Southeast Asian Journal of Economics Vol.14(1), April 2026: 193-221
Received: September 5, 2024
Revision: May 7, 2025
Accepted: May 20, 2025

Exploring Livelihood-Related Factors Affecting Gender Inequality Based on Millennium Development Goals and the Effects of COVID-19 in 82 Developing Countries

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Abstract

Gender inequality is closely related to livelihoods. Hence, this study adopted four livelihood-related models (empowerment-, education-, health-, and infrastructure-related models) built on 11 factors to test the relationship between these factors and gender inequality in 82 developing countries. The data is extracted from the World Bank database. The fixed-effects estimation was adopted to address country-specific effects in the analyses. The findings showed that all factors affected gender inequality in the macro and regional analyses. The education-related model had the most significant impact in the macro analyses, emphasizing the critical role of education in promoting gender equality. The importance of infrastructure and ensuring equal access to healthcare services was highlighted in the regional analyses.

Keywords: gender inequality, developing countries, livelihoods, education.

1. Introduction

Due to gender inequality, men, on average, have better positions than women in socio-economic and political stratification (UN Women & UNDP, 2024). However, the degrees of inequality vary considerably from country to country. For example, developed countries have laws that aim to ensure equal social, economic, and legal rights for men and women, while fewer developing countries and least developed countries (LDCs) have such laws. Thus, obtaining access to resources or economic opportunities can be challenging for women in these countries (World Economic Forum, 2021).

Gender inequality has been recognized as a critical issue internationally and domestically since it has harmful effects on individuals and societies (World Bank, 2022). For instance, systematically excluding women and girls from obtaining access to public services, productive activities, and resources considerably hampers a country's capacity to prosper economically (ILO, 2023). Consequently, gender equality is regarded as a core development issue of the United Nations (UN), which has taken a series of efforts to eradicate inequality between the genders.

The Millennium Development Goals[1] (MDGs) and their successor, the Sustainable Development Goals[2] (SDGs), are the most recent global initiatives. The MDGs were designed to assess the progress of poverty eradication in developing countries and LDCs, but aside from MDG Goal 3[3], none of the goals are directly measurable in terms of reducing gender inequality. Nevertheless, several of these goals are closely linked to promoting gender equality, as they focus

[1] The MDGs set 8 goals with 21 targets focused on three thematic areas, i.e., human capital, human rights in social, economic, and political arenas, and infrastructure to enhance the average living standards: Goal 1: Eradicate extreme poverty and hunger**;** Goal 2: Achieve universal primary education**;** Goal 3: Promote gender equality and empower women**;** Goal 4: Reduce child mortality**;** Goal 5: Improve maternal health**;** Goal 6: Combat HIV/AIDS, malaria, and other diseases**;** Goal 7: Ensure environmental sustainability**;** Goal 8: Develop a global partnership for development (WHO b, 2018).

[2] The SDGs (2015–2030) are the successor of the MDGs (2000–2015) to achieve a sustainable future by encompassing all levels of economic development, i.e., developed and developing countries, to guarantee that no one is left behind (UNDP & World Bank Group, 2016).

[3] Goal 3 was designed to promote gender equality and empower women (United Nations Development Group (UNDG), 2010).

on livelihood-related factors such as education, economic and political empowerment, health, and infrastructure. The MDGs are particularly suitable for examining the impacts of development goals on gender inequality in developing countries because, unlike the SDGs, they focus exclusively on developing countries and LDCs, where inequality is most prevalent and has the most detrimental effects. They also highlight the role that developed countries should play in eradicating extreme poverty (UN, 2015). Thus, the MDGs would provide good indicators to assess varying degrees of gender inequality in the developing world.

Hence, this study adopted 11 livelihood-related factors, derived from the 21 targets of the MDGs, such as education, economic empowerment, health, and infrastructure, using the World Bank database to identify the key factors contributing to gender inequality.

Regression analysis was conducted using data from 2000 to 2023, with a COVID dummy variable (2020–2021) added to test the effects of the COVID-19 pandemic. The analysis aimed to determine whether the impacts on gender inequality were positive or negative, and to what extent, in 82 developing countries and LDCs. The 11 factors were tested in four different models: an empowerment-related model (ERM), an education-related model (EDRM), a health-related model (HRM), and an infrastructure-related model (IRM). Based on the results, policy implications were suggested.

