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Factors Predicting Fertility Rate in Indonesia

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Abstract

The highly competitive environment of the nowadays modern world brought about survival challenges. Hence, individuals all over the globe are striving for a quality life with the fulfillment of their basic needs. Simultaneously, the population plays an important role in determining the distribution of resources and quality of life in a particular area. At the same time, the fertility rate is an important element of the world's population. Hence, this study aims to analyze the effect of women's education, women's participation in the labor market, income, and mortality on the fertility rate in Indonesia as a developing nation. Multiple regression analysis methods with Error Correction Model (ECM) analysis technique were applied. Based on the result of the research conducted, women's education, participation in the labor market, income, and mortality rates together significantly affect fertility in Indonesia in the long term. However, the results were insignificant in the short term. Moreover, based on the long-term results of the data, it is suggested that in fertility control, these factors need to be included in developing nations.

Keywords: Fertility Rate; Women's Education; Women's Participation in the Labor Market; Income; Mortality
JEL classification: J01, J10, J11, J16

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1. Introduction

The current world population is 7.98 billion as of October 2022, according to the most recent United Nations estimates elaborated by World meter. Indonesia is among the 10 most populous countries, with about 280 million people (Pemayun & Sunariani, 2022). Additionally, life expectancy is likely to rise to 77.4 years (from 71.2) by 2050, and the population is set to rise to 321 million (Karuniawati et al., 2021). The large population in Indonesia is not in accordance with the economy's capabilities, as the country's fertility rate exceeds its ability to bear the population. Simultaneously, an increase in the population becomes a burden for sustainable economic development that further drives the policy of reducing the increase in population, especially through birth rate control (Karuniawati et al., 2021). The birth rate or fertility is a component of population growth that is increasing the population (Lazzari, Gray, & Chambers, 2021).

With the high birth rate, the population also experiences very rapid growth. Several opinions based on social and economic approaches explain the factors that affect the level of fertility (Filatotchev, Ireland, & Stahl, 2022). Research shows that social variables related to women's behavior can affect the birth process and birth rate (Brinton & Oh, 2019). In recent years, although Indonesia's fertility rate has been declining, it is

still very nominal. Moreover, Figure 1 shows the fertility rate in Indonesia in the last 15 years.

Besides, researchers highlighted that the level of education determines the age of early marriage (Buckman et al., 2021; Sagalova et al., 2021). Women who have a higher education level tend to reduce the age of their marriage. In connection to that, Kearney, Levine, and Pardue (2022) explained that the education level of women is associated with a low birth rate. At the same time, in Indonesia, the number of women who finished high school education to university continued to increase from 2010 to 2020 (Manullang et al., 2021). However, when it is associated with the theory of fertility conditions and women completing education in Indonesia, the results lack theoretical support, as it is found that regardless of an increasing trend of higher education among women, the birth rate data also show a positive trend. Hence, it is of utmost importance to analyze the impact of education level among women on the fertility rate to extract valuable insights to devise policies and procedures in this context (Chen et al., 2022).

In addition to women's education, their participation in the labor market also affects the birth rate (Klasen et al., 2021). This is because working women plan their children's birth following their work commitments (Horwood et al., 2021). On the other side, women are regarded as an important pillar of the economy, and more human capital formation increases women's participation in the labor market, which may change the birth rate (Al Faizah et al., 2022). Hence, researchers highlighted the importance of examining the influence of women's participation in the labor market to determine the fertility rate in a region. Moreover, from an economic approach, it is known that income is a factor affecting fertility rates. According to, Amrullah, Wahyudi, and Ekawaty (2020) an increase in income reflects the economic situation and may predict the birth rate based on utility and the cost spent on raising and caring for children. Simultaneously, having children is also considered by scholars as an investment creating quality compared to quantity (White et al., 2022).

