples of Peninsular Malaysia, Sabah, and Sarawak. The Chinese and Indians are mostly descendants of colonial-era immigrants. Malaysia's urban population rose from 36.8% in 1974 to 78.7% in 2023, growing at an average annual rate of 1.57%. Its population grew from 6.3 million in 1957 to over 34 million in 2023 (World Bank, 2021 and 2022; DOSM, 2021; Statista, 2022; Macrotrends, 2023). The share of the population by religion in Malaysia in 2020 are Islam (61.3%), Buddhism (19.8%), Christianity (9.2%), Hinduism (6.3%), other religions (1.3%), No religion (0.4%), Unknown (1.7%).

Malaysia's strategic location established it as a key cultural, social, historical, and economic and trade links between Southeast Asia's islands and the mainland. The Strait of Malacca is facilitating extensive maritime trade, integrating influences from China, India, the Middle East, and Africa (The World Factbook, 2023).

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Since its independent in 1957, Malaysia has experienced rapid economic growth, diversifying from agriculture to manufacturing and services, and becoming a leading exporter of electrical components. The GDP per capita has averaged 6.5% growth rate annually, reaching US$11,993 in 2022. Factors influencing this growth include natural resources (oil, gas, palm oil, rubber, etc.), an export-oriented manufacturing sector, a robust services sector, human capital, and political stability (World Bank, 2022, ceic, 2022; Macrotrends, 2023). However, Malaysia faces challenges of with an aging population and declining fertility rates (3.5 children per woman in the 1970s to 2.2 children per woman as of 2021). These emerging dynamics couple with tight restrictions on foreign workers inflow could lead to a smaller working-age population. Low saving and consumption, productivity, and higher social security expenses, and possibly resulting to wider negative economic consequences without appropriate early policy interventions. (World Bank, 2021and 2022; the World Factbook, 2023; Gu et al., 2021; Heintz and Folbre, 2022; Maestas et al., 2023; Statista, 2022).

The relationship between demographic trends and economic growth in Malaysia is complex and multidimensional, affected by development level, human capital quality, natural resources trade openness, investment, and institutional environment. Demographic trends and economic performance are closely interconnected in Malaysia. There has been growing concern about the emerging demographic shifts as the proportion of the population over 60years is expected to reach 22% by 2025, due to declining fertility and improved healthcare, the demographic shift requires timely policy interventions to mitigate possible negative economic impacts. Given the above, this study examines the interplay between demographic trends and economic growth, highlighting ways demographic changes can affect economic growth, labour markets, consumption and saving, and public policy, and seeking to provides insights for policymakers on leveraging demographic changes to drive economic development. Also, it contributes to the literature on demographic dynamics and economic growth. The research includes abstract, introduction, background, literature review, methodology, results and discussion, conclusion and recommendations. Understanding this relationship is essential for effective designing and implementing sustainable economic, social and population policies in Malaysia.

1.1. Background of the study

Southeast Asian nation of Malaysia has experienced significant economic and social changes since 1970s, as shown by various development indicators. The nation's GDP has steadily grown, reaching US$337.46 billion in 2020 with a GDP per capita of US$10,164, which is a decrease from the previous year due to the COVID-19 pandemic impacts. By 2021, GDP increased to 373.83 billion and GDP per capita to US$11,135, and continued to rise to US$407.03 billion and US$11,193 respectively in 2022. However, population growth has declined from 2.9% in the 1960s to 1.09% in 2023 due to factors such as aging population and decreased fertility rates and improved healthcare access. Meanwhile, labour participation rate increased from 42.9% in 1982 to 69.26% in 2022, driven by industrial growth, higher female labour force participation and more job availability. Malaysia has an ageing population, with a median age of 30.4 years and age dependency ratio of 43.22% in 2022. Additionally, the gender ratio in Malaysia is generally skewed towards males (17 million males and 15.7 million

