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GENDER INEQUALITY AND ECONOMIC GROWTH IN DEVELOPING COUNTRIES

ABSTRACT

The purpose of this study is to identify the relationship between gender inequality and economic growth in developing countries. The study uses a panel of countries for the period 1960 to 2019, aggregated in 5-year intervals. The system generalised method of moments (system GMM) model and the panel autoregressive distributive lag model are used to evaluate the relationship between gender inequality in human capital and economic growth across developing countries. A gender inequality index was modelled using the disparities in human capital, with the inclusion of maternal mortality. The findings of this study suggest that gender inequality accounted for a significant variability in GDP *per capita*. The empirical results illustrate that the gender inequality negatively impacts economic growth and that the gender gap needs to be narrowed to achieve higher levels of economic growth for low-income countries.

Keywords: Gender Inequality; Economic Growth; Developing Countries; Fragile State
JEL Classification: B54; D63; O47

RIASSUNTO

Disuguaglianze di genere e crescita economica nei paesi in via di sviluppo

Il fine di questo articolo è identificare la relazione tra disuguaglianze di genere e crescita economica nei paesi in via di sviluppo. Viene utilizzato un panel di paesi nel periodo 1960-2019, in intervalli aggregati di 5 anni. I modelli utilizzati per valutare la relazione tra disuguaglianze di genere nel capitale umano e la crescita economica nei paesi in via di sviluppo sono il system GMM e il panel ARDL. È stato creato un indice di disuguaglianza di genere usando le disparità nel capitale umano, inclusa la mortalità materna. I risultati suggeriscono che le disuguaglianze di genere rappresentano una variabile significativa del PIL pro capite. Secondo i risultati empirici

tali disuguaglianze hanno un impatto negativo sulla crescita ed è necessario diminuire il divario di genere per raggiungere livelli maggiori di crescita economica nei paesi a basso reddito.

1. Introduction

Gender inequality negatively affects economic growth. The human capital gap between men and women has become a prevalent feature in many countries, particularly in developing nations. The gender inequality gap is evident across different aspects of society such as education, wages, employment (particularly formal), accessibility of managerial positions, and political representation. It can also be seen inside the household through bargaining power (Cuberes and Teignier-Baqué, 2012). The increasing literature on the effects of gender inequality on economic growth leads to contrasting results amongst scholars. Mankiw *et al.* (1992) expanded the neoclassical model to include human capital, while Lucas (1988) and Romer (1990) used endogenous growth models to include human capital and technology.

World Bank data shows that women account for nearly half of the world's population (Word Bank Database, 2020). Klasen (2002) explained the selection-distortion effect of employment inequality and concluded that discriminating against women lowers the average workforce capacity considerably. Esteve-Volart (2004) claims that unequal access to managerial positions among women alters their skills distribution, human capital output and productivity, resulting in reduced economic growth. Education enables women to acquire the necessary skills to enter the workforce; as stated above, this will increase the labour force and worker productivity, leading to economic growth. A considerable number of women's time is constrained by domestic household work and family care. Such restrictions limit a woman's willingness to engage in the labour market. Hence, their strengths and abilities are not utilised in ways that would maximise the growth of the economy.

Figure 1 below shows the school enrolment ratio across all income groups for the period 1974 to 2019. Over the years, the school enrolment ratio has increased, with tertiary education in high-income groups showing the most substantial increase for the period 1974 to 2019. Countries have focused a lot on raising the level of education by introducing policies to ensure this is achieved. Education is a form of human capital and enhancing a nation's level of education can lead to high levels of talented and trained workers, positively contributing to the economy. School enrolment

