The Influence of Gender Equality, Female Labor Force Participation, Technology and Investment on Economic Growth in Indonesia

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Abstract. The gender equality index has been an assessment of the gap between female and male, but the role of female in economic growth is considered not yet optimal. The purpose of this study is to analyze the influence of gender equality and female labor force participation rate (FLF) on economic growth in Indonesia, using panel data from 34 provinces between 2019 and 2023. The results of this study show that gender development and empowerment index (GDI and GEI) have a significant and positive effect on Indonesia's GDP, while the FLF variable has positive but not significant effect on Indonesia's GDP. The government can implement regulations related to women's education through scholarships for women and establish regulations for companies regarding equal pay and promotions for women, to ensure they are equally represented in leadership positions.

Keywords: Gender Development Index; Gender Empowerment Index; Women's Labor Force Participation; Indonesia's GDP; Panel Data.

1. Introduction

In building the economy, one aspect that needs to be improved is the quality of human resources [1]. In improving human resources, this cannot be separated from the participation of men and women in building the economy. Women's participation in building the economy or in the world of work often closes women's access, this is because women are considered incapable of making wise decisions, women tend to be assumed to use more feelings [2]. In a broader context, gender issues are a topic frequently discussed not only in Indonesia but also globally. Gender equality is one of the goals of Sustainable Development Goals (SDGs), which has been agreed upon by the United Nations (UN). The SDGs are a long-term global program aimed at maximizing the potential and resources of each country to support sustainable development [3].

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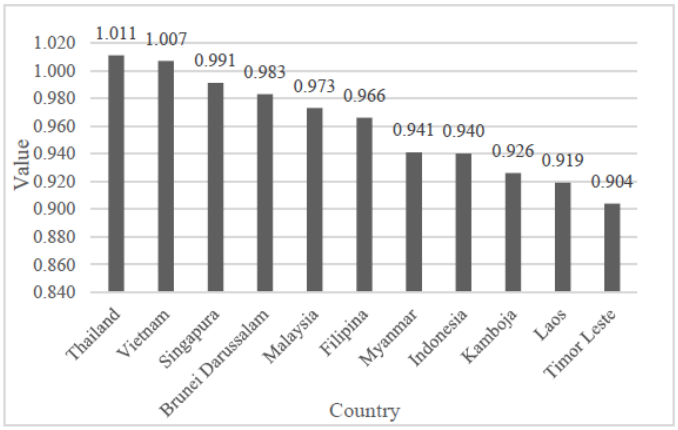

Fig. 1. Gender Development Index ASEAN

Based on data obtained from the United Nations Development Programme (UNDP) in 2022, it can be seen from Figure 1 that Indonesia ranks eighth out of eleven ASEAN countries with a score of 0.940. A value of 1 on the Gender Development Index (GDI) indicates optimal equality between women and men in terms of human capital, as measured by the Human Development Index (HDI). Thus, a score of 0.940 indicates that the level of equality is not yet optimal. The GDI is calculated based on the ratio of the Human Development Index for women to that for men.

Gender issues are also discussed in gender equality theory, which emphasizes the importance of gender equality in achieving inclusive and sustainable economic growth. Gender equality refers to a condition where women and men have the same rights and equal opportunities to participate in the development process of a country [4]. In examining gender equality, the author uses two indicators that project gender aspects: the Gender Development Index (GDI) and the Gender Empowerment Index (GEI). The GEI measures women's participation in political fields, achievements, decision-making, and economic activities. Meanwhile, the GDI is the ratio comparing the Human Development Index (HDI) for women to that for men. Both the GEI and GDI have percentages ranging from 1 to 100, where a value closer to 100 indicates lower gender inequality in terms of human capital and women's economic contribution, whereas a value further from 100 indicates higher gender inequality [5].

