Low Equality for Women, Slower Economic Growth for All? Evidence from D-8 Countries

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Abstract
Gender equality promotes economic improvement and reduces income inequality. Considering the goal of all countries to achieve faster and stronger economic growth, improving gender equality may represent a promising solution. This paper examines the link between gender equality and economic growth in the 'Developing Eight' (D-8) countries from 1998 to 2021. This study provides estimation using a system GMM and panel causality test to determine the effect of gender equality on economic growth. The results indicate a positive and significant effect of gender equality on economic output in D-8 countries. Heterogenous panel non-causality findings suggest that gender equality and economic output have a bidirectional relationship in D-8 countries, indicating that economic output also affects gender equality.

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1. Introduction

In recent years, an increased number of studies have debated the link between gender inequality and economic growth (Vásconez Rodríguez, 2018). The main theory is that the elimination of gender disparities can create a faster and stronger growth engine for more resilient, sustainable, and inclusive economies, especially with equality in education and the labour market (IMF, 2022). Literature documents that gender equality is growth-promoting, goes hand-in-hand with financial stability, boosts private and public sector performance, mitigates demographic shifts, and contributes to financial sector stability (Gonzales *et al.*, 2015; Kochhar *et al.*, 2017; IMF, 2022). In addition, gender equality increases economic diversity and reduces income inequality. However, in many countries, women still face inequality in education or labour participation (ILO, 2022; Katrin *et al.*, 2013). Three major issues that prove gender inequality continues are gender bias in education, the gender pay gap, and lack of employment equality (Human Right Careers, 2022).

Meanwhile, inclusive economic development is the goal of every country, including the 'Developing Eight' (D-8) countries. The D-8 is an organisation established through the Istanbul Declaration in 1997 in Istanbul, and consists of eight developing countries: Bangladesh, Egypt, Indonesia, Iran, Malaysia, Nigeria, Pakistan, and Türkiye. The initial goal of the D-8 is to counter injustice and the ambivalent attitude of Western countries in global economic cooperation. However, over the years, the goals have changed to focus on increasing the welfare of member countries, improving their bargaining position in the global economic system, and creating new opportunities in international trade (Ministry of Foreign Affairs of The Republic of Indonesia, 2022). Key to this is solving income inequality and boosting economic growth. Thus, considering the nexus between gender equality and economic growth, improving gender equality may be a panacea for spurring economic growth in D-8 countries.

Studies in several countries and regions have found that gender equality is a key determinant of economic growth, including in Asia, Brazil, and the United States of America (USA) (Bertay *et al.*, 2021; Eastin & Prakash, 2013; Kim *et al.*, 2016; Klasen, 2002; Klasen & Lamanna, 2009; Mishra *et al.*, 2020; Seguino, 2000; Usman & Lestari, 2018; Vásconez Rodríguez, 2018). However, to the best of the author's knowledge, studies that assess the role of gender equality in promoting economic output in D-8 countries are still limited. Thus, the motivation of this study is to assess the role of gender equality in increasing economic output in D-8 countries.

Assessing the role of gender equality in D-8 countries in achieving faster and

stronger economic growth is relevant due to ongoing barriers and discrimination faced by women. Although women account for 49.7% of the total population in D-8 countries, women continue to have lower educational attainment and represent a smaller share in the labour force (UN, 2020; European Commission, 2022). Constraints such as discriminatory laws, education gaps, wage gaps, and lack of access to financial assets have held women back, which, in turn, holds back the economies (World Development Report, 2012).

The objective of this study is to examine the role of gender equality in promoting economic growth. This study uses panel data from D-8 countries between 1998 and 2021. The selection of the period of study was primarily due to data availability. Gender equality is measured using the gender development index provided by United Nations Development Programme Human Development Reports (UNDP HDR). For the estimation model, this study employs system GMM and panel causality analysis. This study performs cross-sectional dependence and unit root tests to ensure that the result is unbiased. In addition, this study also compares the coefficient estimation between OLS, fixed effect, difference GMM, and system GMM as the procedure of the robustness test. This study has two contributions to knowledge. First, it contributes by providing empirical evidence of the nexus between gender equality and economic output. Second, this study shed lights for policymakers in D-8 countries, on how gender equality can contribute to stronger and faster economic growth.