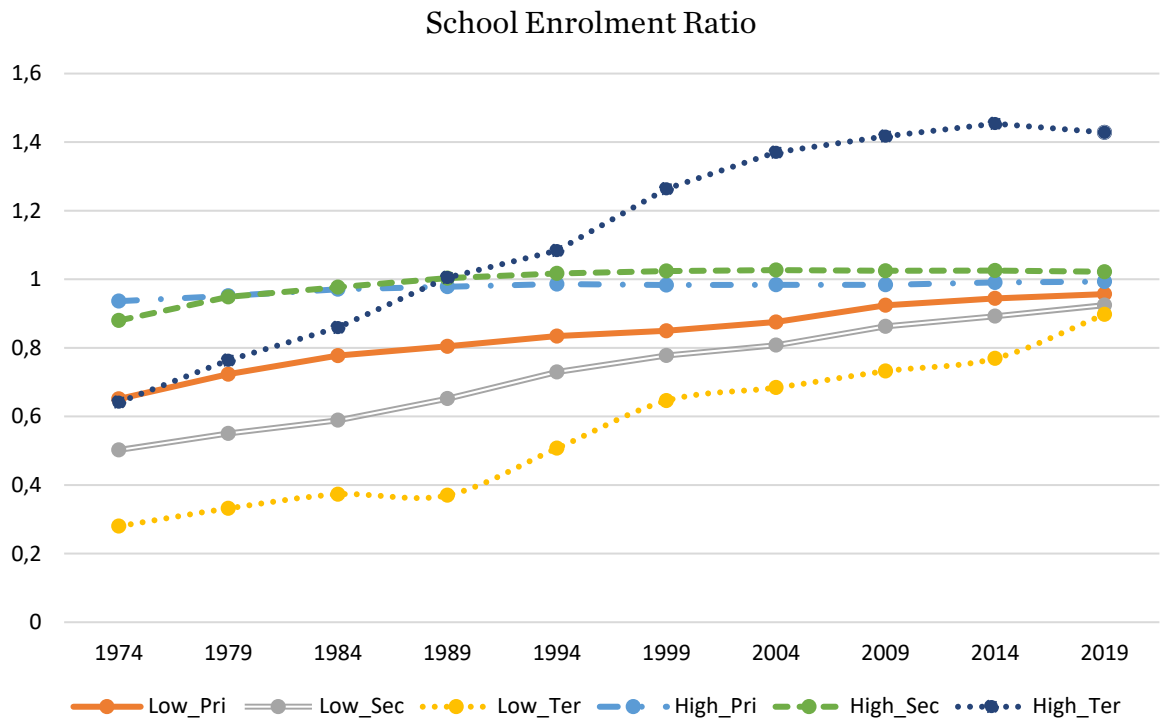
might not always translate into retainment; however, it does give a level of indication of individuals that accessed a certain form of education.

Low-income countries have a larger difference in gender equality than high-income countries, as seen in Figure 1 below. Some low-income countries faced civil war which affected infrastructure and institutions that unfortunately affected the accessibility of education for many individuals. Urdal and Che (2013) note that 'armed' conflicts may contribute to sustain high fertility levels through increased social security, loss of reproductive health services and lower female education. Societal discrimination, poverty, and religious beliefs are some of the factors that have impeded women's education. High income countries may have policies to bring about convergence in the labour market between male and females. Pascall (2008) emphasises that European countries have converged towards a dual worker model, encouraging women to participate in the workplace. Despite the policies adopted to integrate women into the workplace in European countries, gender inequalities still exist. Pascall (2008) noted that gender inequality exists between men and women in European countries particularly in the quality of employment. Figure 1 below shows that at the beginning of the time period, the educational gap between males and females in low-income countries was widespread, but the gap is narrowing over time as more women gain education in the developed world.