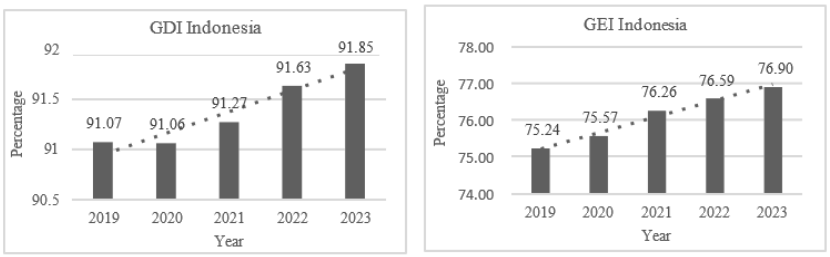

Fig. 2 GDI and GEI Index Indonesia

Data also show that Indonesia's Gender Development Index (GDI) has increased from 2019 to 2023. As illustrated in Figure 2, the GDI percentage rose from 91.07 in 2019 to 91.85 in 2023.

A GDI closer to 100 clearly indicates a smaller development gap between men and women. Additionally, Indonesia's Gender Empowerment Index (GEI) also increased from 75.24 in 2019 to 76.9 in 2023. According to BPS, although the Gender Development Index (GDI) and the Gender Empowerment Index (GEI) have shown improvements, it is important to highlight that the Female Labor Force Participation Rate (FLF) remains low, as illustrated in Figure 3 only 54.52%, while the Male Labor Force Participation Rate (MLF) stands at 84.26%. Given that the population percentages of women and men are not significantly different, the relatively low FLF compared to the MLF raises concerns.

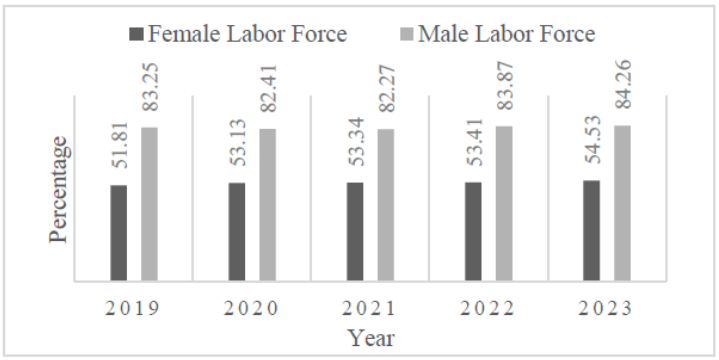

Fig. 3. Percentage Female & Male Labor Force

Several regulations related to gender equality in both politics and employment have been established by the government, such as ensuring that every worker has the right to equal opportunities and fair wages without discrimination. Despite the regulations related to gender equality in Indonesia, data indicates that women receive significantly lower wages compared to men. As shown in Figure 4 in 2019, women earned about 22.71% less than men, with an average monthly wage of IDR 2.45 million compared to IDR 3.17 million for men. In 2020, women earned IDR 2.35 million while men earned IDR 2.98 million. Data for 2021 and 2022 also show that women continued to earn lower average wages compared to men. By 2023, women's average monthly wage was IDR 2.64 million, while men earned IDR 3.47 million per month. This reflects a persistent wage gap between women and men. One aspect contributing to the wage gap is the level of education [6].

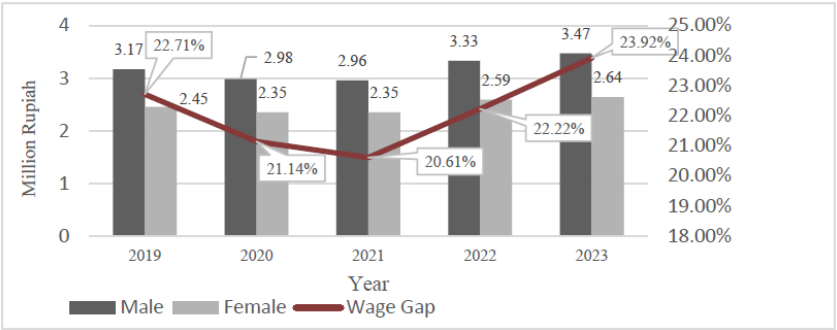

Fig. 4. Average and Wage Gap

This lower level of education results in unequal opportunities for higher-paying jobs, leading to reduced economic participation among women, from [7] known that female education level is

lower than male. This phenomenon is explained by Mincerian theory, which posits that wage levels in the labor market are influenced by human capital and the differences in education among individuals [8]. Therefore, this study aims to examine the impact of gender equality and female labor force participation on economic growth in Indonesia.