This paper is organised as follows. Section 2 provides the method used in this study. Section 3 presents the empirical results and robustness check. Lastly, section 4 presents the conclusion of the study.

2. Literature Review

2.1. The nexus between gender equality and Economic Output

Gender equality refers to the equal enjoyment of all people's rights, responsibilities, and opportunities. It means that all interests, needs, and priorities are respected, regardless of gender. Gender equality may promote economic development (Klasen, 2002). This notion has been gaining the interest of researchers and policymakers concerned about finding the determinant of economic growth. The theoretical framework of this notion is related to Roemer (1986), Lucas (1988), and Barro and Sala-i-Martin (1995), who argue the possibility of endogenous economic growth where growth is not constrained by diminishing returns to capital. These theories emphasise the role of human capital accumulation in promoting economic growth (Klasen, 1999).

Based on these theories, there are three channels off how gender equality affects economic development. First, gender bias in education. Gender inequality in education reduces the average amount of human capital in a society, thus decreasing economic performance, restricting highly qualified women, and taking lower qualified men instead (OECD, 2010). Moreover, if there are declining marginal returns to education, restricting the education of women to lower levels while taking the education of men to higher levels means that the marginal return to education of women is higher than men and thus would boost overall economic performance (Klasen, 2006). Educating women also has beneficial effects on measures of social well-being not always measured by the market. These benefits range from extending the population's life expectancy to improving cultural processes' functioning (King, 1995).

Second, externalities of female education. Increasing female education would lower fertility levels, declining child mortality, and promote the next generation's education, leading to better economic development (Kim, 2016). Third, international competitiveness. Many East Asian countries have long been competitive in global markets through women-intensive export-oriented manufacturing industries (Seguino, 2000). For such competitive export industries to emerge and grow, women must be educated, and there must be no barrier to their employment opportunities in specific sectors (WTO, 2020).

2.2 Related Previous Studies

A growing literature documents the nexus between gender equality and economic output (Agénor & Canuto, 2015; Bertay *et al.*, 2021; Eastin & Prakash, 2013; Kim *et al.*, 2016; Klasen, 1999; Klasen & Lamanna, 2009; Mishra *et al.*, 2020; Seguino, 2000; Vásconez Rodríguez, 2018). Klasen (2002) uses cross-country and panel regressions to examine the effect of gender inequality in education on long-term economic growth. This study suggests that gender inequality in education can affect economic growth both directly and indirectly. Gender inequality in education directly affects economic growth by lowering the average level of human capital. In addition, growth is indirectly affected by the impact of gender inequality on investment and population growth. Bertay *et al.* (2021) found that gender inequality affects economic growth by constraining the use of female labour potential. This study argues that policies designed to ensure fair opportunity for women are a matter of human rights and equity and have an essential role in benefiting the economy by promoting economic growth.

Mishra *et al.* (2020) conclude that gender equality can be a key driver of economic growth in Asian countries. Similarly, Agénor & Canuto (2015) found that

fostering gender equality would have a significant impact on long-run economic growth in Brazil. Meanwhile, Seguino (2000) found that gross domestic product (GDP) growth is positively related to gender wage equality.

3. Method

3.1. Data and Variable

This study uses panel data between 1998 to 2021 from the members of the D-8: Bangladesh, Brunei Darussalam, Egypt, Indonesia, Iran, Malaysia, Pakistan, and Türkiye. The data source is from the World Bank and United Nations Development Programme. The outcome variable in this study is the economic output measured by GDP. Meanwhile, the main interest independent variable is gender equality measured by the Gender Development Index (GDI) provided by the UNDP HDR. According to the HDR, three basic dimensions of human development are used in GDI to measure gender equality achievement, namely health, education, and command over economic resources. First, the health dimension is measured by female and male life expectancy at birth. Second, the education dimension is measured by female and male expected years of schooling for children, and female and male mean years of schooling for adults ages 25 years and older. Lastly, command over economic resources is measured by female and male estimated income.