Many arguments emphasise the effects gender inequality has on economic growth through different channels, with most of these channels being linked to education. However, few studies are focusing on gender inequality in education, especially through different income groups and in countries that face violence, war and conflict. The following research questions arose from the gap identified in the existing literature: *Is there a significant association between gender inequality in human capital and economic growth?* If so, what is the extent of the association between gender inequality and economic growth in developing and/or fragile countries? Based on the research questions of this study, the objective of this paper is to evaluate the impact of gender inequality on education and the labour market and assess its impact on economic growth across different countries, particularly low-income countries and those that face conflict. System-GMM approach and a panel autoregressive distributive lag model will be used to analyse this relationship. The remaining sections are as follows: Section 2 presents the literature review; Section 3 presents the research methodology; Section 4 presents the empirical results and discussion; and finally,

Section 5 summarises the results and concludes by highlighting policy suggestions/recommendations and proposals for further studies in this area.

FIGURE 1 - *School Enrolment Ratio by Education Level across Different Income Groups from 1974 to 2019*



2. LITERATURE REVIEW

The purpose of this section is to review the literature on the determinants of gender inequality, economic growth and gender inequality nexus and to focus on the outcomes of their implications. Several scholars have argued that gender inequality will hinder economic development. For example, Forsythe *et al.* (2000) explain that gender disparity between men and women in occupation and wages is primarily driven by human resource differences. The approach that economic growth impacts gender inequality assumes that gender disparities in employment or labour can be credited to discrimination and will entail additional expenditures from those engaged in these activities. The process of economic growth and market competition is likely to

be weakened by these practices. The key theoretical literature suggests there is a positive relationship between economic growth and gender equality. The proposed channels explain the rise in the cost of opportunities for women not to be included in the labour force. For example, Becker and Lewis (1973) suggest that the quantity and quality of education a child receives is dependent on a family's income. Thus, there is an income level in a country where the average family fertility rate falls in tandem with the expenditure on each child. The study reveals that a rise in wages is the key attribute for demographic change, and that lower fertility rates often encourages women to join the labour force, thereby reducing the gender differences through participation. Galor and Weil (1996) presented a model showing that by decreasing fertility rates, economic growth yields positive returns that lead to demographic changes and faster production. A capital increase linked to economic growth elevates the comparative income for women in the model.

Geddes and Lueck (2002) used a property-rights analysis to determine the relationship between women's rights and the impact on economic growth. Their model explained that in an equal rights marriage, both men and women can make a complete contribution within and outside their homes. However, if men have more rights than women in the marriage, then the concept of principal agent applies whereby the man owns the wife and her income flow. While the technology growth channel put forward by Greenwood *et al.* (2005) postulate to the fact that technologies assist women in easing the domestic workload. They were able to show that the adoption of household appliances tends to free up a portion of the time women devote to housework, thus giving them freedom from the home and opportunity to increase their involvement in the labour force. The children's education channel is a mechanism presented by Doepke and Tertilt (2009) who explain how economic growth reduces gender inequality. Their model explains how men face a trade-off when faced with women's rights and notes that their negotiating power is limited when women are given rights.

Similar to Doepke and Tertilt (2009), Fernández (2009) proposes a theory that describes the development of women's economic and political rights and how it coincides with economic growth. Fernández (2009) explains how wealth accumulation and declining fertility rates changed males' interest in women's property rights, eventually persuading men to adopt a system that would give their daughters equal rights. Under a patriarchal system, men favour their sons over their daughters because women marry into another family and may take the family financial

gains to benefit the son-in-law as opposed to sons who bring a wife to join the family. As a result, higher welfare and lower fertility rates increase the patriarchal regime's welfare costs over. However, when a critical point is reached, men choose to compromise the advantages derived from a patriarchal structure to ensure that their sons-in-law treat their daughters well.