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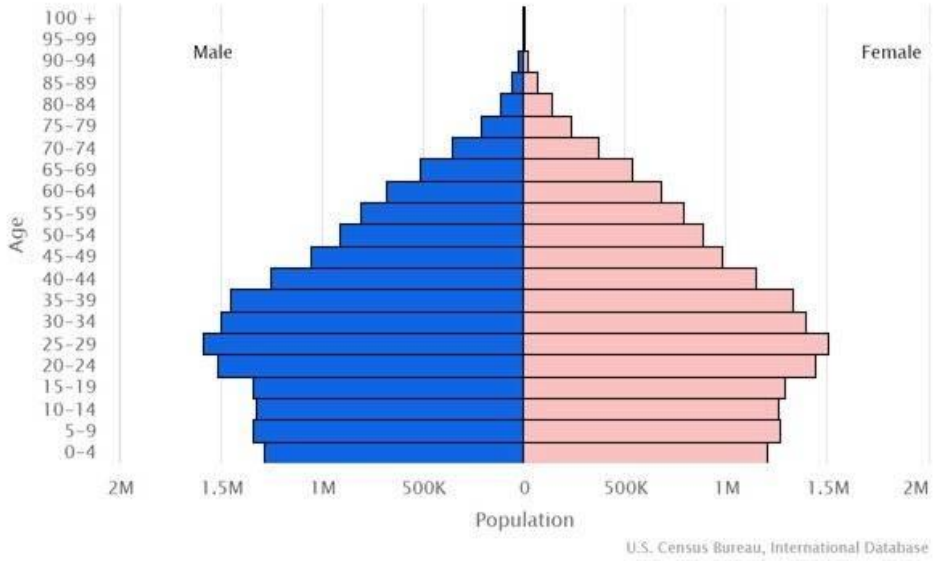
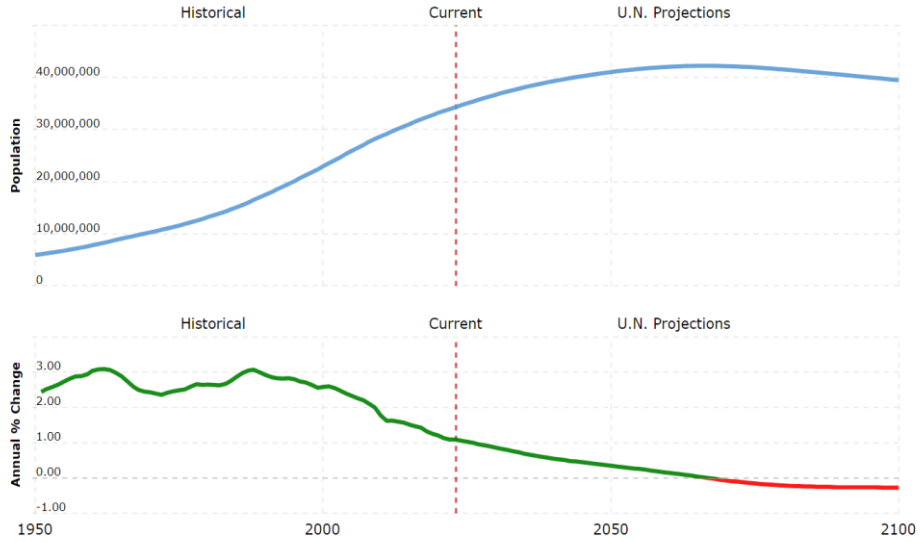
females), with 109 males for every 100 females in 2022. For citizens, the gender ratio is 103 males to 100 females, while for non-citizens, the gender ratio remains 227 males for every 100 females. The population age is structure as 0-14 years: 23.3% (male 3,952,311/female 3,734,607), 15-64 years: 69.5% (male 12,198,930/female 11,556,399), 65 years and over: 8.12% (2023 est.) (Male 1,345,767/female 1,431,961) (Malaysia Department of Statistics, 2022; cia, 2023; World Bank, 2022).

Figure 1: Malaysia 2022 Population pyramid



Source: U.S. Census Bureau, International Database/cia.gov

Figure 2: Malaysia Population and prospects (1950 – 2023 and 2023 – 2100)



Source: United Nations – World Population prospects /Macrotrends

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Malaysia's population is distributed unevenly, with the majority of the population living in urban areas. In 2023, the urbanization rate was 78.7%. The fertility rate in Malaysia has decreased over time, from average 2.9 births per woman in 1960s to 1.09 births per woman in 2023. The mortality rate has also decreased, from 6.5 deaths per 1,000 people in 1973 to 5.4 deaths per 1,000 people in 2022.

The literacy rate in Malaysia is high. The poverty rate is 4.5% (Urban) and 12% (Rural) in 2022. However, poverty remains an issue in certain regions and among certain groups, such as indigenous communities in rural areas (Department of Statistics Malaysia, 2022; World Bank, 2023; Statista, 2023).

Malaysia's urbanization rate has increased over time, from 33.5% in 1970 to 78.7% in 2023. This increase is due to various factors, including rural-urban migration and the growth of the services and manufacturing sector. Also, Malaysia has a net migration rate of 1.52 migrants per 1,000 people in 2022, and an estimated net 1.46 migrant(s)/1,000 population for 2024. Officially, Malaysia had about 1.8 million legal foreign workers as of mid-year 2017 – largely from Indonesia, Nepal, the Philippines, and Bangladesh – but as many as 3 to 4 million are estimated to be in the country illegally. Notwithstanding, this foreign workers in Malaysia play a key role in the day-to-day supply of labour and services despite their status in the country. Immigrants outnumber ethnic Indians and could supplant the ethnic Chinese as Malaysia's second largest population group around 2035 (World Bank, 2023; (Macrotrends, 2023; cia, 2023).

Inflation has been relatively stable over time, with an average rate of 3.3% in 2022. However, there have been fluctuations in the rate in recent time, particularly in response to external factors such as global oil prices, exchange rate, and regional crisis and politics. Unemployment average 3.63% in 2022, with COVID-19 pandemic triggered a temporary increase in unemployment rate. Human development Index (HDI) is high averaging 0.80 in 2022, which is higher than the average for countries in East Asia and the Pacific. The HDI measures the productivity potential of a country's human capital, including education and health outcomes.

While the country has made progress in various indicators of development, there are still areas that require attention, such as reducing inequality, addressing the impacts of the structural imbalances, external shocks, and COVID-19 pandemic on the economy/society, and designing appropriate timely policy interventions to address the demographic dynamics issues.