This paper contributes to the current literature in three respects. First, although studies have been conducted on the extent to which livelihood factors have contributed to reducing poverty, wealth inequality, and narrowing the gap between developed and developing countries, none, to the best of our knowledge, have specifically focused on the effects of livelihood-related factors, derived from the 21 targets of the MDGs, on gender equality in developing countries and LDCs, as well as the effects of the COVID-19 pandemic, using multi-level and multi-

perspective analyses (Fuller & Dwivedi, 2019; Razavi, 2016; UN Women, 2016; WHO, 2018). Second, this study employed a fixed-effects model to address country-specific effects, which are likely to be neglected by previous studies. Lastly, disaggregated analysis was utilized to reduce the heterogeneity of the data and show how the effects vary across regions.

The structure of this paper is as follows. Section 2 presents a literature review of the topic. Section 3 describes the data and methodology. Estimation results are presented in Section 4, followed by the discussion in Section 5 and the conclusion in Section 6.

2. Literature Review

The word "livelihood" refers to activities, assets (access, resources, stores, and claims), and capabilities necessary for securing the necessities of life (UNDP & IRP, 2010).

Livelihoods are critical for gender equality as they are directly linked to survival. A majority of women and girls in middle- and low-income countries are denied access to essential resources to secure necessities such as shelter, food, and health-related services, a fact that is well documented by the UN and reflected in the MDGs (Gentilini, 2022; OECD, 2020; UN Women, 2020a; UNDP & IRP, 2010; World Bank, 2022). These inequities attest to the fact that livelihoods are created within social, economic, and political contexts, and cultures and gender impact livelihoods within a community.

A series of studies has pointed out that economic growth and the attainment of economic self-reliance have narrowed the gender gap (World Economic Forum, 2021; Odera & Mulusa, 2020; Kim, 2021). However, according to the International Labor Organization (ILO, 2018), the female-to-male unemployment rate increased among young cohorts between 2017 and 2018, and in 2018, the global

unemployment rate of women was 0.8% higher than that of men. Since women's labor participation rates in developing countries and LDCs are generally lower than in developed ones, the gap is expected to increase in developing and emerging countries (ILO, 2023). The main reason cited is the excessive burden of household responsibilities and unpaid care, which prevent women from accessing education and participating in the labor market (World Economic Forum, 2021). Moreover, most economically active women in middle- and low-income countries are either contributing family workers or own-account workers (ILO, 2023). Own-account workers, who are self-employed without hired employees, are considered to be in vulnerable employment, as they are typically not registered as legal entities in emerging and developing economies (ILO, 2018; World Bank, n.d.). According to the ILO (2023), own-account workers operating informal economic units constitute the largest group of informally employed individuals in Africa, the Americas, and the Asia-Pacific region, representing nearly half of all informally employed workers. Worse still, a majority of women in these countries have limited autonomy to sell what they harvest, as they are under the authority of their fathers or husbands and do not have income at their disposal (ILO, 2018). Therefore, in this study, three factors were included in the empowerment-related model as possible determinants of gender inequality: the share of female unemployed youth to the total unemployed (SHAREYOUTH), the proportion of female own-account and contributing family workers (PROPORTION), and the female employment to population ratio for women ages 15 and above (EMPLOYMENT).

Along with economic empowerment, education plays an essential role in promoting gender equality as it enables women and girls to obtain the necessary qualification, the upper secondary level, to find decently paying remunerative employment, which allows workers to have their basic needs satisfied (ILO, 2018). The human capital theory posits that education increases productivity and earnings

because it provides the necessary skills, knowledge, and abilities to analyze and resolve issues (Becker, 1994). Good human capital is, by definition, highly educated and skilled employees across generations who strengthen competitiveness and boost productivity and profitability (World Economic Forum, 2017, pp. 3–5). Various factors intertwine to possess good human capital, such as education, infrastructure, and health, and these factors are closely linked to gender equality (Becker, 1994; World Economic Forum, 2017). Becker (1994), one of the leading founders of the human capital theory, rightly argued that owing to the rising number of educated women, women's labor force participation rates, especially those of married women, have remained high, and more women than in previous years have entered high-paying professions such as medicine, law, and university teaching. The full utilization of female workers (human capital) is highly beneficial to a country's economy: Narrowing gender gaps in the labor market could increase GDP by 4.9% in emerging countries and 3.9% worldwide by 2025 (ILO, 2017, p. 19). Given these findings regarding the importance of education for better living standards, the human capital theory was introduced as the theoretical basis of the research.

The Gender Parity Index (GPI) in tertiary level enrolment can also be a good indicator of gender equality, as education levels and earnings are strongly correlated.