The variables used in the econometric model are as follows: Gross Regional Domestic Product (GRDP) of 34 provinces in Indonesia is the dependent variable. Meanwhile, the Female Labor Force Participation Rate (FLF), Gender Empowerment Index (GEI), Gender Development Index (GDI), technology, and investment serve as independent variables. Technology and investment are included as control variables in this study to minimize the influence of external factors beyond the independent variables. The time period for this study from 2019 to 2023 (5 years).

2. Literature Review

2.1 New Growth Economy Theory

Paul M. Romer and Robert Lucas proposed this endogenous growth theory as a critique of the neoclassical growth theory, which fails to adequately explain long-term economic growth [9]. In the neoclassical model, only production machinery is considered as capital, whereas Romer argues that economic growth is influenced by human capital through technological growth, with the following function:

$$Y = F\ (A, K, L, H) \tag{1}$$

In which: Y represents production, A is technology, K is capital and H is human capital. In the production function above, output is influenced by technological development, physical capital, labor, and human resources. According to [10], capital refers to the stock of various structures and equipment used in the production process. In other words, capital consists of goods and money used by firms to drive production.

Besides capital, GDP is also influenced by labor. Labor refers to individuals who perform work, whether within or outside of employment relationships, to produce goods or services to meet societal needs. Labor includes the working-age population who are either employed or seeking employment, as well as those engaged in other activities such as attending school and domestic workers. The percentage of the adult population contributing to the labor force can be measured using the Labor Force Participation Rate (LFPR). According to [10], LFPR can be calculated using the following formula:

$$LFPR = \frac{Labor\ Force}{Working\ Age\ Participation} \times 100 \tag{2}$$

2.2 Human Capital

Human capital refers to the knowledge and skills acquired through education, training, and lifelong health, which affect an individual‘s productive capacity [11]. Another definition by [12] states that human capital consists of inherent attributes that enable individuals to be productive in managing resources, thereby enhancing their own abilities and contributing to economic growth. In other words, human capital is an intangible asset that plays a crucial role in supporting individual quality and productivity. The Mincer model explains the impact of an individual‘s education on their income or wage level. Mincer assumes that educational attainment is

positively correlated with the wages received [13]. The standard econometric form of the Mincer Wage Regression is as follows:

$$LnWage = \beta_0 + \beta_1 Schooling + \beta_2 Exp \quad (3)$$

This model captures the relationship between education, experience, and wages, reflecting how educational attainment and work experience contribute to wage levels.

2.3 Gender Equality

Gender equality refers to equal opportunities for women and men to participate and contribute to development [4]. In the context of gender equality in Indonesia, two indices are used to measure gender aspects: the Gender Development Index (GDI) and the Gender Empowerment Index (GEI). The GDI is a measure of the comparative achievements between the Human Development Index (HDI) of men and women, which can be systematically expressed as follows:

$$GDI = \frac{HDI\ Female}{HDI\ Male} x100 \quad (4)$$

This ratio provides insight into the level of gender disparity in human development achievements between men and women. The Gender Development Index (GDI) measures the ratio between the development achievements of women and men. When the GDI value approaches 100, gender development is more equitable. Conversely, if the GDI value moves away from 100, it indicates increasing gender inequality in development [5].

