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Macroeconomic Impact on Population Density in Indonesia

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Abstract
This research aims to determine and analyze population density by looking at the influence of poverty, income, education, health and urbanization in Indonesia. This research uses panel data regression with the variables poverty, income, education, health, urbanization and population density with data analysis using SPSS 22 software. The research period is 2020-2022. The results of this study show that poverty, education and health are significant to urbanization. Meanwhile, income has no effect on urbanization. Poverty, income and health are directly significant to population density. Meanwhile, education and urbanization have no direct influence on population density. The indirect relationship between poverty, income, education and health has no effect on population density through urbanization.

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1. Introduction

The Directorate General of Population and Civil Registration (Dukcapil) of the Ministry of Home Affairs noted that Indonesia's population had reached 273.87 million people in December 2021. This figure shows that Indonesia's population has increased by 1,64 million people during the June-December 2021 period. fourth, Indonesia has a population of 275 million people in 2022. Among other archipelagic countries, Indonesia is the archipelagic country with the largest population. When the population in an area increases and the area remains the same, population density will increase. This means that more people live per unit area which results in more crowded conditions (Rochaida, 2016). Population density is the ratio between the number of residents and the area inhabited (Mantra, 2007).

The problem of population density in Indonesia is still a problem that needs to be resolved because it increases every year in several provinces. One of the efforts to equalize the population carried out by the Indonesian government is the transmigration program (Mu'awwanah & Illah, 2022). The program was officially implemented on December 12 1950. The aim of the transmigration program is equality, development and improvement of welfare and food security for the community. However, this program has not been optimal because the effectiveness of the transmigration program in reducing population density in a province is very dependent on careful planning and implementation (Sugito, 2016). According to data from the Central Statistics Agency (BPS), the population density level in DKI Jakarta will reach 16,158 per square kilometer in 2022. This figure is an increase of around 1% compared to 2021 and confirms DKI Jakarta province as the most densely populated province in Indonesia. Other regions with high population density are West Java 1379 people/km^2, Banten 1248 people/km^2, DI Yogyakarta 1185 people/km^2, Central Java 1120 people/km^2, East Java 855 people/km^2, Bali 755 people/km^2, West Nusa Tenggara 290 people/km^2, Lampung 262 people/km^2 and Riau Islands 258 people/km^2.

Population density, which refers to the number of people living in a certain unit area, not only reflects population distribution but also influences socio-economic and environmental aspects of an area (Yunianto, 2021). The dynamics of population density are the result of the interaction of various factors, including poverty, income or wages, access to education, quality of health services and urbanization patterns. Poverty is often associated with high birth rates and limited access to health and education services, which can increase population density in a province. Income plays an important role in determining settlement patterns and population density. Provinces with high per capita densities tend to attract more residents, leading to urbanization and increased population density (Syifa & Nasution, 2023). Access to quality education and good health services is usually associated with lower birth rates and lower death rates, which in turn can affect population density (Amjad & Sumarno, 2020). This research will look at how influential the factors of poverty, income, education, health and urbanization are on the increasing population density in Indonesia.

2. Method

The type of research used in this research is quantitative research with a descriptive approach. The location of this research was carried out in 34 provinces in Indonesia from 2020-2022, obtained from the Central Statistics Agency (BPS). The type of data analyzed in this research is secondary data in the form of panel data using a three year period and cross sections in 34 provinces for a total of 102 observations. The data analysis model used to discuss the problems in this research is panel data regression analysis using SPSS 22 software and a sobel test is used to see indirect effects.

To test the level of significance of each independent variable's regression coefficient on the dependent variable, the coefficient of determination (R^2) is used to measure the extent of the model's ability to explain variations in the dependent variable. The coefficient of determination values are 0 and 1. Values close to 1 mean that the independent variables provide almost all the information needed. Next, the F statistical test is to find out whether there is an influence between the independent variables on the dependent variable. If the probability < 0.05, then H_0 is rejected and H_1 is accepted. However, if the probability is > 0.05, then H_0 is accepted and H_1 is rejected. Then, T test to make a decision whether the hypothesis is proven or not with a significance level ($\alpha = 0.05$).