A highly trained or educated person tends to be in a higher-paying occupation than someone who is less trained or educated (UNDP, 2013). Although countries with a skilled and educated workforce may not have an abundance of natural resources, they tend to grow faster than those with a less skilled labor force since they have high levels of human capital (World Economic Forum, 2017). Therefore, promoting economic development by focusing on human capital can be beneficial for developing countries and LDCs. In this context, two education-related factors,

primary completion rate (COMPLETION) and the GPI in tertiary level enrolment (TERTIARY), were added under the education-related model.

Improving access to health benefits is another critical initiative for promoting gender equality in the developing world, as women are presently disadvantaged in this area (UNDP, 2015). Tuberculosis (TB), for example, is highly related to gender inequality in many developing countries. Women in developing countries tend to have limited or no access to TB services due to socio-cultural factors, and they tend to be stigmatized if they contract TB (UNDP, 2015).

In addition to the TB incident rate, high infant mortality rates also considerably affect gender equality. Countries with high infant mortality rates also have high fertility rates, and mothers tend to bear sole child-rearing responsibilities in these countries (Roser, 2017). Hence, these women have little time or opportunity to empower themselves by finding paid employment or obtaining an education (ILO, 2023). Thus, this study included three factors, i.e., the infant mortality rate (INFANTMORTALITY), total fertility rate (FERTILITY), and TB incident rate (TB), as livelihood indicators under the health-related model.

Infrastructure-related factors are a third component that correlates with levels of gender equality alongside education and health factors (WHO, 2018; Fuller & Dwivedi, 2019). Telephones, such as mobile and landline phones, offer substantial benefits, including time and space savings, and are indispensable for female economic and social empowerment (UNDP & World Bank Group, 2016). In relation to educational benefits, both mobile and landline phones can provide access to school-based knowledge for girls who need to be absent from school to take care of their siblings or do household work to help their mothers (Porter et al., 2020).

The accessibility of clean water is a component of infrastructure that is essential in improving gender equality. Many girls undertake a great deal of unpaid household work in poor communities in developing countries, and this work

involves carrying water (Fuller & Dwivedi, 2019; UNICEF, 2016; WHO, 2018b). Due to the lack of access to clean water and sanitation, girls typically spend long hours fetching clean water. Approximately 89 million people spend more than 30 minutes for a round trip to fetch clean water in the Western Pacific region, and much of this labor is done by women (WHO, 2018, p. 16). To account for this and the above components of infrastructure, this study included the fixed-telephone subscriptions (SUBSCRIPTION), the mobile-cellular subscriptions (TELEPHONE), and the proportion of the population using improved drinking water sources (WATER) under the infrastructure-related model.

3. Methodology

3.1 Data

The Gender Inequality Index (GII) (UNDP, n.d.) was utilized as a dependent variable to test the various degrees of gender inequality in the sample countries. GII by UNDP measures gender inequalities on a scale of 0, the lowest inequality, to 1, the highest inequality, in three major areas of human development amongst 162 countries: reproductive health, empowerment, and labor market (UNDP, n.d.). A panel data set comprising 82 LDCs and developing countries from 2000 to 2023 was adopted from the World Bank database and used as the independent variables (World Bank, n.d.). Eleven indicators were placed under the four livelihood-related models and examined. Table 1 shows the results of descriptive statistics.

Table 1. Descriptive statistics

Indicator	Variables	Observations	Mean	S.D.	Min	Max
Gender Inequality Index	INEQUALITY	1,182	0.45	0.14	0.12	0.79
Empowerment-related model						
Contributing family workers, female (% of female employment)	PROPORTION	1,182	15.54	17.66	0.07	72.17
Unemployment, youth female (% of female labor force ages 15-24)	SHAREYOUTH	1,182	20.23	13.95	0.64	56.90
Employment to population ratio, 15+, female (%)	EMPLOYMENT	1,182	44.34	16.27	5.89	77.77
Education-related model						
Primary completion rate, female (% of relevant age group)	COMPLETION	1,182	89.27	13.85	40.73	115.10
School enrollment, tertiary (gross), gender parity index (GPI)	TERTIARY	1,182	33.86	43.39	0.36	91.22
Health-related model						
Mortality rate, neonatal (per 1,000 live births)	INFANTMORTALITY	1,182	16.58	10.58	1.70	46.50
Fertility rate, total (births per woman)	FERTILITY	1,182	2.96	1.31	1.31	6.96
Incidence of tuberculosis (per 100,000 people)	TB	1,182	159.54	189.49	2.10	988.00
Infrastructure-related model						
People using safely managed drinking water services (% of population)	WATER	1,182	67.50	26.85	7.74	97.92
Fixed telephone subscriptions (per 100 people)	SUBSCRIPTION	1,182	11.74	13.98	0.06	91.22
Mobile cellular subscriptions (per 100 people)	TELEPHONE	1,182	91.16	44.27	0.21	178.40