Minasyan *et al.*'s (2019) study uses a systematic review and meta-regression analysis to investigate educational gender gaps and economic growth nexus. The results reveal a positive correlation link between educational gender equality and economic growth. Nguyen (2021) using a different approach examine the effects of four aspects (employment, health, education, rights) of gender equality with 20 variables in an economic complexity index over the period 1991-2017. The study reveals that labour participation, health conditions and education have a positive impact on economic complexity. Malghan and Swaminathan (2021) examines the global trends in intra-household gender inequality for forty-five different countries across a four-decade period (1973-2016), using global micro-data from 2.85 million households. The study shows that intra-household gender inequality has declined by 20% in the four decades and that there exists micro-Gender Kuznets Curve relationship in the estimated model. Ovadia's (2021) study addresses gender inequality through employment and procurement approach and finds that government has not pursued holistic approach to gender equality in legislation, regulation, policy, education and training in order to maximize the benefit from extractive industries and petro-development. Asongu *et al.* (2020) applies Generalised Method of Moments (GMM) and Fixed Effects (FE) regressions to investigate how financial access can be used to modulate the effect of income inequality on gender economic inclusion for 42 countries in sub-Saharan Africa (SSA) for the period 2004-2014. The results reveal that there is negative effect from the role of financial access in modulating the Gini coefficient and the Palma ratio for female employment. Kim (2021) explores the critical factors influencing gender inequality for 34 OECD and non-OECD countries by adopting multi-level (macro and micro) and multi-perspective analyses based on five models. The study reveals the crucial roles of financial empowerment and institutions as well as the interrelations with formal and informal institutions in gender issues.

Ogundari and Awokuse (2018), Karoui and Feki (2018a) and Pegkas and Tsamadias (2017) examine the correlation between the gender gap in education and economic growth across various geographic locations. The enrolment rate and literacy rate are some of the indicators used to measure the disparity between male and female education. These studies have concluded that

educating women impacts economic growth positively. Kleven and Landais (2017) use a micro-database spanning a wide range of *per capita* income levels to examine the history of gender inequality in the labour market. The authors used a fixed-effects regression approach. The main findings from the study reveal that the reduction of gender disparities in earnings is driven by participation in the labour force and pay levels, but not by hours. Some studies evaluated the impact of gender inequality in education on economic growth on a country-specific scale. For example, Chaudhary (2003), Yumusak *et al.* (2013) and Pegkas and Tsamadias (2017) assessed the impact of gender inequality for Pakistan, Turkey and Greece. All these authors found that economic growth for their respective regions was negatively affected by gender inequality. In the literature in general and from the above studies, gender equality/inequality has been studied in terms of four main aspects: health, education, employment, socioeconomic & political rights, institutional, socioeconomic factors, religion, and legal systems are often pointed to as the main roots of gender inequality (see for example, Njoh *et al.*, 2018; King *et al.*, 2020; Asongu & Odhiambo, 2020; Çalıyurt, 2020; Harbers, 2020; Brzezinski, 2021 among others).

Despite the above studies, there is still a gap in the research where the long-term impact of gender disparity on education is not measured. Education and health are two factors that are included as human capital in the augmented Solow (1956) model when assessing the impact of gender inequality on economic growth. The technology rate and population rate are kept as a constant. In this study, the focus will be on evaluating the impact of gender inequality on economic growth by modelling a gender inequality index using school enrolment, labour force participation and maternal mortality. Previous studies have observed gender inequality in either education, the labour force or health, but not collectively. There is a gap in analysing gender inequality using this index to better understand the impact it has on the economy from a broader perspective. We included maternal mortality in modelling gender inequality index because the Relative Status of Women could be examined in the context of other measures of well-being, which includes maternal mortality (Dijkstra and Hanmer, 2000). The choice of the variables that composed our gender inequality index follows previous studies such as Shen and Williamson (1999), Dijkstra and Hanmer, (2000), Bandara (2015), Mitra *et al.* (2015) among others.