Demographic dynamics significantly influence economic performance through labour markets, savings, consumption, and urbanization. A growing population can boost economic output by increasing the labour supply. But excessive growth may lead oversupply, lowering wages and increasing unemployment rate. Equally, a declining population can cause labour shortages, which can drive up wages. Population growth stimulate demand for goods and services, supporting economic growth, but can strain resources and infrastructures if too rapid. Education, skills level, technological advances, natural resources, and cultural orientations also affect population and economic growth patterns (Acemoglu and Restrepo, 2017; Simon, 2019; Vennemo et al., 2009; Ahmad and Khan, 2019).

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Extant studies on the subject matter are mixed: Bloom and Williamson (1998) found population growth initially leads to increased economic growth, but eventually impede it due to resource pressure. Similarly, a study by Lutz and Weber (2018) found that population aging can lead to reduced economic growth, as it can lead to a decline in the labour force and increased costs for healthcare and pensions. Lutz and Weber (2018) suggested that aging population could reduce economic growth due to a shrinking labour force and higher healthcare costs. Some scholars posited that a favourable demographic structure, with a high population of working-age individuals, offers a demographic window for economic development (Bloom et al., 2003 Lee and Mason, 2006; Rasiah and Shari, 2008). Other scholars contend that population dynamics have negative effects on economic growth by creating demographic challenges such as ageing population, low fertility, high dependency ratio, ethnic inequality, urban congestion, environmental degradation, health risks, social unrest, and policy dilemmas (Abdullah et al., 2012; Ananta et al., 2014; Jones, 2014; Tey et al., 2016; Heintz and Folbre, 2022; Jones, C. I., 2022; Maestas et al., 2023). This study seeks to shed light on the specific relationship between demographic trends and economic performance, as measured by GDP per capita, in Malaysia. The findings will provide insights into the impact of demographic dynamics on economic development in Malaysia and guide policymakers on strategies to harness and leverage the potential of demographic changes to drive sustainable economic development, and also contribute to broader literature on the relationship between population dynamics and economic development. Understanding this relationship is key for designing effective economic, social and population policies. Findings and insights from Malaysia context have broader implications for other nations with similar demographic challenges. Thus, further research is crucial to comprehensively understand how these factors interact and influence each other in Malaysia.

2.0. LITERATURE REVIEW

Demographic dynamics and economic performance are interrelated aspects of development impacting productivity, social welfare, environmental sustainability, and public policy. demographic dynamics - how population size, structure, distributions, and other demographic characteristics, including population growth, fertility, mortality, and migration, changes over time have significant impact on economic growth and development. On the other hand, economic growth, measured by GDP, income per capita, and productivity, involves improving the quality of life, income, and societal well-being. The relationship between demographic dynamics and economic development is complex, involving demographic transition, human capital, resource availability, labour market, migration, urbanization, environment, health, social security, and public policy (Heintz and Folbre, 2022; Bloom et al., 2018; Barro, 2013; Notestein, 1945; Canning and Shultz, 2012; Ahmad and Khan, 2019; Gu et al., 2021; Jones, C. I., 2022).

As highlighted earlier, demographic trends significantly impact economic performance through labour availability. A growing population can increase the workforce, which can drive economic growth by increasing productivity and output. However, a rapidly growing population can strain resources and infrastructure, leading to negative economic consequences

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(Acemoglu and Restrepo, 2017; Vennemo et al., 2009; Simon, J. L., 2019). Demographic changes, such as an aging population or declining fertility rates, can reduce workforce, potentially slowing economic growth (Maestas et al., 2023; Bloom et al., 2014; Lee, R., and Mason, 2014; Jones, C. I., 2022). Equally, economic performance influences population dynamics, with growth improving the living standards and fertility rates, while economic decline leads to emigration and population decline (Bhagwati, J. 2012; Simon, J. L. (2019; Heintz and Folbre, 2022). Education, skills, technological advances, and natural resources also impact economic growth.

Several theoretical frameworks are often used to examine the relationship between demographic dynamics and economic growth. The demographic transition theory, proposed by Warren Thompson (1929), suggests that as countries develop economically, they experience declines in fertility and mortality rates, creating a "window of opportunity" for economic growth, as the declines in fertility leads to a smaller dependent population, savings and investment, and a larger labour force. The human capital theory, introduced by Gary Becker (1964), argued that investments in education and healthcare, can lead to increased economic growth by boosting human capital. The modernization links economic growth and development to technological advances and the adoption of modern systems, leading to improved living standards and shifts in demographic trends. These theories have been used to study these variables in developed and developing economies like Malaysia.