3.1 Models

Based on human capital theory, four livelihood models relating to empowerment, education, health, and infrastructure were adopted to examine the impacts of the selected indicators on gender inequality. The estimated regression function of the empowerment-related model is presented as follows:

$$INEQUALITY_{it} = \beta_1 PROPORTION_{it} + \beta_2 SHAREYOUTH_{it} + \beta_3 EMPLOYMENT_{it} + u_i + \varepsilon_{it} \quad (1)$$

where $INEQUALITY_{it}$ represents the gender inequality level of a country i at time t; $PROPORTION_{it}$ is defined as the proportion of employed women as either own-account or contributing family workers; $SHAREYOUTH_{it}$ is the proportion of unemployed female youth to the total unemployment rate; and $EMPLOYMENT_{it}$ is the employment to population ratio. In addition, u_i is the country-specific effect, and ε_{it} is the idiosyncratic error term.

Similarly, the estimated regression function for the education-related model is presented below:

$$INEQUALITY_{it} = \beta_4 COMPLETION_{it} + \beta_5 TERTIARY_{it} + u_i + \varepsilon_{it} \quad (2)$$

where $COMPLETION_{it}$ represents the primary completion rate among girls, and $TERTIARY_{it}$ is the GPI in tertiary level enrolment.

The regression function for the health-related model is shown as follows:

$$INEQUALITY_{it} = \beta_6 INFANTMORTALITY_{it} + \beta_7 FERTILITY_{it} + \beta_8 TB_{it} + u_i + \varepsilon_{it} \quad (3)$$

where $INFANTMORTALITY_{it}$ is the infant mortality rate (0–1 year) per 1,000 live births; $FERTILITY_{it}$ denotes the fertility rate by births per woman; and TB_{it} is the annual TB incidence rate per 100,000 population.

The function for the infrastructure-related model is as follows:

$$INEQUALITY_{it} = \beta_9 WATER_{it} + \beta_{10} TELEPHONE_{it} + \beta_{11} SUBSCRIPTION_{it} + u_i + \varepsilon_{it} \quad (4)$$

where $WATER_{it}$ is the proportion of the population using improved drinking water sources; $SUBSCRIPTION_{it}$ signifies the number of mobile-cellular subscriptions per 100 inhabitants; and $TELEPHONE_{it}$ is the number of fixed-telephone subscriptions per 100 inhabitants.

It is generally assumed that u_i should be uncorrelated with livelihood factors to obtain coefficients that capture the main effects between gender inequality and livelihood factors. However, this assumption is not likely to hold in this study due to the unobservable characteristics of each country. Thus, to handle the longitudinal dataset's unobserved effects, we applied the fixed-effects (FE) model approach to control time-invariant unobserved characteristics (Allison, 2009). The FE approach has weaknesses. For example, it only measures how the change in the independent variable affects the change in the dependent variable. Thus, we recommend that other advanced models be used in future studies to overcome these econometric obstacles.

In this study, we utilized robust standard errors to produce a consistent variance-covariance matrix estimator. To mitigate the potential impact of exceptional values, we winsorized all variables by the 1st and 99th percentiles. The results of Pearson's correlation coefficient matrix and Variance Inflation Factor (VIF) are presented in Appendix 1. The results from VIF show values lower than the threshold of 10, which indicates that there was no strong multicollinearity among the independent variables.

4. Results

4.1 Macro-level Analysis

Table 2 presents the relationship between gender inequality and the four models. The first column shows the coefficients between inequality and the empowerment-related model using the OLS and FE approaches. From the

estimation, the findings indicate that PROPORTION and EMPLOYMENT have a positive and negative association with inequality from both models, respectively, at a significance level of 1%, while SHAREYOUTH has an insignificant effect on inequality with FE models. The FE model can address country-specific effects, which may be overlooked by the OLS model. In conclusion, PROPORTION aggravates gender inequality. Regarding the magnitude, a one standard deviation increase in PROPORTION is associated with a 0.31 standard deviation increase in the GII.