The study of Elveren *et al.* (2022) investigates the militarization-women's labour force participation rate-gender inequality nexus by utilising a panel cointegration method for 74 countries between 1990 and 2017. The main findings of the study reveal a negative relationship

between the indicators of militarization and women's labour force participation, and gender equality. Girón and Kazemikhasragh (2022) examine the impact of gender inequality on economic growth in developing and least developed countries in Asia and Africa. The authors employed panel vector autoregression analysis for data from 2010 to 2018. The results indicate a negative and significant relationship between the gender inequality index and economic growth. Maisonnave and Mamboundou (2022) investigate the impact of two Plan for an Emerging Senegal (PES) measures (investment subsidies and an increase in production subsidies for the agricultural sectors) on economic growth, women's employment, poverty and inequality using a dynamic computable general equilibrium model linked to a microsimulation model. The results from the study show that both policies have generally positive effects in reducing poverty and gender inequalities. However, the findings further reveal that investment subsidies in the agricultural sectors have stronger impacts in reducing gender inequality and poverty in the long term. Xu *et al.* (2022) examines the effect of multidimensional inclusive finance index and other financial indicators on gender inequality in 41 countries in Africa from 2000 to 2020 using the two-stage least squares instrumental variable regression (2SLSIV). The study showed that the thresholds for gender inequality indicators yield a positive net effect on economic growth in Africa.

As explained in the introduction section gender inequality across different spheres has the potential to hinder economic growth. The exclusion of women from attaining education, workforce or healthcare impedes economic progress by lowering the pool of workers available in the workforce and impacting their lifespan. This study hypothesises the following:

Hypothesis 1: Gender inequality negatively affects economic growth in developing countries

Focusing solely on developing countries, the aim of this study is to evaluate if gender inequality affects economic growth in developing nations. Klasen (2002) assessed gender inequality in education in low-income countries and found that it had a negative impact on economic growth. While Klasen (2002) assessed low-income countries, this study will evaluate both low-, lower-middle, upper-middle and high-income countries. The low- and lower-middle countries will be identified as developing countries in this study.

Following the primary hypothesis, the study will also look at the secondary hypothesis which are as follows:

Hypothesis 2: Gender inequality negatively impacts growth in war-torn countries and those faced with high crime and violence

Urdal and Che (2013) state that in armed countries women are usually undermined and are not given a voice to share their troubles and concerns as it is limited to males. Undermining women and not giving them freedom of speech can impact economic growth of any country. This study will test the impact of gender inequality in education, labour and health in war-torn countries to supplement the findings from the main hypothesis.

Hypothesis 3: Gender equality will continue to positively impact economic growth in the long run

In the long run when more women get an education and enter the workforce, there will be an impact on productivity, and it will in turn positively impact economic growth. The larger the work force the higher the productivity and output level hence a higher level of economic growth.

The contribution to the literature that this paper makes is to evaluate the impact of the gender inequality gap on economic growth through education, the labour force and health in developing countries. Compared to previous studies, this research considers the human capital aspect more since human capital is basically acquired through education, and because according to Alderman and King (1998)

"There is wide gender gap in schooling".

Hence, the need to investigate the gender inequality gap aspect of it on growth most especially for developing countries for the purpose of policy direction. Given that the quality of human capital could be strongly linked to education, hence, the reason behind the use of it (Khan *et al.*, 2017). The study is conducted over a period of 50 years (1960-2019) in low-income and fragile countries, clustered in 5-year intervals. Using income groups in this study as opposed to a single-country analysis or regional groups provides a better understanding of what happens across countries with similar levels of income and those that are fragile irrespective of geographical location.

Similar to Ogundari and Awokuse (2018), the system generalised methods of moments (system GMM) estimator is used in this study. In addition, to eliminate endogeneity and evaluate long-run effects, this study will apply the panel autoregressive model.

3. Research methodology

3.1 Theoretical Framework

In this section, we start with the theoretical foundation on which our econometric model stands. The Cobb-Douglas production function on which our model took its root as proposed by Mankiw *et al.* (1992) is presented as follows:

$$Y = K^{\alpha} H^{\beta} (AL)^{(1-\alpha-\beta)} \tag{1}$$

where Y represents the aggregate output, K is physical capital, H is human capital. A indicates technology progress and L is labour.