Malaysia like other Southeast Asia countries is experiencing a demographic transition from high birth and mortality rates to low birth and mortality rates, with expected significant implications for economic growth and development. In this regard, the demographic transition theory suggests this shift can create a “window of opportunity” for economic growth if managed properly. Modernization theory opined those technological advancements and modern systems drives development, and while human capital theory highlights the role of a growing, healthy population in boosting economic performance. Studies and debates among scholars highlight both positive and negative impacts of demographic dynamics on economic growth and development. Some research suggests that a large working-age population can accelerate development, while others highlight challenges such as aging population, low saving, consumption, and investments, small working-age population, low fertility, high dependency ratio, and strain on social welfare system (Jones, C. I., 2022; Shairilizwan Taasim et al. 2020; Ismail et al. 2015; Siti Nur Ain Mohd Ayunee et al. 2021; Zain, 2016, Sánchez-Robles and Sánchez-Robles ,2019, Bongaarts and Bulatao ,2000; Chan and Tan 2019; Lee, R., and NTA Network., 2022; Bloom et al.,2003; Lee and Mason, 2006; Rasiah & Shari, 2008; Tan and Lim 2020; Abdullah et al., 2012; Ananta et al., 2014; Jones, 2014; Tey et al., 2016). For Malaysia, studies shows that declining fertility and mortality rates have accompanied increased economic development but also leading to a reduced labour force and more pressure on social welfare systems. The aging population is affecting labour force participation and increasing government spending on healthcare and welfare, negatively impacting economic growth (Jones, C. I., 2022; Ayunee et al. 2021; Shairilizwan et al. 2020; Ismail et al. 2015; Maestas et al., 2023; Heintz and Folbre, 2022).

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Generally, the interplay between demographic dynamics and economic performance in Malaysia is complex, with several factors including demographic shifts, technological progress, and human capital investments playing significant roles. These dynamics requires careful and timely policy interventions to mitigate negative impacts and harness potential economic benefits.

To address the challenges highlighted above and promote sustainable economic growth and development, several strategies have been proposed. These include encouraging labour force participation through flexible work arrangements and education/training, promoting fertility via increased access to contraception and family planning, and enhancing productivity through improvements in education and skills. Research reveals that rapid population growth in developing countries can lead to a "youth bulge," which can boost economic growth through increased labour supply but also lead to social instability and strain on resources (Ehrlich and Ehrlich, 2013; Cincotta and Doces, 2011; Simon, J. L., 2019). Studies on population policy strategies show that reducing population growth through access to contraception and education for women can improve long-term economic outcomes but may have negative short-term impacts due to a reduced labour force (Bloom et al., 2018). In Malaysia, researchers have explored the impact of population aging on economic growth using various models and data.

Shairilizwan Taasim et al. (2020) found that fertility rate had a significant negative impact on economic growth in the long-run, while government expenditure on education had a positive impact on economic, suggesting that investment in human capital can enhance productivity and mitigate the effects of ageing. Ismail et al. (2015) also discovered that fertility rate had a long-run cointegration with economic growth, with physical capital, human capital and trade openness positively contributing to economic growth. Ayunee et al. (2021) discovered that aging population negatively affected economic growth while labour force participation had a positive impact.

Summarily, the interplay between demographic dynamics and economic performance in Malaysia is intricate and multilayered, with mixed evidence on the positive and negative impacts. Further research is needed to understand this interaction better and identify effective policies to mitigate negative impacts, harness economic benefits, and promote sustainable economic growth amidst changing demographic trends.

2.1. Conceptual Framework

The conceptual framework for this study explains the relationship between the independent variables (Population growth rate, Inflation rate, foreign direct investment, Unemployment rate, and Labour force participation rate) and the dependent variable (GDP growth).

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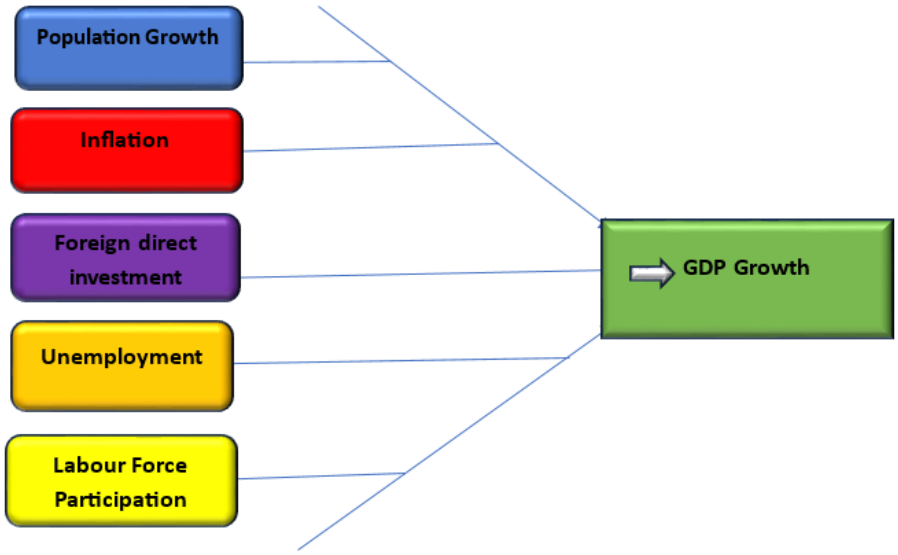
Figure 3: Conceptual Framework Diagram



Source: Author's

The conceptual framework diagram above visually maps out the relationship between key economic indicators and demographic dynamics in Malaysia. Each variable is colour-coded for clarity. GDP (Green) indicates the overall economic performance. Population growth rate (Blue) shows demographic trends affecting labour supply and economic demand. Inflation rate (Red) highlights the cost of living and economic stability. Foreign direct investment (Purple) denotes external economic inputs influencing growth. Unemployment rate (Orange) points to labour market conditions and economic health. Labour force participation rate (Yellow) shows workforce engagement levels. By analysing these variables using appropriate econometric techniques, the framework aims to illustrates how demographic dynamics and economic variables affect economic growth in Malaysia, offering insights for policy development and strategic planning for sustainable economic development.