Turning to factors in the education-related model, the results from both models show that COMPLETION is negatively associated with inequality, indicating that higher primary completion rates among girls and tertiary level enrolment are both associated with higher levels of gender equality. Regarding the health-related model, the FE results indicate that INFANTMORTALITY and TB correlate with a higher level of inequality. Meanwhile, FERTILITY has no correlation with inequality using the FE model. Lastly, under both models, the results for infrastructure indicate that only WATER and TELEPHONE are negatively associated with gender inequality.

The last column presents the aggregate model of all variables. In this specification of the FE model, the findings indicate that EMPLOYMENT, INFANTMORTALITY, TB, WATER, and TELEPHONE are significantly associated with gender inequality, lending further support to our findings. In conclusion, various factors in the four models were correlated with gender inequality. As selecting countries in different continents raises the issue of heterogeneity, examining for potential heterogeneity is required. Thus, regression analyses by regions are presented in the next section.

Table 2. Main regression

	Empowerment		Education		Health		Infrastructure		Aggregate model	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE
PROPORTION	0.324***	0.310***							0.00677	0.00857
	(0.0273)	(0.0608)							(0.0167)	(0.0654)
SHAREYOUTH	-0.139***	-0.0739							-0.0416*	-0.0000617
	(0.0409)	(0.0738)							(0.0238)	(0.0585)
EMPLOYMENT	-0.123***	-0.487***							-0.181***	-0.355***
	(0.0336)	(0.1180)							(0.0242)	(0.0945)
COMPLETION			-0.452***	-0.0742**					0.0243	-0.000516
			(0.0197)	(0.0300)					(0.0227)	(0.0166)
TERTIARY			0.119***	0.04					0.119***	0.0261
			(0.0154)	(0.0256)					(0.0154)	(0.0198)
INFANTMORTALITY					0.531***	0.541***			0.441***	0.318***
					(0.0285)	(0.0807)			(0.0310)	(0.0832)
FERTILITY					0.323***	-0.133			0.323***	-0.146
					(0.0263)	(0.1750)			(0.0286)	(0.1420)
TB					-0.00843	0.137***			0.0216	0.0646**
					(0.0142)	(0.0332)			(0.0153)	(0.0296)
WATER							-0.160***	-0.369***	-0.0419***	-0.281**
							(0.0257)	(0.1130)	(0.0162)	(0.1270)
SUBSCRIPTION							-0.291***	0.00524	-0.0595**	0.0067

							(0.0551)	(0.0180)	(0.0254)	(0.0159)
TELEPHONE							-0.390***	-0.188***	-0.0733***	-0.121***
							(0.0277)	(0.0211)	(0.0202)	(0.0220)
COVID	-0.207***	-0.225***	-0.220***	-0.255***	-0.0255	-0.111***	-0.115*	-0.135***	-0.0362	-0.120***
	(0.0684)	(0.0239)	(0.0638)	(0.0247)	(0.0458)	(0.0280)	(0.0604)	(0.0262)	(0.0440)	(0.0280)
Observations	1,182	1,182	1,182	1,182	1,182	1,182	1,182	1,182	1,182	1,182

Note: * p<0.1, ** p<0.05, and *** p<0.01. Robust standard errors are in parentheses.

4.2 Disaggregated Analyses by Regions

Due to its advantage in measuring country-specific effects, the FE model was applied for the remainder of the study. The regions were categorized into four groups based on the UN's regional grouping for the analyses: the Americas, Africa, Asia, and Europe (UN, n.d.).

Table 3 presents the regression results of the empowerment-related model. The relationship between PROPORTION and gender inequality is significant in the Americas and Asia at a significance level of 1%, and in Africa at $p < 0.05$. This association is the largest in the Americas, exceeding the average by a 0.6 standard deviation, while it is smaller in Africa by a 0.345 standard deviation and in Asia by a 0.27 standard deviation. SHAREYOUTH is only statistically associated with gender inequality ($p < 0.05$) in the Americas, whereas EMPLOYMENT is negatively associated with gender inequality in the Americas and Europe ($p < 0.05$), with an approximate 0.7 standard deviation. The results also indicate that the strong correlation between gender inequality and the education-related model is mainly driven by Africa: COMPLETION in Africa ($p < 0.01$) helps reduce gender inequality.

Regarding the health-related model, the results suggest that TB, INFANTMORTALITY, and FERTILITY significantly affect gender inequality ($p < 0.01$ and $p < 0.05$) in the Americas, Africa, Asia, and Europe. In particular, an increase of one standard deviation in TB is associated with a 0.18 standard deviation increase in the inequality index in Africa and 1.3 in Europe. The association between INFANTMORTALITY and gender inequality is observed in the Americas, Africa, and Asia, with a similar magnitude. The correlation between FERTILITY and gender inequality is only for the Americas.