Another index used to assess gender equality is the Gender Empowerment Index (GEI). The GEI measures women's participation in politics, decision-making, and economic activities to evaluate disparities in achievements between men and women [14]. The GEI is derived from the average of three components: the involvement of women in parliament, women in professional occupations, and women's income contributions [15].

Gender equality promotes women's participation in economic growth. Through gender equality, women can become drivers of both production and consumption activities [16]. Additionally, welfare is a primary goal of economic growth, and one of its key components is justice. Gender equality also involves the elimination of discrimination and injustice against both men and women. When justice and equality are achieved for both genders, it leads to equitable access, opportunities, and control over development, as well as fair and equal benefits [17].

2.4 Empirical Review

Research by [18], using the VECM method, and [19], employing panel data regression, both show that female labor force participation positively affects economic growth. Similarly [20], using OLS & ARDL methods, examined female labor force participation from 122 countries and found that female labor force positively impacts economic growth. However, [21] found that while female labor force participation has a positive effect, but not significant.

Studies incorporating gender equality variables, such as those [14] and [22], also indicate that the role of women, as projected by the Gender Development Index (GDI), does not significantly impact economic growth. Similarly, the Gender Empowerment Index (GEI) in [14] study did not show a significant effect on economic growth. On the other hand, [23] reported that the GEI has a significant positive effect on economic growth.

3. Research Methodology

3.1 Data And Sample

The variables used in this study include the Gross Regional Domestic Product (GRDP) of 34 provinces in Indonesia as the dependent variable. The independent variables consist of the Female Labor Force Participation Rate (FLF), Gender Empowerment Index (GEI), Gender Development Index (GDI), technology, and investment. Data on GRDP and total investment are transformed into natural logarithm form.terms (LnGRDP) and (LnInvestment). Technology and investment are included as control variables to minimize the influence of external factors beyond the independent variables. The time period for this study is from 2019 to 2023 (5 years). The data utilized in this research are annual data obtained from Badan Pusat Statistik (BPS). The study employs Panel Data Regression Analysis.

3.2 Variable Description

$$LnGRDP_{it} = \beta_0 + \beta_1 FLF_{it} + \beta_2 \text{GDI} + \beta_3 GEI_{it} + \beta_4 Technology_{it} + \beta_5 LnInvest_{it} + u_i + e_{it} \quad (5)$$

In which: FLF represents female labor force, GDI is gender development index in this study used growth of GDI, GEI is gender empowerment index, β is the setimated coeffiicients and e is error in the model. Measurements of all variables in this study are describe in Table 1.

Table 1. Measurements of Variables

Variable	Variable Name	Lables	Measurement
Dependent	Gross Regional Domestic Product	LnGRDP	Percentage
Independent	Female Labor Force	FLF	Percentage
	Gender Development Index	GDI	Percentage
	Gender Empowerment Index	GEI	Percentage
	Technology	Technology	Percentage
	Investment	Invest	Percentage

3.3 Methodology

This study, the analysis method used is a quantitative method employing panel data regression. This is done to determine the effect of independent variables on the dependent variable. Panel data is a combination of cross-sectional data and time series data. The advantage of using panel data for modeling is that it results in a larger degree of freedom due to the larger amount of data, which can address omitted variable issues. The use of panel data also helps reduce bias in estimates [24]. In panel data, there are several individual units observed over a specific period. If the time units are the same for each individual, it is called a balanced panel. However, if the time units differ for each individual, it is called an unbalanced panel. The panel data regression model uses three estimation model approaches: the Pooled Ordinary Least Squares (PLS), the Fixed Effects Model (FEM), and the Random Effects Model (REM) [25]. In adjusting the panel data regression model, several tests are conducted, such as model fit tests, classical assumption tests to ensure that the research is unbiased and aligns with the Best Linear Unbiased Estimator (BLUE), and statistical tests.