3.0. RESEARCH METHODOLOGY

In recent years, concerns have grown about the impacts of demographic dynamics on Malaysia's economic performance, particularly regarding its aging population and declining fertility rates, with over 22% of the population expected to be over 60yrs by 2025 (World Bank, 2022). This research examines the interplay between demographic dynamics and economic growth using quantitative methods and secondary data from sources like the World Bank, Department of Statistics Malaysia, United Nations, and Macrotrend. Covering the period 1970 to 2022, the study analyses indicators such as population growth rate, GDP per capita, inflation rate, foreign direct investment, labour force participation, and unemployment rate.

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The basic model for this study is specified as:

$GDP = \beta 0 + \beta 1 Pop + \beta 2 X + \varepsilon$ ..... (i)

Empirically the model is stated as:

$(GDP_C)_t = \beta_0 + \beta_1 (POP_r)_t + \beta_2 (Infl)_t + \beta_3 (FDI)_t + \beta_4 (LFP)_t + \beta_5 (Uempl)_t + \varepsilon_t$ ..... (ii)

Where, GDP_c = Gross Domestic Product per capital POP_r = Population growth rate. In equation (i), X = Control variable (such as inflation, foreign direct investment, labour force participation rate, and unemployment rate) ε = Error term, t = Time period

The above model in eqn (1) is a linear regression model that estimates the relationship between GDP and population growth rate (Pop) while controlling for other factors that may affect economic growth (X).

The coefficients β_1 and β_2 in equation (i) are the parameters of interest, representing the relationship between population dynamics and economic performance in Malaysia. A positive coefficient for β1 would indicate that population growth has a positive impact on GDP, while a negative coefficient for β1 would indicate that population growth has a negative impact on GDP. In eqn (ii) this study includes GDP per capita as a proxy for economic growth, population growth rate (POP) to capture the impact of demographic dynamics on economic performance in Malaysia, Inflation rate to gauge the influence of price levels and consumer purchasing power, Foreign direct investments to capture the rate of investment inflow and the investors' confidence in Malaysia economy, Unemployment rate to gauge employment opportunities, and labour force participation rate to capture willingness to work and availability of jobs.

The study is guided by this hypothesis: $\mathbf{H_a0}$: No relationship exists between demographic dynamics and economic growth in Malaysia. $\mathbf{H_a1}$: A positive relationship exists between demographic dynamics and economic growth in Malaysia. $\mathbf{H_b0}$: No relationship exists between labour force participation rate, unemployment rate, inflation, foreign direct investment, and economic performance in Malaysia.

$\mathbf{H_b1}$: A positive relationship exists between labour force participation rate, unemployment rate, inflation, foreign direct investment, and economic growth in Malaysia. The study employs econometric techniques to test these hypotheses. The combination of regression analysis and econometric modelling was utilized to analyze the interaction between the variables of the study in Malaysia.

Specifically, descriptive analysis, boxplots analysis, stationarity tests, cointegration analysis, and ARDL ECM analysis was carried out. The study provides policy implications for Malaysia and other stakeholders (Businesses, investors and others).

The findings will help policymakers to understand the interplay between the variables of the study, and inform policy decisions relating to population growth, labour force participation, unemployment, inflation, foreign direct investment, and economic development. The results of the empirical analysis are presented under the results and discussion section below.

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4.0. RESULTS AND DISCUSSION

4.1 Descriptive statistics Result

Table 1: Descriptive Statistics

	GDP	POP	INFL	FDI	UEMPL	LFP
Mean	7.49	2.32	3.33	3.67	2.06	48.44
Median	8.53	2.51	2.81	3.28	3.10	64.80
Maximum	48.36	3.07	17.33	8.76	4.61	69.70
Minimum	-29.69	1.09	-1.14	0.06	0.00	0.00
Std. Dev.	11.97	0.57	2.87	1.72	1.72	29.35

Source: Author's EViews 12 Computations

The descriptive statistics in table 1 reveals key insights into Malaysia's economic and population growth variables. The results for GDP suggest a volatile per capita GDP growth with a high standard deviation (11.97%) and a range from -29.69% to 48.36%, indicating economic instability.

The average population growth (2.32%) is moderate, but effective strategies is needed to ensure it matches economic opportunities in the near-term and long-term. Inflation (3.33%) is relatively stable within the sample period, however the maximum of 17.33% suggest potential spikes that need continuous monitoring. The mean FDI (3.67%) with standard deviation of 1.72% shows fluctuation, implying the need for consistent foreign investment inflow attraction strategies.

The average Unemployment rate (2.06%) withing the sample period is generally low. But, the standard deviation (1.72%) suggests fluctuations that requires attention. The mean of labour force participation (48.44%), with a wide range indicates disparities in the workforce management. The implications of the descriptive statistics is that policymakers should focus on economic stabilization and growth through sound and prudent fiscal/monetary policy, matching population growth with job opportunities sustainably, controlling and monitoring inflation closely, encouraging steady and long-term FDI, addressing unemployment fluctuations, and promoting inclusive labour force participation to leverage the full potential of the labour market.