As for the infrastructure-related model, the results highlight the association between WATER and gender inequality in Asia ($p < 0.01$). TELEPHONE plays a

critical role in reducing gender inequality in all four regions ($p < 0.01$), with a relatively similar magnitude, and SUBSCRIPTION considerably affects gender inequality in Europe ($p < 0.01$) by a 0.34 standard deviation and a minor association in Africa. Lastly, in these models, we see that the COVID-19 pandemic is highly negatively correlated with gender inequality on all continents.

Table 3. Disaggregate results by continents

	Americas	Africa	Asia	Europe
PROPORTION	0.600***	0.345**	0.270***	0.544*
	(0.1930)	(0.1440)	(0.0816)	(0.2620)
SHAREYOUTH	-0.177**	-0.000807	-0.0584	-0.161
	(0.0622)	(0.1370)	(0.1830)	(0.1050)
EMPLOYMENT	-0.701***	-0.133	-0.534	-0.783**
	(0.1040)	(0.2190)	(0.3730)	(0.2840)
COVID	-0.249***	-0.183***	-0.178***	-0.312***
	(0.0425)	(0.0446)	(0.0497)	(0.0884)
Observations	297	374	380	131
COMPLETION	-0.0678	-0.102***	-0.0596	0.0609
	(0.0722)	(0.0308)	(0.0656)	(0.1460)
TERTIARY	-0.000197	0.024	0.101	0.0766
	(0.0267)	(0.0219)	(0.0796)	(0.1260)
COVID	-0.278***	-0.209***	-0.215***	-0.368***
	(0.0404)	(0.0245)	(0.0666)	(0.0565)
Observations	297	374	380	131
TB	0.0495	0.181***	-0.00387	1.367**
	(0.2180)	(0.0303)	(0.1670)	(0.5490)
INFANTMORTALITY	0.651***	0.659***	0.547***	0.281
	(0.1360)	(0.1430)	(0.1400)	(0.2270)
FERTILITY	0.356**	-0.286*	-0.328	0.389
	(0.1530)	(0.1650)	(0.4460)	(0.3730)
COVID	-0.0652*	-0.0303	-0.129*	-0.196**
	(0.0346)	(0.0317)	(0.0736)	(0.0607)
Observations	297	374	380	131
WATER	-0.297*	-0.29	-0.633***	-0.0512

	(0.1460)	(0.1880)	(0.1810)	(0.1370)
TELEPHONE	-0.201***	-0.190***	-0.165***	-0.270***
	(0.0316)	(0.0344)	(0.0451)	(0.0513)
SUBSCRIPTION	-0.0364	-0.00766**	-0.00253	0.340***
	(0.0218)	(0.0033)	(0.0466)	(0.0853)
COVID	-0.174***	-0.109***	-0.0708	-0.202**
	(0.0432)	(0.0277)	(0.0663)	(0.0820)
Observations	297	374	380	131

Note: * p<0.1, ** p<0.05, and *** p <0.01. Robust standard errors are in parentheses.

5. Discussion

The significant effects of empowerment-related factors underscore the crucial role of financial empowerment. Paid work is essential for women as it enhances their sense of autonomy; however, the proportion of vulnerable female workers, i.e., the share of own-account and contributing family workers, was over 80% in 2019 (ILO, 2023, p.19). Interestingly, the regional results showed considerable impacts on the share of female youth unemployed to total unemployed (p <0.01) in the Americas. In 2021, female youth unemployment rates were 22.2% in Latin America, indicating a much greater gap than the world average of 13.2% (ILO, 2020, p.33). In addition, in 2019, the gender gap in labor force participation rates among youth stood at 16.2% worldwide; however, these rates were much higher in the Americas, especially Latin America, at 18.3% (ILO, 2020, p. 25). One of the main reasons for low female youth employment rates is the lack of trained or adequately educated workers (ILO, 2023).

The results also emphasize the negative impacts of socio-cultural norms and stereotypes on job acquisition and family formation. Women are deemed the primary family caretakers in developing countries, leaving them little or no time for paid employment (ILO, 2023). Furthermore, taking up the primary caretaker role makes women less attractive in the job market because they are at higher risk

than men of being absent from work due to caretaking responsibilities (World Economic Forum, 2017).