Table 1 describes the variables used in this study. There are several control variables in the estimation model, such as gross capital formation (GCF), unemployment rate, and Human Development Index (HDI). In economic development literature, GCF cannot be separated from economic growth. According to Harrod–Domar (1940), capital formation is the first step to economic growth. Many studies conclude that capital formation has a positive effect on economic growth in many countries (Bal *et al.*, 2016; Reddy & Ramaiah, 2020). Higher capital formation leads to higher production productivity, increasing income and enhancing economic growth (Makris & Stavroyiannis, 2019). In addition, the unemployment rate is commonly negatively associated with economic growth. Castells-Quintana (2017) argues that high unemployment rates have a negative and significant effect on economic growth through income inequality. Increasing inequality would slow growth in countries with high levels of urbanisation. In the case of Nigeria from 1980 to 2013, Michael (2016) found a negative and statistically significant relationship between the unemployment rate and economic growth, with a 1% increase in the unemployment rate reduced the GDP by about 0.125. Meanwhile, literature has proven that human capital has a

positive relationship with economic growth. Based on the new theory of economic growth, labour productivity is denoted as an important factor of economic growth (Pelinescu, 2014).

Table 1. Descriptive Statistics

Variable	Description	Source
lnGDP	Gross domestic product (GDP); represents economic output	The World Bank
GDI	Gender Development Index; represents gender equality	United Nations Development Programme
lnGCF	Gross capital formation	The World Bank
unemp	Unemployment rate	The World Bank
HDI	Human Development Index; represents human capital	United Nations Development Programme

3.2. Estimation Method

This study estimates the role of gender equality in promoting economic output. Before estimating the main model, this study performs the cross-sectional dependence test and unit root test. Cross-sectional dependence is an essential diagnostic method to examine the presence of cross-sectional dependence of error terms between countries (De Hoyos & Sarafidis, 2006). When the presence of cross-sectional dependence in the data is ignored, the estimation of pooled OLS becomes inefficient, while fixed effects (FE) and random effects (RE) estimators will be biased and inconsistent (Phillips & Sul, 2003). This study uses Pesaran's (2004) CD test to determine the presence of cross-sectional dependence in the data series. The null hypothesis for these tests is that no cross-sectional dependence exists in the data. This study also tests the stationary of data used in this study, known as the unit root test. This test is needed to prevent spurious regression (Lyócsa, 2009). This study used a second-generation panel unit root test, CIPS (cross-sectional augmented IPS) by Pesaran (2011). The null hypothesis of this test is that data series are non-stationary.

Furthermore, to estimate the link between gender equality and economic output, this study uses the regression model as shown in equation 1.

$$InGDP_{c,t} = \alpha_0 + \beta_1 InGDP_{c,t-1} + \beta_2 GDI_{c,t} + \beta_3 InGCF_{c,t} + \beta_4 unemp_{c,t} + \beta_5 HDI_{c,t} + T_t + \varepsilon_{c,t} \quad (1)$$

Where $GDP_{c,t}$ indicates economic output measured by GDP of country c in period t. This study assumes that the lagged GDP affects current GDP. $GDP_{c,t}$ is the Gender Development Index. $InGCF_{c,t}$ represent gross capital formation (in natural logarithm). $unemp_{c,t}$ is the unemployment rate. $HDI_{c,t}$ indicates human

development index. T_t is a time dummy, including to control time variation effect. $\varepsilon_{c,t}$ is the idiosyncratic error. β_1 represents the link between gender equality and economic output. To conclude the significance level of coefficient estimation, this study uses 1% and 5% significance levels.

This study uses the system-generalised method of moment (system GMM) estimator proposed by Blundell & Bond (1998) to estimate the coefficient of β_1. The benefit of using system GMM is that it can account for unobserved country-specific effects, measurement errors, omitted variable bias, and even endogeneity problems with the lagged dependent variables (Vedia-Jerez & Chasco, 2016). Since system GMM uses lagged differences as instruments, thus, this study performs the Hansen test and the Arellano and Bond (AB) test to examine the instrument's validity and ensure that there will be no second-order serial correlation in error terms. For robustness check, this study compares the coefficient of estimation for Pooled OLS, fixed effect estimation, difference GMM, and system GMM. Following the rules of thumb by Bond (2002), this study sets Pooled OLS as the upper bound and fixed effect as the lower bound. If the coefficient estimation of difference GMM estimation is less than the fixed effect, then system GMM provides a more consistent and unbiased estimation.