4.2. Boxplot Analysis

The boxplot analysis in figure 3 for Malaysia reveals several insights into the country's economic indicators. GDP per capita growth shows fluctuations with outliers implies occasional volatility, suggesting a need for targeted and strategic policies that stabilize economic growth. Population growth is moderate, nonetheless, policy should ensure it aligns with job creation to maintain balance.

Inflation's variability and outlier's points to possible periods of economic stress, requiring measures for price stability. Foreign direct investment's low median but high outliers indicate uneven investment inflows. Hence, steady and continuous FDI promotion strategies are needed.

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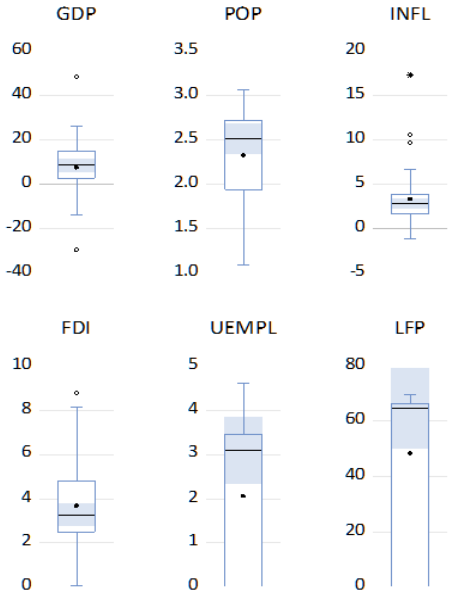
Unemployment shows fluctuation, suggesting the necessity for robust inclusive employment policies. Finally, the median for Labour Force Participation indicates a generally active workforce, which is positive, however, continuous efforts should be made to include all demographics in the labour market. Summarily, policies and strategies should aim for sustainable economic and population growth, price stability, steady FDI, and inclusive labour participation.

Figure 4: Boxplot Analysis Results



Source: Author's EViews 12 Computations

4.3. Unit root Test Results

Table 2. Unit Root (Augmented Dickey Fuller Test) Results

VARIABLES	ADF. LEVEL	1ST DIFF.	2ND DIFF.	ORDER	REMARK
GDP	-5.483448	-	-	I(0)	Stationary @
P-Value	(0.0000)				Level
POP	0.288921	-2.85802	-	I(1)	Stationary @
P-Value	(0.9755)	(0.0575)			1st Diff.
INFL	-4.133434	-	-	I(0)	Stationary @
P-Value	(0.002)				Level
FDI	-3.927886	-	-	I(0)	Stationary @
P-Value	(0.0036)				Level
UEMPL	-1.358463	-6.77989	-	I(1)	Stationary @
P-Value	(0.5954)	(0.0000)			1st Diff.
LFP	-2.900668	-	-	I(0)	Stationary @
P-Value	(0.0521)				Level

Source: Author's EViews 12 Computations

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The Augmented Dickey-Fuller test in table 2 indicates that the study variables have mixed integration orders, some being stationary at level I(0) and others at first difference I(1). This supports the use of ARDL estimation method for co-integration analysis.

4.4. Cointegration Test Results

Table 3: F-Bounds Test Result for Cointegration

Null Hypothesis: No level relationship				
Test Statistics	**Value**	**Significance**	**I(0)**	**I(1)**
F-Statistic	8.0496	10%	2.08	3
K	5	5%	2.39	3.38

Source: Author's EViews 12 Computations

The F-Bounds Test result in table 3 rejects the null hypothesis of no levels relationship, indicating that there is a long-term relationship between Population growth, Inflation, FDI, Unemployment, Labour force participation, and GDP in Malaysia. The F- statistic is 8.0496, which is greater than the critical values at the 10% and 5% levels, confirming the rejection of the null hypothesis of no levels relationship.

4.5. Long-run Impact of Population Dynamics on economic growth in Malaysia

Table 4: ARDL Long-run Form Estimated Results

Dependent variable: **GDP**			
VARIABLES	**Coefficients**	**t-ratio**	**P-Value**
POP	2.0257	0.7439	0.4618
INFL	-0.3577	-0.6112	0.5449
FDI	-0.3547	-0.3102	0.7582
UEMPL	0.7972	0.6239	0.5366
LFP	-0.2566	-4.0257	0.0003
C	16.4829	2.2013	0.0342

Source: Author's EViews 12 Computations

Table 4 present the long-run coefficients, t-statistics and p-value for GDP, POP, INFL, FDI, and LFP in Malaysia. The results, with the dependent variable being the change in GDP, reveal key points. The coefficients show the long-term relationship between GDP and the independent variables i.e., population (POP), inflation (INFL), foreign direct investment (FDI), unemployment (UEMPL), and labour force participation (LFP). The positive coefficient (2.0257) for POP suggests that population growth contributes positively to GDP growth, but the t-statistic is not statistically significant. The inflation (-0.3577) and foreign direct investment (-0.3547) negative coefficients indicates that higher inflation and foreign direct investment are linked with lower GDP growth in the long-run, albeit the t-statistics are also not statistically significant at 5% level. The positive coefficient for UEMPL is counterintuitive, as higher unemployment is classically associated with lower GDP, although this result is not statistically significant either. Labour force participation negative coefficient (-0.2566) and significant p-value (0.0003) indicates that higher labour force participation is associated with lower GDP growth, and is significant at the 1% level. This could suggest that an increase in