Where if t-count > t-table, then H_1 is accepted and if t-count < t-table, then H_0 is accepted. Next, the Sobel test is carried out with a test tool, namely using the calculation for the Sobel test which is available on the web https://www.danielsoper.com/statcalc/calculator.aspx?id=31 and information is needed by including the original sample and standard error of each independent variable on the dependent variable if there is a mediator and without a mediator. If the Sobel statistical test is > t-table with a significance of 5%, then the variable can be said to be able to mediate between the independent variable and the dependent variable.

3. Results and Discussion

After testing between variables with the help of SPSS 22 software, the research results can be seen in the following table with information about Poverty (X_1), Income (X_2), Education (X_3), Health (X_4), Urbanization (Z) and Population Density (Y).

Table 1. Results of Direct Influence Test between Variables

Influence between variables	Coefficient	t-statistics	Probability	Information
X1 → Z	0.367	3,621	0,000	Significant
X2→ Z	-0.065	-0.222	0.824	Not significant
X3 → Z	-0.055	-3.128	0.002	Significant
X4 → Z	0.099	10,500	0,000	Significant
X1 → Y	-1,700	-2,471	0.015	Significant
X2→ Y	-3,526	-1,886	0.062	Significant
X3 → Y	0.048	0.409	0.683	Not significant
X4 → Y	0.269	3,057	0.003	Significant
Z → Y	0.912	1,409	0.162	Not significant

*) Significance at α = 5%
(R2) Z = 0.903 F = 0.000
(R2) Y = 0.472 F = 0.000
N = 102

Table 2. Indirect Effect Test Results between Variables

Influence between variables	t-statistics	Probability	Information
X1 → Z →Y	1,314	0.188	Not significant
X2→ Z → Y	0.219	0.826	Not significant
X3 → Z → Y	1,279	0.200	Not significant
X4 → Z → Y	1,398	0.162	Not significant

Based on the R square Urbanization (Z) value in table 1, it is 0.903. This means that 90% of urbanization variables in Indonesia can be explained simultaneously by poverty, income, education and health variables. Meanwhile, the remaining 10% is explained by other variables not included in the research model. This is also confirmed by the F test with a probability of 0.000, meaning that the independent variables together can explain urbanization at the 5% level. When observing the urbanization estimation results, the variable that did not show an insignificant effect was the income variable. Meanwhile, the poverty, education and health variables have a significant influence with a significance level of 5 percent.

The R square value of population density (Y) in the processed data is 0.472. This means that 47% of population density variables in Indonesia can be explained simultaneously by the variables poverty, income, education, health and urbanization. Meanwhile, the remaining 53% is explained by other variables not included in the research model. This is also confirmed by the F test with a probability of 0.000, meaning that the independent variables together can explain the level of population density at the 5 percent level.

The results of data processing in table 1 show that poverty (X_1) has a significant positive effect on urbanization with a probability value of 0.000 < 0.05. The test results are in accordance with the first hypothesis. Poverty is closely related to human resources that are very lacking or even do not have them at all. Poverty arises because human resources are of poor quality and improving the quality of human resources is an effort to eliminate the shackles of poverty (Zulfiyah & Imron, 2017). Rural areas often experience limitations in terms of basic resources and infrastructure such as roads,

sanitation and access to clean water. The combination of these inadequacies with limited access to technology and information can worsen living conditions for the poor, pushing individuals to move to cities where infrastructure and social services are more available and accessible (Sheyoputri, 2016). Then, the direct influence of poverty on population density shows a negative and significant influence with a probability value of 0.015 < 0.05. The test results are in accordance with the fifth hypothesis. In Indonesia there is a correlation between poverty and high birth rates. Poor families tend to have more children for various reasons, including the need for labor within the family (Kumala et al., 2013). In addition, poverty also limits the ability of individuals and families to obtain adequate housing. In urban areas, this often results in an increase in the number of slums and densely populated areas where families live in crowded and unhealthy conditions (Damanik & Sidauruk, 2020). Meanwhile, the indirect effect of poverty on population density through urbanization is based on the results of the Sobel test calculation in Table 2 with a t-statistic value of 1.314. Because the t-statistic value is 1.314 < t-table 1.98498 with a significance level of 5%, it can be concluded that poverty has no influence on population density through urbanization. Thus the tenth hypothesis is rejected. Poverty often drives individuals to migrate in search of a better life. However, in areas with extensive land availability and abundant natural resources, poverty does not cause an increase in population density. An evenly distributed population can reduce pressure on certain areas even if there are high levels of poverty (Bandiyo & Indrawani, 2010).