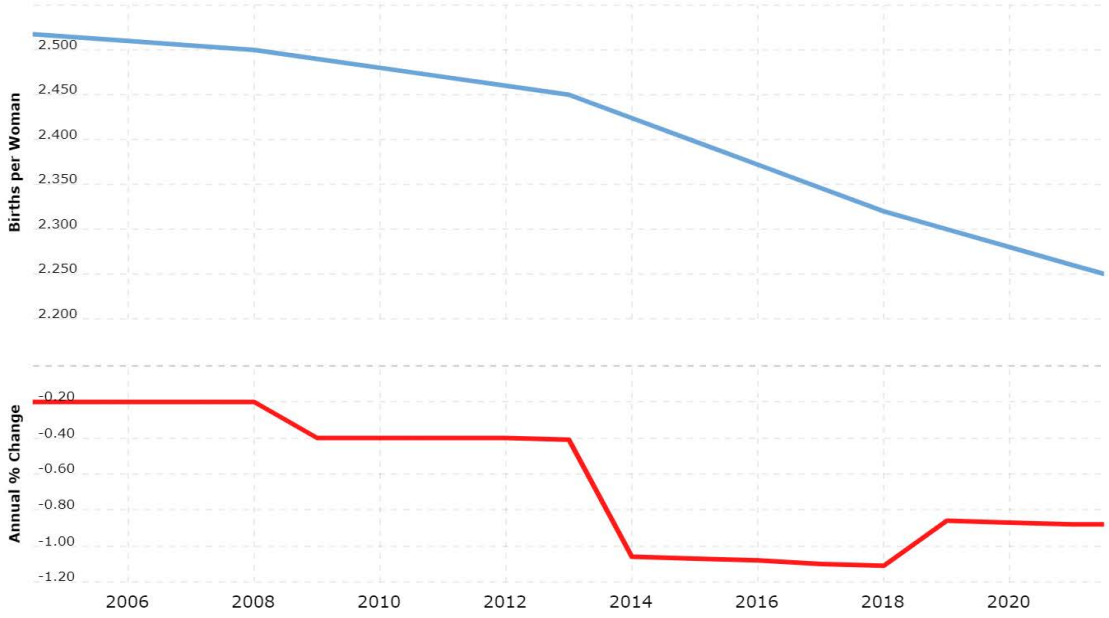

Figure 1: Fertility rate from 2005-2020 in Indonesia

Source: https://www.macrotrends.net/countries/IDN/indonesia/birth-rate

Parental income is the income obtained, which can be seen from wages or salaries (Carneiro et al., 2021). The average income of parents based on the average wage/salary in Indonesia continued to increase from 2009 to 2020. This explains that the data trend from per capita income is positive (Amrullah et al., 2020). Based on the theoretical explanation, the relationship between income and fertility is negative, meaning that an increase in income will decrease births (Sari & Rudi Purwono, 2021). However, if viewed from the actual conditions as seen from the development of live birth data, it shows a fluctuating condition. In contrast, according to theory, when income increases, births actually decrease (Hellstrand, Nisén, & Myrskylä, 2022). Regardless of evidence regarding the influence of income on the number of households, the literature has limited evidence regarding the impact of income level on the fertility rate, specifically in a developing nation context. Hence, the current study addresses these gaps in the literature.

Moreover, demographic factors also determine the birth rate. As Aitken (2022) explained, the infant mortality rate could also determine the birth rate or fertility, which explains that a decreased mortality rate will reduce the number of births or fertility. This is further related to the fact that with the decline in infant mortality, parents spend a long time taking full care of their children. In addition, with reduced infant mortality, parents pay for their children's needs. The mortality rate per 1000 baby births shows a negative trend, which means that the tendency for death rate per 1000 births decreased from 2010 to 2020. In accordance with the previous explanation and literature support, infant mortality and birth rates show a positive relationship (Owusu, Sarkodie, & Pedersen, 2021), which means that when deaths per 1000 births decline, then The number of births will also decrease. However, if viewed from the birth trend, it has a positive trend, meaning that there is an increase in the number of births. This situation is contrary to the theory. Based on the explanation of the theory and the actual situation, as seen from the empirical data, the opposite trend was found between the data and the theory. It encourages the author to do further research related to the level of fertility and the factors that affect fertility conditions in Indonesia.

Therefore, the current study aims to explore more about "Factors Affecting Fertility Rates in Indonesia. Hence, based on the description of the background above, the problem addressed in the current study is whether women's education, participation in the labor market, parents' income, and children's mortality rate affect fertility in Indonesia.