4. Result And Discussion

4.1 Data Estimation Results

To determine the best estimation model, model fit tests are required through several stages of estimation testing, namely Pooled Least Squares (PLS), Fixed Effects Model (FEM), and Random Effects Model (REM). In the first stage, a Chow test is performed to select the best model between PLS and FEM. The results of the Chow test in this study show that the probability value for the estimation model is 0.0000, which is lower than the alpha level of 0.05. In other words, we accept H_1 indicating that the best model in this test is FEM. Next, a Hausman test is conducted to determine the best estimation model between FEM and REM. In this study, the probability value of the Hausman test is 0.000, which is lower than the alpha level of 0.05. Therefore, the best estimation model in this study is FEM.

Table 2. Model Fits Test

Model Fits Test	Probability *Chi-Square*	Model
Chow Test	0,0000	*Fixed Effect Model*
Hausman Test	0,0000	*Fixed Effect Model*

After conducting the model fit test for the estimation model, the next step is to perform classical assumption tests on the estimation model used. The classical assumption tests in this study consist of tests for multicollinearity, heteroscedasticity, and autocorrelation. This study assumes that the data is normally distributed because the sample size is greater than thirty (N > 30) [26], so the normality test is not required. To examine the correlation between independent variables, the estimation model requires a multicollinearity test [27]. In this test, the model is not considered to have multicollinearity if the correlation values do not exceed 0.8.

Table 3. Multicollinearity Test

	FLF	GDI	GEI	Technology	Ln_Invest
FLF	1,0000				
GDI	0,0572	1,0000			
GEI	-0,0009	-0,0973	1,0000		
Technology	-0,1984	-0,2815	0,0520	1,0000	
Ln_Investasi	-0,2278	0,1480	0,2238	0,3640	1,0000

The heteroscedasticity test is used to examine the differences in residual variance between different observation periods. This study uses the Wald test to perform the heteroscedasticity test. The probability value is 0.0000, which is smaller than the alpha level of 0.05, indicating that the model in this study has heteroscedasticity issues.

Table 4. Heteroscedasticity Test

chi2 (34)	2343.47
prob>chi2	0.0000

Next, an autocorrelation test is performed to determine if there is a correlation between the errors of a given period and those of the previous period in the model. The test used in this study is the Wooldridge test. The probability value from this test is 0.0000, which is smaller than the alpha level of 0.05, indicating that there are autocorrelation issues in the estimation model.

Table 5. Autocorrelation Test

chi2 (34)	39.692
prob>chi2	0,0000

4.2 Generalized Least Square Model

The results of the model fit test in this study indicate that the best model is the Fixed Effects Model (FEM). Based on these results, classical assumption tests were conducted, revealing that the model has issues with heteroscedasticity and autocorrelation. Therefore, the next step involves improving the model using Generalized Least Squares (GLS). The results of the classical assumption tests after model improvement can be seen in the Table 6.

Table 6. Generalized Least Square Model

Variable	Coefficient	Prob
FLF	0,0026917	0,285
GDI	0,0557121	0,001**
GEI	0,0057781	0,084*
Technology	0,0038105	0,000***
Invest	0,0189763	0,054*
Constant	10,9239	0,000
Prob>F		0,0000
R-Squared		0,5655

After used GLS, there are four variables that significantly effect Indonesia's GDP: IPG, IDG, technology, and investment.

4.3 Regression Analysis

4.3.1 Female Labor Force

From the regression results obtained, the estimation model shows that the Female Labor Force Participation Rate (FLF) has a positive but not significant effect on Indonesia's GDP, with a p-value of 0.285, which is greater than the alpha level. This finding is consistent with the research conducted by [21], which states that the female labor force has a positive effect but is not a significant factor influencing GDP. Although the research conducted by [20] indicates that female labor has a positive impact, its effect is smaller compared to the contribution of male labor to economic growth. Women also tend to work in jobs with flexible hours due to their household roles, which often results in them working in the informal sector. The informal sector here refers to economic activities carried out by households or micro and small enterprises with low income [28].