Based on the test results for the income variable (X_2), it shows that there is a negative and insignificant influence on urbanization with a coefficient value of -0.065 and a probability of 0.824 > 0.05, which means hypothesis 2 is rejected. Income is one of the main factors that encourages individuals to urbanize (Suffina et al., 2022). However, there are certain conditions where income is not the main factor influencing individuals to urbanize because someone who is satisfied with life in rural areas, including work, community and natural environment, chooses not to urbanize even though they can get a higher income in urban areas (Xing et al., 2022). The Indonesian government has also implemented various Rural Development programs aimed at improving the quality of life in rural areas. The program reduces people's incentives to urbanize. Several provinces that have implemented this program are East Java, Central Java, West Sumatra, South Sulawesi, Bali, NTT and East Kalimantan. Then, the direct influence of income on population density shows a negative and significant influence with a coefficient value of -3.526 and a probability of 0.062 < 0.05. The test results are in accordance with the sixth hypothesis. Economic differences between regions in Indonesia cause income disparities, which in turn influence internal migration. Areas with higher per capita incomes tend to attract residents from areas with lower incomes (Jaya & Fitanto, 2004), thereby increasing density in areas such as the provinces of DKI Jakarta, East Kalimantan and the Riau Islands which have high population densities caused by high per capita income. Meanwhile, for the indirect effect of income on population density through urbanization, based on the results of the Sobel test calculation in Table 2, the t-statistic value is 0.219. Because the t-statistic value obtained is 0.219 < 1.98498 with a significance level of 5 percent, it can be concluded that income has no effect on population density through urbanization, meaning that the eleventh hypothesis is rejected. Although urbanization offers high incomes, the higher cost of living in large cities can reduce the appeal of these income increases. The higher costs of rent, transportation and daily necessities in the city are not commensurate with individual income which ultimately makes some individuals choose to remain in the countryside. With these conditions, population density will not occur in big cities.

The results of data processing on the Education variable (X_3) show that there is a negative and significant influence on urbanization with a coefficient value of -0.055 and a probability of 0.002 < 0.05. Thus the third hypothesis is accepted. Education is considered as one of the main means for socio-economic mobility. Families and individuals often undertake urbanization as an important step in improving socio-economic status, with education a key factor in this process. Big cities offer a wider variety in terms of Education quality and specialization. From international schools, leading universities, to specialized courses and training institutions. Urban areas offer a wider variety of educational options that meet the specific needs and interests of various individuals. Then, the direct effect of education on population density shows a positive but not significant influence with a coefficient value of 0.048 and a probability of 0.683 > 0.05. The test results are not in accordance with

the seventh hypothesis. The Indonesian government has implemented various programs in the world of education in rural areas with the aim of improving the quality and access to education in these areas, such as the Smart Indonesia Program (PIP), the Driving School Program, Diniyah Madrasas and Islamic Boarding Schools, School Operational Assistance (BOS), Village Internet and Frontline Teachers (Dimmera & Purnasari, 2020). With education policies that can be accessed evenly throughout Indonesia, population density will not increase in urban areas. Meanwhile, the indirect effect of education on population income through urbanization is based on the results of the Sobel test calculation in Table 2 with a t-statistic value of 1.279. Because the t-statistic value obtained is 1.279 < from the t-table 1.98498 with a significance level of 5%, it can be concluded that education has no influence on population density through urbanization. Thus the twelfth hypothesis is rejected. In areas with already very high population density such as DKI Jakarta, increasing access to education does not significantly affect population density because limited physical space and high costs of living can inhibit further migration. If quality education can be accessed evenly, including in rural and remote areas, the motivation to migrate to urban areas with the aim of getting a better education will be reduced (Yunianto, 2021). This will keep population density stable in various regions.