2. Literature Review and Theoretical Framework

The current study formulated the hypothesis and proposed a theoretical framework based on a set of existing theories as follows:

a. Population Theories

Population theories are comprised of multiple theories, including ***Malthusian Theory.*** Malthus, in his book entitled Principles of Population, asserted the faster rate of human development than the available resources to meet their needs (Secord, 2021). Malthus was one of those people who were pessimistic about the future of humanity. Moreover, ***Classical Stream*** asserts that an increasing number of people will cause a division of labor so that, in its application, it will cause skills to increase (Erikson & Shirado, 2021). If the population increases, jobs are more diverse, and human skills increase, so per capita output also increases.

Following the ***Marxist theory,*** the human population does not suppress food but affects employment opportunities (Øversveen, 2022). Poverty does not occur because of rapid population growth but because the capitalists take part in the rights of the workers. The higher the level of the human population, the higher the productivity if technology does not replace human labor. So that humans do not need to suppress the number of births. This further rejects Malthus' theory of moral restraint to suppress the birth rate. According to this theory, birth rates and death rates are both high. But in fact, this is not the case. Population growth is low in the Soviet Union, and its fraction is almost the same as in developed countries (Voskoboynikov, 2021). China cannot tolerate high population growth and must be constrained

in using contraception and allowing abortions as food supplies are increasingly scarce. On the other hand, the motto of one child in the household (one child campaign) in China is an effort to reduce population growth (Gu, 2022).

Additionally, the basic assumption of the ***Optimum Population Theory*** lies in the relationship between the population and existing resources (Liu et al., 2021). Besides, classical economists discuss the effects of population size, labor division, specialization, and law on the other. According to labor productivity, in general, declines with the increase in workers working on the land (Dong et al., 2021). Several other authors have stated that the concept of optimum population is not synonymous with economic factors such as welfare, life expectancy, number of families, natural resources and land, or socio-cultural factors as determinants of optimum population. Moreover, the optimum population concept can be explained through adjustments between population variables to changes in technology, availability of resources, and other very complex factors (Liu et al., 2021). If the relationship between these variables is not known with certainty, it is very difficult to formulate the concept of the optimum population.

On the other hand, ***Social Capillarity Theory*** is based on the analogy that the liquid will rise rapidly in a narrow capillary tube, which is identical to the number of children (Almeida et al., 2021). Social capillarity theory can develop well in democratic countries, where every individual has the freedom to achieve a position in society, including determining the number of children. In a country where the democratic system works well, everyone is racing to get to a higher position, and the birth rate drops fast. On the other hand, the theory of social capillarity does not work well in a country with a socialist system where there is no freedom to achieve a high position in society (Almeida et al., 2021).

At the same time, ***Competition Theory*** emphasizes the consequences of high population growth. Countries or regions with a high population density lead to competition for survival (Zhang, 2021). To win this competition, each individual tries to improve their education and skills with a certain specialization. Furthermore, ***Physiological Theory*** doubts this axiom, with evidence that in many countries, such as India, Indonesia, and China, the population density is very high, but population growth is also high (Galliera & Rutström, 2021). Instead, Malthus' assumption is much more concrete, in an area with high fertility rates, population growth is low due to high mortality. On the other hand, a high fertility rate can be achieved when the fertility rate is high. Then, high fertility rates can also cause low fertility rates due to contraception.

b. Fertility Theory

Fertility can be seen in the number of live births and the Total Fertility Rate (TFR), which reflects the number of live births in a group or groups of women at the time of entering reproduction until the time of data collection (Aitken, 2022). Furthermore, fertility indicators can also be seen from the Total Fertility Rate (TFR), which is a number that shows how many children will be born to a woman who survives until the end of her reproductive period and experiences at each age a fertility rate determined by the age of a certain period (Lazzari et al., 2021). Becker's approach to the relationship between economic conditions and birth from the point of view of utility costs and returns has been carried out by Becker (1981). He was of the view that children are durable goods. Children generate psychic income for their parents.