Lastly, this study employs the panel causality test proposed by Dumitrescu & Hurlin (2012) – the DH test – to estimate causal relationships between variables among the variables utilised. This study performs the panel causality test because the system GMM only tells the link between gender equality and economic output but does not provide the direction of causality. The panel causality test can provide the direction of causality of the variables utilised in this study. The null hypothesis of the DH test is that there is non-causality for the panel between the dependent and independent variables in the model.

4. Results and Discussion

4.1. Preliminary Analysis

Before proceeding to the main results, this study provides preliminary analysis to enrich the analysis and provide the behaviour of data before estimating the relationship. Table 2 shows the summary statistic, including the mean and standard deviation of variables used in this study. Based on Table 2, the gender development index (GDI) has a mean of 0.88 with a standard deviation of 0.08. In this study, GDI indicates gender equality, and the mean is higher compared to the mean of gender equality in other studies, such as Bertay et al. (2021) and Eastin & Prakash (2013). The average unemployment rate in D-8 countries is 6.69%, while the average HDI

value of 0.68, the same as most developing countries. Most highly developed countries have an HDI of at least 0.8 (World Population Review, 2023).

Table 2. Summary Statistics

Variable	Description	Obs.	Mean	Std. Dev.
lnGDP	Gross Domestic Product	192	25.83	1.30
GDI	Gender Development Index	192	0.88	0.08
lnGCF	Gross capital formation	192	24.42	1.42
unemp	Unemployment rate	192	6.69	3.60
HDI	Human Development Index	192	0.68	0.11

Gender equality and women's empowerment are essential for meeting countries' aspirations of inclusive and sustainable development (ADB, 2022). Thus, countries should take action to increase gender equality, including boosting the earnings and productivity of women workers, expanding female labour force participation and employment, and promoting women's engagement and participation in decision-making in communities, businesses, and the public sector (World Bank, 2022). Figure 1 provides the trend of the gender development index of D-8 countries between 1998 to 2021.

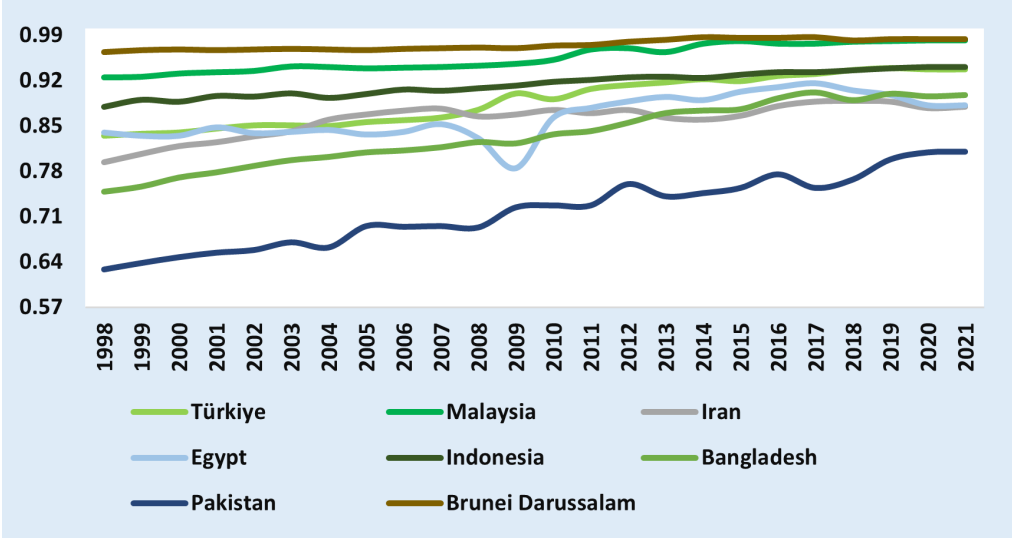

Figure 1. Gender Development Index in D-8 Countries, 1998-2021

As illustrated by Figure 1, most D-8 countries have an increasing trend for GDI, indicating that gender equality is improving in D-8 countries. Pakistan has the lowest GDI value during the period of observation, reaching 0.81 in 2021, while Brunei Darussalam has the highest. Brunei Darussalam also has the highest GDP between 1998 and 2021 compared to other D-8 countries, indicating that the

highest rate of gender equality may lead to the highest economic output, and vice versa.