Results of data processing on variables health (X_4) shows a positive and significant influence on urbanization with a coefficient value of 0.099 and a probability of 0.000 < 0.05. Thus the fourth hypothesis is accepted. The best and most complete health facilities tend to be concentrated in big cities. This includes hospitals, specialist clinics and health practitioners with more specific training. Individuals who require special or routine medical care will choose to move to the city for easier access to that care(Tambaip et al., 2023). Several provinces that have relatively good health services are DKI Jakarta which has a number of large and well-known hospitals including Cipto Mangunkusumo Hospital and St. Carolus, apart from that, West Java has the Hasan Sadikin Hospital which is one of the largest teaching hospitals in Indonesia, East Java and Bali. Good health services in these provinces not only improve the quality of life of local residents but are also an important factor driving urbanization. Then, the direct influence of health on population density shows a positive and significant influence with a coefficient value of 0.269 and a probability of 0.003 < 0.05. The test results are in accordance with the eighth hypothesis. Quality health services in urban areas will be a reason for people to move. This migration affects the distribution of population density, increasing density in urban areas while reducing density in rural areas (Sidabutar & Chotib, 2021). Other factors are birth rates and death rates. Good health tends to reduce mortality rates, including maternal and infant deaths, which directly affects population growth. On the other hand, access to reproductive health and family planning services can help regulate birth rates. The balance between birth rates and death rates greatly influences population density in a province. Meanwhile, the indirect effect of health on population income through urbanization is based on the results of the Sobel test calculation in Table 2 with a t-statistic value of 1.398. Because the t-statistic value obtained is 1.398 < from the t-table 1.98498 with a significance level of 5%, it can be concluded that health has no influence on population density through urbanization. Thus the thirteenth hypothesis is rejected. There are situations where people who have economic limitations would prefer not to migrate. Apart from that, the government also provides health facilities in rural areas such as the Alert Village Program, Healthy Village Program, BPJS Independent Village Program with the aim of improving better health in the rural environment (Easter, 2023).

Furthermore, the results of data processing on the urbanization variable (Z) show that there is a positive but not significant influence on population density with a coefficient value of 0.912 and a probability of 0.162 > 0.05. Thus the ninth hypothesis is rejected. Equal development has the potential to increase social welfare throughout Indonesia, both urban and rural. Urbanization followed by the expansion of city areas can spread the population over a wider area, thereby keeping population density relatively stable (Sabitha, 2022). On the other hand, improvements in technology and infrastructure, such as efficient transportation systems, can allow residents to live further from the city center while remaining connected to work areas and city services. This can reduce the impact of urbanization on increasing population density in the city center.

4. Conclusion

Based on the research results, conclusions regarding the Macroeconomic Impact on Population Density in Indonesia for the 2020-2022 period are as follows:

1) Poverty has a direct influence on urbanization and population density. This finding has the implication that poverty will have a direct impact on urbanization and also have a direct impact on population density. However, indirectly through urbanization it has no effect on population density. This implies that poverty has no impact on population density through urbanization.

2) Income has no direct influence on urbanization. This has the implication that large and small incomes do not have a direct impact on urbanization. However, income directly influences population density. This has the implication that income or wages will have a direct impact on population density in cities. Furthermore, income indirectly through urbanization has no effect on population density. This has the implication that increasing income in urban areas does not have an impact on population density through urbanization.

3) Education directly influences urbanization. This has the implication that educational facilities in urban areas influence urbanization. However, education does not have a direct or indirect influence on population density through urbanization. This has the implication that educational facilities in urban areas do not influence someone to urbanize.

4) Health directly influences urbanization. Likewise, the relationship between health and population density also has an influence. This has the implication that health services in urban areas directly influence someone to urbanize and also directly impact population density. However, health indirectly has no influence on population density through urbanization. This implies that there are other factors that influence a person to urbanize.

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