Fertility is determined by the income of the parents, the cost of having children, and other factors such as a lack of security and personal taste. Children are not considered a "luxury item," so an increase in long-term income will increase parental spending on them. However, there are two ways in which parents can increase spending on children, i.e., by increasing the level of education and health and calculating the cost of a child quantitatively. The net cost of a child is equal to the present value of the expenses spent plus the calculated value of child services. Bender et al. (2022) interpret the concept of demand for children as the desired number of children. Included in the definition of number are the sex of the child, quality, time of having children, and so on. Moreover, the concept of demand for children is measured through survey questions about the ideal or expected, or

desired number of families and is regarded as an important predictor of the fertility rate.

c. Hypotheses Development

Research shows that the higher the education of women, the greater the opportunity in the labor market so that work participation will increase (Brinton & Oh, 2019). This condition will cause women to consider the opportunity left behind in having children because they will spend time getting pregnant, giving birth, and raising children (Chen et al., 2022). Especially with women with higher education ranging from high school to university, who participate in the job market and have enormous opportunities in their career paths (Brinton & Oh, 2019). The higher the education a woman has, the work she gets will get better or better quality, both in terms of salary and position. Hence, they will be more career-oriented and more anxious to concentrate on births. Moreover, In addition to women's participation in the labor market is significantly linked to the birth rate (Klasen et al., 2021). Since women are regarded as an important part of the economy, their participation in the labor market may change the birth rate (Al Faizah et al., 2022).

At the same time, the economic approach analyzes the influence of parents' income levels and the costs of caring for and raising children on birth rates {Otrachshenko, 2022 #2258}. According to him, children can be considered durable consumers and are assumed to provide satisfaction. When income increases, the number of children desired will increase. In other words, there is a positive relationship between family income and fertility. Simultaneously, the infant mortality rate has been considered an important predictor of fertility (Owusu et al., 2021). Grimm et al. (2022) further explain that a decreased mortality rate will reduce the number of births or fertility. However, in the context of a developing nation, the influence of infant mortality rate together with women's education, participation in the labor market, and parents' income are least explored. Hence, to bridge this gap in the literature the current study postulates that:

H1: Women's education and fertility rate are inversely related.
H2: Women's participation in the labor market has a negative effect on the fertility rate.
H3: Income has a negative effect on the fertility rate.
H4: The mortality rate has a positive effect on the fertility rate.

3. Research Method

This research was conducted in Indonesia using secondary data for 2005-2020 published by the relevant agency, institution, and ministry. The current study applied the multiple regression model analysis method using the Error Correction Model (ECM) analysis technique (Mansoor, 2021). The Error Correction Model (ECM), known as the error correction model, is a model that is used to look at long-term and short-term projections. The Error Correction Model (ECM) analysis technique is also a descriptive analysis method aimed at identifying "long-term and short-term relationships." Before estimating the Error Correction Model (ECM), several steps are carried out, such as the Stationarity test and the Cointegration Degree Test (Omay & Iren, 2021).

4. Data Analysis and Results

a. Stationarity Test

Based on the Augmented Dickey-Fuller test results at the level and 1st difference level, it is known that not all variables are stationary. It is necessary to carry out the Augmented Dickey-Fuller test at the 2nd difference level (Ahmed et al., 2021). From the result of data processing, the result of the unit root test at the 2nd difference level is obtained, as shown in Table 1 below:

Table 1. Augmented Dickey Test Result at Level 2nd Difference

Variable	Prob.	Information
Fertility	0.0013	Stationary
Women's Education	0.0000	Stationary
Income	0.0033	Stationary
Mortality Rate	0.0048	Stationary

Source: Processed EViews, 2022

Based on Table 1, it can be seen that the Prob ADF value for the variables of fertility, women's education, income, and mortality is less than 0.05. So that the data is stationary on the Augmented Dickey-Fuller (ADF) test at the 2nd difference level.

b. Cointegration Test

The Cointegration test result is obtained by forming a residual by regressing the independent variable to the dependent variable by OLS (Omay & Iren, 2021). The cointegration test is used to provide an initial indication that the model has a long-term relationship. The result of long-term regression analysis by regressing with OLS are presented in Table 2.

After regression with OLS forms a residual for the cointegration test by creating a residual with the name, etc., which is then carried out a stationarity test that must be stationary at the level using the unit root test for more clarity. It can be seen in Table 3.