According to the UNDP HDR, there are three dimensions used to measure GDI: health, education, and income. Thus, this study provides the trend of four variables that are used to construct three dimensions of the GDI: expected years of schooling, mean years of schooling, life expectancy, and GNI per capita in Figure 2. Based on this figure, in 1998, the expected years of schooling for women in Türkiye, Iran, Egypt, Indonesia, Bangladesh, and Pakistan were lower than for men. However, in 2021, women's expected years of schooling in Iran, Egypt, Indonesia, and Bangladesh increased and became higher than men's. In Pakistan, expected years of schooling women remained lower than men's from 1998 until 2021.

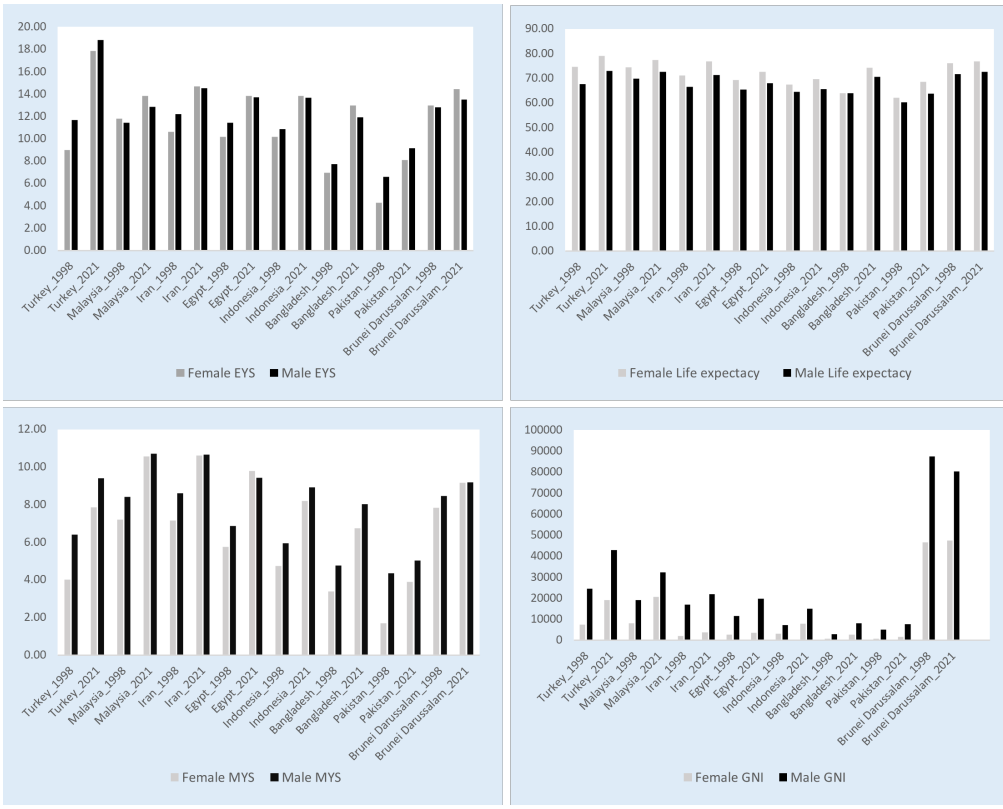

Figure 2. Three Dimensions of the Gender Development Index in D-8 Countries, 1998-2021

Meanwhile, mean years of schooling show a different pattern with expected years of schooling in D-8 countries. In 1998, all D-8 countries saw women's mean years of schooling lower than men's. However, in 2021, women's mean years of schooling in Egypt increased significantly and exceeded men's. In contrast, the life

expectancy of women in all countries of D-8 countries is higher than that of men. The income per capita of women in D-8 countries is lower than men, indicating that the income gap between men and women also occurs in D-8 countries. Of all variables that explain gender equality, Pakistan has the most significant gap between women and men.