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labour force participation without matching job creation, and gainful employment may lead to lower productivity or underemployment. The implications are that policymakers need to focus on quality job creation and gainful employment that matches population growth to ensure that increased labour force participation translates into productive and gainful employment. Also, prioritizing education and skill development to improve workforce productivity is pertinent, and continuous monitoring of labour market dynamics closely to ensure that increases in labour supply are met with adequate employment opportunities is key. Policies that ensure inflation is effectively control and balanced to create a stable macroeconomic environment is needed. Develop strategies which foster a business environment that encourages both domestic and foreign investment in sectors that have a high potential for economic growth and job creation, and make judicious use of the FDI, ensuring it align with national goals and contributes to sustainable economic growth.

4.6. Short-run Impact of Population Dynamics on economic growth in Malaysia

Table 5: ARDL Short-Run ECM Estimated Results

Dependent variable: **GDP**			
Variables	**Coefficient**	**t-ratio**	**P-Value**
ΔGDP_{t-1}	0.5197	4.0789	0.0002
ΔPOP_{t}	-26.2079	-1.3936	0.172
ΔFDI_{t}	2.4031	2.8958	0.0064
ΔFDI_{t-1}	0.2579	0.2947	0.7699
ΔFDI_{t-2}	2.5052	2.6691	0.0113
$\Delta UEMPL_{t}$	-6.8907	-2.8129	0.0079
ΔLFP_{t}	-0.1917	-2.6439	0.0121
ECM_{t-1}	-1.3244	-8.1079	0.0000
R-squared	0.7031		
Adjusted R-squared	0.6536		
Durbin-Watson stat.	1.9519		

Source: Author's EViews 12 Computations

Table 5 presents the short-run coefficients, t-statistics, and p-values showing the impact of GDP, POP, INFL, FDI, and LFP dynamics on economic growth in Malaysia. The ARDL Error Correction Regression for Malaysia's GDP growth (ΔGDP_t) indicates short-term dynamics among the variables. The lagged change in GDP (ΔGDP_{t-1}) has a positive coefficient (0.5197) and significant p-value (0.0002), suggesting that past GDP changes have a continuing effect. The ΔPOP_{t} negative coefficient (-26.2079), though not statistically significant, could mean that short-term population changes negatively impact GDP growth. The positive coefficients ((2.4031), (0.2579), (2.5052)) for FDI and its lags (ΔFDI_t, ΔFDI_{t-1}, and ΔFDI_{t-2}) suggest that changes in foreign direct investment have a positive short-term impact on GDP growth, with the first and second lags being statistically significant ((0.0064), (0.0113)). The negative coefficient (-6.8907) for $\Delta UEMPL_t$ indicates that that increases in unemployment have a detrimental impact on GDP growth in the short-term, and is statistically significant (p-value = 0.0079). Labour force participation (ΔLFP_t) negative coefficient (-0.1917) implies that short-

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term changes in LFP negatively affect GDP growth, and is also significant (p-value = 0.0121). The Error Correction Mechanism ((ECM_{t-1}) coefficient is negative and highly significant as expected, suggesting a quick adjustment back to long-term equilibrium after short-term shocks. The implications of these results are that enhancement of job creation strategies to mitigate the negative impact of unemployment on GDP growth, address the root causes of unemployment, and support sustainable employment is needed. There is need for policymakers to create conducive business environment, facilitate and encourage stable, long-term, and diversified FDI, as it has shown a positive effect on GDP growth. Also, continuous monitoring of labour force participation to mitigate, and ensure short-term fluctuations do not adversely affect GDP growth, and creation of programs that promote consistent labour force participation, particularly targeting demographics that may experience volatile employment conditions should be prioritized. The F-bounds Test confirms a level relationship, thus validating the importance of short-term dynamics and the significance of policy interventions to manage these relationships effectively. The model's good fit, suggested by the R-squared and Durbin-Watson statistics, supports the reliability of these results for policy considerations.

4.7. Diagnostic Tests

4.7.1. Breusch-Godfrey Serial Correlation LM test

Table 6: Breusch-Godfrey Serial Correlation LM Test Results

Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.5587	**Prob. F (2,34)**	0.5771
Obs*R-squared	1.5908	**Prob. Chi-Square (2)**	0.4514

Source: Author's EViews 12 Computations

The Serial Correlation LM test results shows that there is no evidence of serial correlation in the residuals of the model i.e., the residuals are independent of each other. Thus, the results can be considered for policy analysis, planning for economic interventions, and forecasting.