Based on Table 3, it can be seen that the prob value of 0.0268 is smaller than 0.05. If Etc is stationary at the level, then ECM estimation can then be carried out to see the short-term relationship

Table 2. Long-Term Analysis Results

Variable	Coefficient	Std. Error	t-statistics	Prob.
Women's Education	-0.075	0.031	2.442	0.034
Income	0.282	0.162	4.587	0.012
Death Rate	0.319	0.237	5.890	0.009
Constant	0.724	0.120	6.119	0.000
R^2	0.890	Mean dependent var		45100
Adjusted R^2	0.857	S. D. dependent var		21631
S E of regression	81532	Akaike info criterion		25.690
Sum Squared residual	6.65E+10	Schwarz criterion		25.872
Log-likelihood	-175.832	Hannan-Quinn criterion		25.673
F-statistics	27.168	Dubin-Watson stat		1.6234
Prob.	0.000			

Source: Processed EViews, 2022

Table 3. Test Results Augmented Dickey-Fuller (ADF) Residual Etc

		t-statistics	Prob.*
Augmented Dicky-Fuller test statistics		-5.303	0.0016
Test Critical values	1% level	-4.122	
	5% level	-3.145	
	10% level	-2.714	

Source: Processed Eviews, 2022

c. Error Correction Model (ECM) Analysis

The results of the data analysis have passed the cointegration test, which means that an Error Correction Model (ECM) analysis can be carried out, which aims to see the relationship of the independent variable to the dependent variable in the short term. The results of the ECM analysis in this study are in Table 4.

Table 4. Results of Short-Term Multiple Linear Regression Analysis

Variable	Coefficient	Std. Error	t-statistics	Prob.
Women's Education	0.048	0.025	-1.533	0.163
Income	0.081	0.029	-0.591	0.577
Death Rate	0.094	0.010	0.178	0.861
Constant	0.131	0.151	0.8532	0.418
R^2	0.393	Mean dependent var		31609
Adjusted R^2	0.0905	S. D. dependent var		80668
S E of regression	76930	Akaike info criterion		25.600
Sum Squared residual	4.73E+10	Schwarz criterion		25.231
Log-likelihood	-161.549	Hannan-Quinn criterion		25.573
F-statistics	1.2985	Dubin-Watson stat		1.812
Prob.	0.3479			

Source: Processed EViews, 2022

Table 4 shows that partial short-term estimates of each independent variable consisting of women's education, income, and mortality have no effect on fertility (birth) because the significant value is greater than 0.05 against fertility (birth). However, the ECT coefficient can measure the regression and response each period that deviates from balance. The equilibrium coefficient in absolute form describes how fast the time is required to get the equilibrium value. The Etc coefficient value of 0.862079 means that birth with a balance value of 0.648037 will be adjusted within 1 year.

d. Multiple Linear Regression Analysis

Multiple linear regression analysis in this study aims to determine the effect of women's education, women's participation in the labor market, income, and mortality rates on fertility in Indonesia in 2005 – 2020, for the regression analysis equation using the long-term regression equation. Based on Table 2 above, the following multiple linear regression equation is obtained:

$$Y = a - b1X + b2X2 – b3X3 \quad (1)$$

$$Y= 7244594 – 0.075221X1 + 0.281805X2 – 63187.45X3$$

5. Discussion

One aspect that can affect birth is the level of education of women (Amka & Dalle, 2021). Following the results of Kearney et al. (2022), education and birth have an opposite relationship, which means that increasing education will encourage a decrease in birth. In the current study, education's effect on fertility has a negative effect, which means that when the number of women with high school education up to college increases, fertility, namely the number of live births, also decreases. However, even though the number of women with higher education has increased for a shorter time, the number of babies born alive has also increased. This is because there is no prohibition in Indonesia for women who continue their higher education to get married. Although the number of women who have completed higher education from high school to university has increased, the birth rate has also increased.

Moreover, results show that the influence of women's education on fertility in the ECM analysis is known in the long term, but in the short term, women's education does not affect fertility. The results of this study are in line with research conducted by Buckman et al. (2021). However, the results of the analysis contradict the findings of Manullang et al. (2021), where the research results revealed that education has a positive effect on the birth rate. In accordance with the results of the current study, it can be stated that education affects fertility in the long term, while in the short term, it does not affect fertility. That might be because of the time taking effect of eduction rather than a short term immediate influence.