4.2. Main Results

4.2.1. Cross-sectional dependence and panel unit root testing results

Before estimating the primary model in this study, this study performs cross-sectional dependence tests and unit root tests to prevent the results from spurious regression. The results are presented in Table 3. The Pesaran tests indicate the results of the cross-sectional dependence test. On the other hand, the CIPS (level) and the CIPS (first dependence) showed the unit root test results at the level and first difference. This study uses a 1% significance level to reject the null hypothesis of cross-sectional dependence and unit root test.

Table 3. Results of Cross-sectional and Unit Root Tests

Variable	Pesaran CD test	Unit root test with cross-sectional dependence	
		CIPS (level)	CIPS (first difference)
lnGDP	22.902***	-2.596	-3.674***
lnGDI	22.503***	-3.125	-5.121***
lnGCF	22.46***	-1.998	-3.989***
unemp	3.838***	-1.550	-4.231***
HDI	24.37***	-1.620	-4.248***

The results of the cross-sectional test show that D-8 countries significantly depend on each other, fulfilling the requirement for applying second-generation unit root tests. It also indicates economic integration between D-8 countries. Thus, this study used the cross-sectional augmented panel unit root test (CIPS) proposed by Pesaran (2004), which has the null hypothesis that series are non-stationary. The results show that this study failed to reject the CIPS null hypothesis. Variables are found to be integrated of order one, indicating that the variables are stationary at the first difference.

4.2.2. Two-step system of GMM estimation

Table 4 provides the results of coefficient estimation in this study using the system GMM. This study employs robust standard errors to account for heteroscedasticity. To ensure the results of the system GMM are valid, this study provides the result of the serial correlation test, AR (2) and the Hansen test. The result of serial correlation AR (2) tests are insignificant in all estimations, indicating no autocorrelation in the first difference levels of AR (2). In addition, the Hansen

test results are robust to autocorrelation and over-identification problems. Thus, the system GMM results are valid.

Table 4. Estimation Results

Variable	Coef.	Standard Error
GDI	1.664 ***	0.541
l.lnGDP	0.661 ***	0.091
lnGCF	0.339 ***	0.061
unemp	0.008	0.014
HDI	-1.13	0.598
Constant	-0.137	1.564
Time-year effect	Yes	
Observation	184	
Number of countries	8	
AB – AR (1); p-value	-1.95; 0.052	
AB – AR (2); p-value	-1.54; 0.124	
Hansen test	1.000	

*** is significant at 1% level. l.lnGDP indicates the lagged GDP (t-1).

Table 4 shows that the coefficient of GDI is positive and significant at the 5% significance level. It indicates that a 1% rise in GDI results in a 1.66% rise in GDP in D-8 countries. These results support the findings of Mishra *et al.* (2020) and Bertay *et al.* (2021), who also suggested a positive effect of gender equality on economic output. In this study, gender equality is measured by GDI, with a higher value indicating higher achievements in health, education, and income. Previous studies have found that investing in women's health provides economic benefits such as long-term productivity, providing faster economic growth (Onarheim et al., 2016; Remme *et al.*, 2020). In addition, increasing women's education would improve women's productivity, increase family health, reduce poverty, decrease income inequality, and promote economic growth (King, 1995; Klasen, 2002; Oztunc *et al.*, 2015). Thus, increasing these three dimensions would positively affect economic growth. Based on our data shown in Figure 2, the value of these three dimensions increased between 1998 and 2021.

Meanwhile, the coefficient of lagged GDP is also positive and significant, showing that a 1% increase in GDP (t-1) increases GDP by approximately 0.661%. The significant effect of lagged GDP on current GDP proves that using a dynamic panel estimation (system GMM) in this study is the right decision. The results of the explanatory variables suggest that gross capital formation (lnGCF) positively and

significantly affects GDP. A 1% increase in gross capital formation increases GDP by 0.339%. The unemployment rate and human development index are insignificant for GDP during the period observed in this study.

