

The impact of demographic variables on economic growth in North Sumatra, Indonesia

Henni Tumangger , Martahadi Mardhani , and Iskandar

Department of Development Economics, Faculty of Economics, Universitas Samudra, Langsa, Indonesia

ABSTRACT

The relationship between demographic variables and economic growth has been studied extensively, revealing complex and varied interactions. This research aims to investigate the impact of demographic variables on economic growth in Dairi Regency, North Sumatra Province, Indonesia, during the period 2011-2022. We apply the multiple regression method to test its effect on economic growth. The research results show that population growth has a negative impact on economic growth. Meanwhile, the human development and labor force variables do not significantly impact economic growth. This finding indicates that a high population growth rate can reduce the economic growth of a country, especially in developing countries.

KEYWORDS

Demographic variable; economic growth; human development; labor force

1. Introduction

Demographic variables play a crucial role in shaping economic growth dynamics. They include population size, age structure, fertility rates, life expectancy, and educational attainment (Bloom & Williamson, 1998). Understanding the impact of these variables on economic growth is essential for policymakers and researchers alike. By examining the relationship between demographic variables and economic growth, we can gain valuable insights into the mechanisms that drive economic development.

The relationship between demographic variables and economic growth has been the subject of extensive research and debate among economists and policymakers. The impact of population age structure on economic performance is complex and multifaceted, influencing various aspects of an economy, from labor markets to investment patterns. This introduction sheds light on how demographic changes can shape economic growth trajectories.

CORRESPONDING AUTHOR Martahadi Mardhani ✉ martahadi@unsam.ac.id 📧 Department of Development Economics, Faculty of Economics, Universitas Samudra, Langsa, Indonesia

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Demographic structure, encompassing the distribution of different age groups within a population, can significantly affect economic growth through various channels. For instance, the proportion of middle-aged workers in developed countries has been found to positively influence economic growth through improved institutions, increased investment, and enhanced education (Headey & Hodge, 2009). Conversely, a larger share of the senior population may dampen growth due to its effects on institutions and investment (Headey & Hodge, 2009). In developing countries, the relationship appears to be more nuanced, with some evidence suggesting that a higher share of young workers could negatively impact economic growth through channels such as investment, financial market development, and trade (Headey & Hodge, 2009).

The concept of the demographic dividend, which refers to the economic growth potential that can arise from changes in a population's age structure, mainly when the working-age population grows more significantly than the non-working-age share of the population, has been a focal point of research (Bloom et al., 2003). This demographic dividend has been shown to have varying effects on different regions, with the labor market, health, and education policies playing a crucial role in harnessing the potential economic benefits (Bloom et al., 2003).

Research on the Organisation for Economic Co-operation and Development (OECD) countries between 1950 and 1990 has demonstrated that age structure changes can explain a significant portion of the growth patterns in GDP per worker, with older age groups exerting a positive influence and the group above 65 contributing negatively (Lindh & Malmberg, 1999). However, the mechanisms behind these age effects remain an area for further investigation (Lindh & Malmberg, 1999).

In developing nations, the Solow-Swan model, extended to include demographic variables, has provided insights into the overall effect of demographic transition on economic growth, as evidenced by studies on China, India, and Pakistan (Wongboonsin & Phiromswad, 2017). These studies have quantified the contributions of population dynamics to GDP growth, highlighting the significant role played by the working-age population growth differential and dependency ratios. The relationship between population growth and economic development has been debated from optimistic and pessimistic perspectives, with demographic transition theory attempting to reconcile these views (Menike, 2018).

Indonesia's experience with the demographic bonus, a period when the working-age population exceeds the non-working-age population, illustrates the potential for demographic factors to boost economic growth (Menike, 2018). However, the subsequent demographic burden highlights the need for strategic policies to maximize the benefits of the demographic bonus and mitigate future challenges (Menike, 2018). A broader literature review on population growth and economic development has

revealed divergent views, with some economists emphasizing the positive aspects of population growth. In contrast, others stress the need for population control to achieve higher development (Rohlin, 1998).

Demographic variables play a critical role in shaping economic growth, with the effects varying across different countries and stages of development. Understanding these dynamics is essential for designing effective economic policies that capitalize on demographic opportunities and mitigate potential challenges.

This introduction sets the stage for a comprehensive examination of how demographic variables influence economic growth, drawing on empirical evidence from various countries and regions to understand the nuances of this relationship.

2. Literature review

In examining the impact of demographic variables on economic growth, a review of the related literature reveals a multifaceted relationship influenced by factors such as population growth, human development, and the labor force.

Global demographic trends also play a significant role in shaping economic outcomes. Changes in population structure affect consumption patterns, factor prices, and social security systems (Rahman et al., 2020). Demographic factors are among the main determinants of economic growth for indebted countries. A systematic literature review identified five key themes, including demographic variables, crucial for stimulating growth in such countries. The review emphasizes the importance of considering these variables in policy-making and economic modeling to avoid biased estimations (Attanasio et al., 2016).