The significant effects of primary completion rate in the macro analyses underline the critical role of education in reducing gender inequality. Education is a foundation for a better standard of living because empowerment—financial, political, and social—is proportional to education level (ILO, 2017). Statistics, however, show that people in developing countries and LDCs spend less money on education for girls than for boys (UNDP, 2024). In addition, in middle- and low-income countries, wide disparities in girls' primary completion exist between countries and within a country. Thus, to increase completion rates, government interventions such as the provision of free primary schooling are essential to help low-income families obtain access to the education needed to enter the job market and have better lives.

Regarding the health-related model, infant mortality rate was significantly associated with gender inequality ($p < 0.01$) in the macro and regional analyses. As of 2020, 2.4 million infants died in the first month of their life worldwide and approximately 6,700 infants died every day. In this regard, providing high coverage of skilled care at birth, quality antenatal care and post-natal care for mothers and babies, and overall good health services would considerably reduce infant mortality rates. To ensure the availability of these services, governments must allocate sufficient budgets and resources to implement effective healthcare systems that cater to mothers' and babies' needs. Adopting universal coverage for extensive maternal and infant healthcare services can be a starting point (World Economic Forum, 2021).

Information and communication technologies (ICTs) play a pivotal role in promoting gender equality in middle- and low-income countries. In conservative and male-dominated cultures, negative attitudes toward gender equality tend to create and impose gender stereotypes that limit women from obtaining access to

education or working in public (Ortiz-Ospina et al., 2024). ICTs can offset this disadvantage by helping women who suffer from social isolation caused by informal institutions (i.e., customs and cultures) gain access to the world (Porter et al., 2020). Hence, when drawing up ICT-related policies, each government must consider various social factors such as education levels and multiple socially constructed gender roles and responsibilities. A suggested measure would be to set up ICT centers allocating women-only time that would increase accessibility. Telecentres in South Asia and ICT centers in India are good examples (World Bank, 2021).

When adding the COVID dummy variable, the GI level was slightly improved. Various papers and research have highlighted the positive effects of the COVID-19 pandemic on gender issues (Fisseha et al., 2021; Flor et al., 2022; Freizer, 2021; Gentilini, 2022; ILO, 2020b; King et al., 2020; OECD, 2021; Singh & Pandey, 2024; UN, 2021; UN Women & UNDP, 2024; World Health Organization, 2022). Three major reasons can be cited for the positive effects of the pandemic:

First, during the pandemic (2020–2021), countries around the world made enormous efforts to reduce the socio-economic impacts, and a series of fiscal stimulus packages and social assistance programs were adopted to maintain equality, opportunities, and social protection (Gromada et al., 2020; UN Women, 2020; UNICEF, 2021). For example, 105 countries adopted fiscal response packages worth USD 4.8 trillion, and 106 nations introduced job and social protection programs targeting vulnerable groups, such as informal workers, single parents, and the elderly, in the first quarter of 2020 (UN, 2020). Within these packages, social assistance (non-contributory transfers) was the most commonly adopted, along with social insurance and supply-side labor market interventions. Cash-transfer programs were widely introduced as social assistance interventions. The size of cash transfers was 70% higher than in the pre-COVID period; for

instance, 1.36 billion individuals received at least one cash transfer payment worldwide (Gentilini, 2022).

Second, the importance of both paid and unpaid care work, which has long been underfunded and overlooked, was highlighted during the COVID-19 crisis. Many countries implemented comprehensive measures to compensate for income and job losses, expanding coverage for the first time to include the self-employed, temporary workers, and domestic workers, sectors where women are disproportionately represented (Gentilini, 2022; ILO, 2020b). For instance, income replacement measures were introduced to support informal workers in Thailand and Peru during the COVID-19 pandemic (UN, 2020). In the United States, the National Domestic Workers Alliance established the Coronavirus Care Fund, a relief initiative designed to support domestic workers experiencing financial difficulties (ILO, 2020b).

Third, the new normal caused by the pandemic created equal opportunities for both women and men to engage in telework, helped address work-family conflicts, and ensured that occupational safety and health concerns, including domestic violence, were effectively managed (Dempere & Grassa, 2023). Flexible working hours and remote work, which many companies implemented during the lockdown, are likely to become more common in the future, enabling working mothers to balance work and family responsibilities more effectively.

6. Conclusion

This study utilized 11 livelihood-related factors, derived from the 21 targets of the MDGs, to identify the key contributors to gender inequality in 82 developing countries and LDCs. The study adopted multi-level analyses: macro and regional analyses, along with a fixed-effects approach to address country-specific effects.