4.2.3. Robustness Check

It is important to test whether the OLS estimator is inconsistent and whether system GMM is required (Baum *et al.*, 2003). Thus, to ensure the validity of the findings, this study compares the estimation of pooled OLS, fixed effect, difference GMM, and system GMM. This comparison ensures that system GMM results are an unbiased and consistent estimator. The coefficient estimation is shown in Table 5.

Table 5. Robustness Check: Comparison Between Panel Estimation and Dynamic Panel Estimations Results

Variable	Pooled OLS	FE	Diff GMM	System GMM
l.lnGDP	0.999***	0.986***	0.963***	0.661***
	(0.003)	(0.010)	(0.013)	(0.091)

The robustness check results in this study, as shown in Table 5, proves that system GMM produces more unbiased and consistent estimations than the other three estimators. Based on the coefficient estimation, the results show that the coefficient estimate OLS is set as an upper bound and fixed effect estimation as a lower bound. The difference GMM estimation is lower than the fixed effect estimation, indicating that system GMM is the best approach.

4.2.4. Panel Causality Test Results

Table 6 provides the results of panel causality tests using the approach proposed by Dumitrescu and Hurlin (2012). Based on the results, there is one statistically significant bidirectional causality related to economic output (GDP), which is between gross capital formation and GDP. Meanwhile, one other statistically significant bidirectional causality exists between HDI and gross capital formation. In addition, there are six statistically significant unidirectional causal relations to variable GDP: from variable GDP to gross capital formation, unemployment rate, and GDI. This result indicates that economic growth may affect gender equality in the long term in D-8 countries.

Table 6. Heterogenous Panel Causality Test Results of Variables in GDP Mode

Null Hypothesis	Z-bar tilde
GDI does not Granger-cause lnGDP	0.454
lnGCF does not Granger-cause lnGDP	1.901**
unemp does not Granger-cause lnGDP	1.334
HDI does not Granger-cause lnGDP	1.481
lnGDP does not Granger-cause lnGCF	3.821***
GDI does not Granger-cause lnGCF	0.228
unemp does not Granger-cause lnGCF	3.668***
HDI does not Granger-cause lnGCF	4.228***
lnGDP does not Granger-cause unemp	2.107**
GDI does not Granger-cause unemp	4.770***
lnGCF does not Granger-cause unemp	1.822
HDI does not Granger-cause unemp	1.426
lnGDP does not Granger-cause HDI	1.242
GDI does not Granger-cause HDI	2.807***
lnGCF does not Granger-cause HDI	4.923***
unemp does not Granger-cause HDI	1.112
lnGDP does not Granger-cause GDI	5.407***
lnGCF does not Granger-cause GDI	8.697***
HDI does not Granger-cause GDI	6.061
unemp does not Granger-cause GDI	-0.322

5. Conclusion and Policy Implications

This paper examines whether gender equality has macroeconomic effects and whether gender equality has promoted the rate of economic growth in D-8 countries. The data used in this study is a panel dataset of eight countries: Bangladesh, Brunei Darussalam, Egypt, Indonesia, Iran, Malaysia, Pakistan, and Türkiye from 1998 to 2021. This study employs the system GMM to estimate the link between gender equality and economic growth.

Based on the system GMM estimation, this study found a positive and significant association between gender equality and economic growth. The heterogeneous panel causality test shows one statistically significant bidirectional causality related to economic output (GDP), which is between gross capital formation and GDP. Meanwhile, another statistically significant bidirectional causality exists between HDI and gross capital formation. In addition, there are six statistically significant

unidirectional causal relations to variable GDP: from variable GDP to gross capital formation, unemployment rate, and GDI. These results also suggest that economic growth may also affect gender equality.

This study suggests several policy implications. First, the results prove that increasing gender equality can be a promising solution to achieve sustainable and strong economic growth, especially equality in education and labour participation. To promote gender equality, leaders and policy makers can provide regulation and social assistance to ensure women and girls have an equal opportunity in education and training. Second, gross capital formation is proven to have a positive impact on economic output, so increasing investment will lead to faster economic growth. This study proves that there is economic integration between D-8 countries; thus, it may help D-8 countries reduce the cost of trade, improve the availability of goods and services, and increase efficiency.

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