4.7.2. Breusch-Godfrey Heteroskedasticity Test

Table 7: Breusch-Pagan-Godfrey Heteroskedasticity Test Results

Null hypothesis: Homoskedasticity			
F-statistic	1.573019	**Prob. F (13,36)**	0.1394
Obs*R-squared	18.11295	**Prob. Chi-Square (13)**	0.1533
Scaled explained SS	20.14577	**Prob. Chi-Square (13)**	0.0916

Source: Author's EViews 12 Computations

Table 7 present the results of the Breusch- Pagan-Godfray Heteroskedasticity test. The F-statistic value of 1.5730 with p-value of 0.1394 suggests that the null hypothesis of homoskedasticity cannot be rejected at a common significance level (0.05). This implies that there is no strong evidence of heteroskedasticity. The Obs*R-squared value of 18.1129 with p-value of 0.1533 also supports the conclusion that there is no significant heteroskedasticity. Thus, the model's estimates and statistical implications are valid.

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4.6. Policy Implications

The ARDL ECM regression results reveal key insights for policymakers in Malaysia. The significant and negative coefficient of ECM_{t-1} suggests a stable long-term relationship between GDP growth and the explanatory variables - population growth, inflation rate, foreign direct investment, and labour force participation. This indicates that deviations from this equilibrium will be corrected over time. Policymakers could use long-run coefficients to assess how changes in these variables impact economic development in the country. The significant coefficients of the first differences of these variables implies that fluctuations in the variables have short-term impacts on GDP growth. Policymakers can use these coefficients to understand the short-term dynamics and adjust policies in response to shocks. The F-bounds test results suggest a long-term causal relationship between GDP growth and the explanatory variables. Policymakers may well use this to understand the direction and strength of causality among these variables, as well as find potential sources of growth or volatility for economic growth in Malaysia. The coefficients of population growth in the long-run and short-term, highlight the critical role of population growth as one of the drivers of economic development. Thus, policymakers need to focus on quality job creation and gainful employment that matches population growth to ensure that increased labour force participation translates into productive and gainful employment. Also, prioritizing education and skill development to improve workforce productivity is pertinent, and continuous monitoring of labour market dynamics closely to ensure that increases in labour supply are met with adequate employment opportunities is key.

The results shows that the effects of inflation on GDP growth is negative, implying that Policies that ensure inflation is effectively control and balanced to create a stable macroeconomic environment is needed. The significant coefficients of FDI and its lags implies that policymakers in Malaysia need to develop strategies which foster a business environment that encourages both domestic and foreign investment in sectors that have a high potential for economic growth and job creation, and make judicious use of the FDI, ensuring it align with national goals and contributes to sustainable economic growth. The negative coefficients of unemployment suggests that enhancement of job creation strategies to mitigate the negative impact of unemployment on GDP growth, address the root causes of unemployment, and support sustainable employment is needed. The negative coefficients of LFP suggests that changes in labour force participation have significant impact on GDP growth. Thus, continuous monitoring of labour force participation to mitigate, and ensure short-term fluctuations do not adversely affect GDP growth, and creation of programs that promote consistent labour force participation, particularly targeting demographics that may experience volatile employment conditions should be prioritized. The F-bounds Test confirms a level relationship among the variables, thus validating the importance of short-term dynamics and the significance of policy interventions to manage these relationships effectively. The model's good fit, suggested by the R-squared and Durbin-Watson statistics, supports the reliability of these results for policy considerations. The above highlights the importance of stable and predictable economic policies for long-term and short-term sustainable economic development in Malaysia.

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5.0. CONCLUSION AND RECOMMENDATIONS

This paper investigates the impact of demographic dynamics alongside other key economic indicators – Inflation, Foreign direct investment, Unemployment rate and labour force participation rate, past and present on Malaysia's economic performance, using the ARDL ECM estimation techniques with data from 1970 to 2022. The results show that Population growth rate, Inflation, Foreign direct investments, level of employment, (Past & Present), and GDP past values have significant relationship with economic growth in Malaysia. Base on the finding of the study, it is clear that significant changes in the composition of demographic dynamics, price level, FDI, employment level, and labour force participation rate can transform the national output and industrial composition of the Malaysia's economy. Thus, this study concludes by recommending that policymakers in Malaysia focus on quality job creation and gainful employment that matches population growth to ensure that increased labour force participation translates into productive and gainful employment. Prioritize education and skill development to improve workforce productivity.

Continuously monitor labour market dynamics closely to ensure that increases in labour supply are met with adequate employment opportunities. Also, implement policy that ensure inflation is effectively control and balanced to create a stable macroeconomic environment. Equally, develop strategies which foster a business environment that encourages both domestic and foreign investment in sectors that have a high potential for economic growth and job creation, and make judicious use of the FDI, ensuring it align with national goals and contributes to sustainable economic growth. In addition, creation of programs that promote consistent labour force participation, particularly targeting demographics that may experience volatile employment conditions should be prioritized. Finally, a mix of short-term and long-term policies is essential for economic stability, with a comprehensive approach to addressing immediate challenges and long-term structural issues for sustainable and inclusive economic development in Malaysia.

Declarations

- **Ethics approval and consent to participate**

  Not applicable

- **Consent for publication**

  Not applicable

- **Availability of data and materials**

  The datasets used and/or analysed during the current study are available on reasonable request.

- **Competing interest**

  The authors declare that they have no competing interests

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- **Authors' contributions**

  BFB conceptualized and wrote the manuscript, curate data and design the methodology, provided resources and Software, conducted formal analysis, review and editing. AAD and RR supervised and reviewed the manuscript. All authors read and approved the final manuscript.

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