Regarding the magnitude of the coefficients in the macro analyses, EMPOWERMENT was shown to reduce gender inequality the most, followed by WATER, COMPLETION, and TELEPHONE. By contrast, INFANTMORTALITY, followed by PROPORTION and TB, were the most aggravating factors of gender inequality. All factors either positively or negatively correlated with gender inequality in both analyses, indicating that the 11 livelihood-related indicators in this study had substantial effects on gender inequality. It is noteworthy that all three empowerment factors had considerable impacts in the Americas. Moreover, TELEPHONE was highly correlated with gender inequality in the macro analyses and all four regions in the regional analyses, highlighting the importance of infrastructure to promote gender equality. The findings underscore the need for women and girls to be granted equal opportunities in accessing resources to improve their livelihood support and employment opportunities.

It is noteworthy that COMPLETION was highly correlated with gender inequality in the macro analyses. This finding supports the human capital theory, according to which education is key to empowering women and girls. In the developing world, women and girls have minimal exit options because the majority are financially dependent on male breadwinners (World Economic Forum, 2021). Those with more education tend to have better financial security and more negotiating power, and their financial independence enables them to trigger changes in workplaces, societies, and families (World Bank, 2023). Hence, it is imperative to increase the educational opportunities of women and girls.

Based on the results, a series of policy recommendations is presented. In the short run, partnerships are urgently needed to obtain and allocate the necessary human and material resources for implementing gender-related measures that provide women with various essential services, such as infrastructure-related and healthcare services, because developing countries and LDCs do not have enough

technical, financial, material, and human resources to execute major policies alone. For example, a global partnership is needed to reduce the high infant mortality rates in LDCs because the high rates have been caused by insufficient resources and a lack of essential medical services (Fuller & Dwivedi, 2019; UN, 2017, 2020). Governments in the developing world can also learn from private sectors that possess essential technologies, skills, and knowledge in specific fields. In return, the government can provide incentives, such as tax reductions, to the relevant companies, which can be a win-win strategy. Adopting public-private partnerships and building partnerships for development with developed countries are thus two short-term ways of securing financial aid and technologies, knowledge, and skills, which play key roles in furthering gender equality. Moreover, the COVID-19 pandemic highlighted the urgent need to expand existing social protection systems, such as health insurance, paid sick leave, and unemployment benefits, to include female informal workers. To secure the necessary financial resources for these expansions, establishing global partnerships is crucial, as they can help mobilize the required human, material, and financial resources, enabling the implementation of gender-sensitive measures in developing countries and LDCs, which often lack the capacity to address these issues independently.

In the long run, deep-rooted gender discriminative cultures, stereotypes, customs, mindsets, and practices must be changed to appropriately resolve gender issues, which have hindered achieving gender equality in the developing world. Increased advocacy to raise awareness of the impact of gender stereotypes through media would significantly contribute to promoting gender issues. For instance, the World Federation of Advertising and the Geena Davis Institute on Gender in Media have developed guides and toolkits to help businesses identify focus areas, such as preventing harmful gender stereotyping and promoting diversity and inclusion (UN Women & UNICEF, 2023). Conducting awareness campaigns on gender

stereotypes and sharing gender-related information, such as the progress of gender policies and programs compared to international standards, through all available channels (e.g., local governments and civic groups) would also be highly beneficial in promoting gender equality.

The process of increasing gender equality will be challenging and time-consuming. However, to accomplish the true meaning of gender equality and make the world a safe and better place for women and girls, each government's sincere efforts are indispensable.

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Appendix

Table A1: The Pearson's correlation coefficient matrix

Empowerment				VIF	**Education**				VIF
	PROPORTION	SHAREYOUTH	EMPLOYMENT			COMPLETION	TERTIARY		
PROPORTION	1			1.18	COMPLETION	1			1.01
SHAREYOUTH	-0.3167*	1		1.83	TERTIARY	-0.0820*	1		1.01
EMPLOYMENT	0.0079	-0.5966*	1	1.65					
			Mean VIF	1.55				Mean VIF	1.01
Health					**Infrastructure**				
	TB	INFANTMORTALITY	FERTILITY			WATER	TELEPHONE	SUBSCRIPTION	
TB	1			1.26	WATER	1			1.16
INFANTMORTALITY	0.4481*	1		2.74	TELEPHONE	0.2435*	1		1.09
FERTILITY	0.2917*	0.7614*	1	2.4	SUBSCRIPTION	0.3322*	0.2194*	1	1.15
			Mean VIF	2.13				Mean VIF	1.13