In addition, income was found to significantly affect fertility (live-born babies) in Indonesia. This can be seen from the regression coefficient value of the income variable, which has a positive sign: when income increases, it encourages an increase in the number of births. The significant positive effect of per capita income on fertility (live-born babies) is in line with research by White et al. (2022), who found that income positively affects fertility. However, the result of the study actually found that income and fertility or live births actually showed a positive relationship, which means that an increase followed an increase in per capita income in the number of births. It further shows that having children is satisfaction for parents; when parents' income increases, they prioritize quality over quantity of children, thus limiting the number of children they have. Moreover, sources of income for people in Indonesia consist of 17 economic sectors in Indonesia, the sector which is the largest contributor according to the report (BPS, 2020); in 2018, the PDB in Indonesia was dominated by the agriculture, forestry, and fishery sectors by contributing 12.81% of the total PDB of Indonesia.

This study was found to have a negative effect on mortality per 1000 births on fertility (live births). The result of this study is also in with the research conducted by Owusu et al. (2021), which shows that mortality has a negative effect on fertility in the long term. However, the study's results align with the opinion of Vergani et al. (2019), which explains that when mortality is low, fertility will increase. The results of the data analysis showed that death had a negative and significant effect on fertility. This further reflects that the mortality rate in Indonesia tends to show a negative trend, which means that it tends to decrease, although the birth rate also has an increasing trend. Many factors have caused this to happen in Indonesia, one of which has been the lax policy on implementing family planning, so there are still many couples of childbearing age who do not use contraception, especially since Indonesia is an archipelagic country, of course, it is difficult to implement the objectives of the family planning program. Moreover, according to the physiological theory, human reproductive power is limited by the population. It further asserts that human reproductive power, namely fertility, is inversely proportional to population density. If the population density is high, the reproductive power will decrease and vice versa. Further, Owusu et al. (2021) explain a high fertility rate and low population growth due to high mortality in an area. On the other hand, a high fertility rate can be achieved when the fertility rate is high. Then, a high fertility rate can also cause a low fertility rate due to the use of contraception.

Implications of the Study

Considering the significant influence of women's education on the fertility rate in the long term, there is a need to increase the average length of schooling for women in Indonesia, considering the average length of schooling of the population in Indonesia up to junior high school. So it is necessary to take a policy considering that education in the long affects fertility by encouraging women to continue their education up to high school and college. Moreover, following study results, it is necessary to encourage women's participation in the labor market so that women should be more productive, not only at the workplace but also in households that are encouraged to stay productive at home. This can be done by empowering women in economic activities.

Moreover, it is necessary to re-campaign about the importance of family planning, especially for rural communities whose economic activities are in the agricultural and plantation sectors. So that parents can improve their children's education and choose to create quality children compared to the number of children they have. The government should refocus on family planning programs, especially for young married couples who still have very little knowledge about the use of contraceptives because they are in a transitional period of government. So it is better if media such as posyandu is effectively used, especially as a guide for family planning, so that the population, by suppressing births, can be controlled in the long term.

6. Conclusion

Based on the significance of the fertility rate in predicting an area's population and resource allocation in a country, the current study aims to investigate the effect of women's education, women's participation in the labor market, income, and mortality on the fertility rate in Indonesia. Multiple regression analysis methods with Error Correction Model (ECM) analysis technique were applied to a data set extracted from 2005-2020 in a developing nation (Indonesia); results showed that women's education significantly negatively affected fertility in Indonesia. This means that an increase in the number of women with high school education up to university will encourage a decline in fertility in Indonesia. Women's participation in the labor market significantly negatively affects fertility in Indonesia. This means that the change in the number of women with higher education participating in the labor market partially affects Indonesia's fertility rate. Income has a significant positive effect on fertility in Indonesia. This means that when there is an increase in income, it will encourage an increase in fertility in Indonesia. Finally, the mortality rate significantly negatively affects fertility in Indonesia. This means that a partial increase in the mortality rate will reduce fertility in Indonesia. In contrast, the results are not significant in the short term reflecting the long-term predictive nature of the study variables in terms of fertility rate. Moreover, the results of the current study can be used by the government, practitioners, and economists to devise valuable policies to control the fertility rate to enhance economic growth and stability in a country.

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