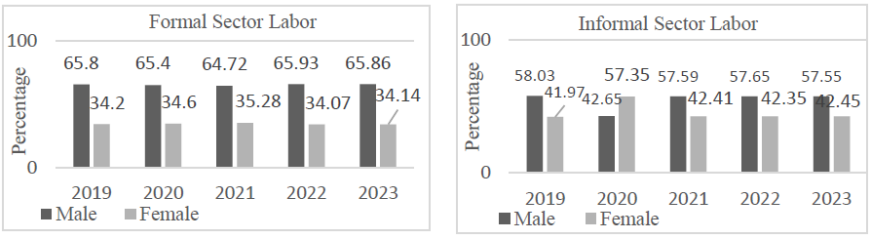

Fig. 5. Formal & Informal Sector Labor

Although the percentage of women in both formal and informal employment sectors has increased each year, the workforce in both sectors remains predominantly male compared to female. This clearly indicates that women's participation is not yet as high as that of men.

4.3.2 Gender Development Index

From the regression results obtained, the estimation model shows that the Gender Development Index (GDI) has a positive and significant effect on Indonesia's GDP. An increase in the Gender Development Index (GDI) indicates equitable economic development without differences between men and women in terms of human capital. The GDI includes components such as health, projected by life expectancy; education, projected by expected years of schooling and average years of schooling; and a decent standard of living, projected by per capita expenditure. According to the Mincerian model, individuals who obtain higher education are expected to earn better wages. Better wages improve individuals' living standards, and subsequently, improvements in health will enhance human productivity [29]. Therefore, equality in human capital will support productivity, which will positively impact economic growth.

4.3.3 Gender Empowerment Index

Based on the estimation results obtained, the model shows that the Gender Empowerment Index (GDI) has a positive and significant effect on Indonesia's GDP. Research conducted by [30] indicates that reducing gender inequality, eliminating role differences between men and women, could increase global GDP by approximately $12 trillion, or around 16.5%, aimed at enhancing economic well-being. According to [31] also states that reducing the gender gap in the workforce will result in higher productivity and increased economic value. This is further supported by research conducted by [23], which finds that the Gender Empowerment Index (GDI) has a positive and significant impact on economic growth. Empowerment of gender provides equal opportunities in both politics and the economy. These equal opportunities lead to increased income for women, which can contribute to higher family income. This, in turn, will indirectly support economic growth.

4.3.4 Technology and Investment

Technology and investment are included as control variables to minimize the influence of external factors beyond the independent variables. Based on the estimation results shows that technology and investment has a positive and significant effect on Indonesia's GDP. An increase in the community's skills in Information ang Communication (ICT) will help make the production process more efficient and effective [32] and the investment variable aligns with the New Growth Economics Theory, which posits that capital or investment has a positive effect on increasing production output.

5. Conclusion

Based on the panel data method, the best model for this research is the Fixed Effects (FE) model. The conclusions are the Gender Development Index (GDI) and Gender Empowerment Index (GEI) positively and significantly affect Indonesia's GDP. Enhancements in GDI and GEI contribute to GDP growth by promoting equal opportunities for improving human capital and economic participation but variable Female Labor Force (FLF) does not significantly impact GDP. This is attributed to lower productivity among women working outside the home and their prevalence in the informal sector, which is not fully captured in official labor force statistics.

Consequently, FLF is lower compared to the Male Labor Force (MLF). Based on the research findings, several recommendations can be considered to improve gender equality in Indonesia. Although regulations related to equal access to education are in place, these regulations are not yet optimally implemented, as evidenced by the lower enrollment rates for women compared to men. The government could provide scholarships to women to ensure equal opportunities and enhance educational equality. It also regulations on gender equality in politics, labor, and wages, these regulations have not been fully effective, as evidenced by the persistent wage gap between men and women. The government could require companies to report on equal pay practices and support women in obtaining promotions to ensure a balance for both female and male stakeholders in the workplace.

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