Demographic changes, particularly those affecting the labor supply, are critical for understanding labor market dynamics. In Lithuania and Poland, for example, a decrease in the productive-age population and an increase in the post-productive-age population have significant implications for labor markets. Monitoring these demographic shifts is necessary to address labor force deficiencies (Mberu & Ezech, 2017).

The relationship between population growth and economic development has been debated from both optimistic and pessimistic perspectives. While some argue that population growth can benefit economic development, others contend that rapid and high fertility rates can hinder economic progress. The demographic transition theory clarifies this relationship, suggesting that population growth should be controlled during economic development (Menike, 2018).

In Sub-Saharan Africa, the impact of population factors on economic growth and development is evident. Zambia's and Botswana's case studies demonstrate how divergent demographic indicators since the 1960s have contributed to their different

economic trajectories. The analysis underscores the importance of addressing rapid population growth through interventions such as voluntary family planning to achieve key development goals (Salvati & Zambon, 2019).

Demographic variables are integral to understanding and predicting economic growth patterns. The literature indicates that these variables can positively and negatively affect economic development, depending on the context and how they interact with other economic factors. Therefore, policymakers must consider demographic trends and their implications when formulating economic strategies.

3. Method

The type of data used in this research is secondary data sourced from BPS-Statistics Indonesia from 2011-2022. This data consists of data on economic growth (*RGDP*), population growth (*POP*), the labor force (*LF*), and the human development index (*HDI*) in Dairi Regency, North Sumatra Province, Indonesia (Table 1).

Table 1. Description of variables

Variable	Description	Period	Source
POP	Natural logarithm of population growth	2011-2022	BPS - Statistics Indonesia
RGDP	Natural logarithm of real gross domestic product	2011-2022	BPS - Statistics Indonesia
LF	Natural logarithm of the labor force	2011-2022	BPS - Statistics Indonesia
HDI	Natural logarithm of human development index	2011-2022	BPS - Statistics Indonesia

The data analysis used in this research is multiple linear regression. The model equation is shown in Equation (1) below.

$$RGDP_t = \beta_0 + \beta_1 POP_t + \beta_2 LF_t + \beta_3 HDI_t + \varepsilon_t \quad (1)$$

RGDP is the real gross domestic product, *POP* is population growth, *LF* is the labor force, and *HDI* is the human development index. β_0 is constant, $\beta_1 - \beta_3$ is regression coefficient, t is time, and ε_t is an error term. All of these variables have transformed into natural logarithms.

4. Results and discussion

We are using time series data for the 2011-2022 period using the Ordinary Least Squares (OLS) method. Data calculations in this research help in partial or simultaneous hypothesis testing. Table 2 shows that the population growth coefficient value is -1.808930 in a negative direction. For every 1% increase in population growth (*POP*), economic growth will decrease by 1.81%, assuming that the other variables are *ceteris paribus*.

The results of the F-test can be seen where the probability value is significant at the 1% level. Furthermore, the Adjusted R-Square value is 0.851466, which means that the proportion of influence of the POP, LF, and HDI variables on the economic growth variable is 85.1%. In comparison, the remaining 14.86% is influenced by other variables not included in this research model. The increasing population has resulted in an increasingly large workforce. This means that the number of people looking for work is increasing. In order to achieve a balanced situation, they should all be accommodated in a suitable job following their desires and skills. However, it will be a problem if population growth is not in line with job growth, resulting in unemployment.

Table 2. Results of OLS estimated

Variable	Coefficient	Std. error	t-statistic	Probability
POP	-1.808930	0.349976	-5.168723	0.0009
LF	-0.033851	3.773265	-0.008971	0.9931
HDI	-18.30685	10.17633	-1.798963	0.1097
Constant	81.78997	36.62794	2.232994	0.0560
Adjusted R-squared	0.851466			
F-statistic	22.01897			
Prob(F-statistic)	0.000320			

Note: RGRDP is the dependent variable.

Source: Author's calculations

Apart from that, population growth that is not balanced by improving the quality of human development (Nurhasanah et al., 2021) and creating jobs that can absorb the labor force will only burden an economy. The results of this research align with research conducted by Headey & Hodge (2009) and Lindh & Malmberg (1999). Population growth can increase the demand for foreign capital and lead to a negative international net investment position, potentially becoming a barrier to future economic development (Garba, 2021).

5. Conclusion

The impact of demographic variables on economic growth is a multifaceted issue with varying implications depending on the specific demographic factor. The evidence suggests that population growth has a complex relationship with economic development. Overall, while demographic variables undoubtedly play a role in economic growth, the nature of this role is highly context-dependent. Various factors, including the level of economic development, government policies, and the functioning of financial markets, mediate the effects. Policymakers should consider the nuanced and often indirect ways demographic factors influence economic growth and tailor their policies to harness the potential benefits while mitigating adverse effects.

Disclosure statement

The authors declare that there is no conflict of interest regarding the publication of this paper.

ORCID

Henni N. Tumangger  <https://orcid.org/0009-0005-9405-3916>

Martahadi Mardhani  <https://orcid.org/0000-0003-2942-2648>

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