The Solow (1956) model assumes that A and L grow at constant and exogenous growth rates, n and g respectively. The elasticity of the output to the respective inputs of physical and human capital is measured by the exponents in the model, α and β respectively.
The model assumes diminishing returns to scale, hence, $\alpha + \beta < 1$.

The gender inequality ratio is calculated as follows:

$$GII = \frac{H_f}{H_m}, \tag{2}$$

whereby GII is the gender inequality ratio and H_f and H_m are human capital for females and males respectively.

The growth level of output per worker is used to evaluate the impact of human inequality on growth. The GDP for each country is divided by the labour force and the equation is as follows:

$$\frac{Y}{L} = AE^{\alpha InGI + \alpha InH} + \frac{k^{\beta_1} L^{\beta_1 - 1}}{L} + \varepsilon, \tag{3}$$

$$\frac{Y}{L} = \alpha InGI + \alpha InH + \frac{k^{\beta_1}}{L} + \varepsilon, \tag{4}$$

where Y measures the aggregate output, A measures labour productivity, H measures human capital inequality and L is the labour force. Equation (4) above measures the level effect of human capital on output per worker.

Equation 5 captures the effect human capital has on economic growth, inclusive of the gender inequality ratio:

$$\text{In Y=a+}\alpha_1\text{In H}E\text{+ }\alpha_2\text{In GI+ }\beta_1\text{k.} \tag{5}$$

We express the equation in growth rates:

$$\frac{dy}{dx} = \frac{\Delta a}{A} + \beta_1 \frac{\Delta H}{H} + \beta_2 \frac{\Delta GI}{GI} + \beta_3 \frac{\Delta k}{k}. \tag{6}$$

Equation (6) measures the growth effects of human capital and the human inequality ratio.

A long run regression is used to capture the effects of the statistically significant independent variables on the dependent variable.

Long-run effects for the K^{th} parameter are computed as follows:

$$\frac{\beta_K}{1-\Phi}. \tag{7}$$

In the long run, the economy will reach a steady state, whereby the output, physical and human capital and labour will all grow at the same rate as expressed by equation (9):

$$\frac{\Delta Y}{Y} = \frac{\Delta A}{A} \tag{8}$$

$$\frac{\Delta A}{A} = g_i + \alpha_1 In\ HI + \alpha_2 InH. \tag{9}$$

Equation (9) expresses the dynamic growth. Equation (10) below is a combination of the long run and short run effects of human capital on economic growth:

$$g_{it} = \alpha_i + \alpha_1 InH + \alpha_2 InGI + \beta_1 In(H_{it} + H_{it-1}) + \beta_2 In(GI_{it} - GI_{it-1}) + \beta_3(K_{it} - K_{it-1}) \tag{10}$$

where i is the number of income groups, t is the number of years corresponding to observations of five years apart, H is the human capital component, GI is the gender inequality ratio and K is the physical capital component. α and β are the coefficients of exogenous variables. This model will assist in answering the research question: "*Is there a relationship between gender inequality and economic growth in the long run?",* as Equation 10 evaluates the long effect of the independent variable on the dependent variable.

3.2 Econometric Specification

The Arellano-Bond estimation is used to examine the impact of gender inequality on economic growth, while taking into consideration possible endogeneity of several right-hand side (RHS) variables (such as capital formation, human capital, gender inequality, income groups and fragility state index). The equations include a lagged dependent variable (output). As a panel dataset is used in the analysis, random and fixed effects analysis need to be performed. A variable depending on the explanatory variable is rarely instantaneous. Every so often the dependent variable reacts to the explanatory variable with a lapse of time. The Arellano-Bond GMM specification takes care of issues that may arise from using fixed and random effects. It differences the endogenous and predetermined variables and uses lags of their own levels as instruments.

The relationship between gender inequality and output is examined in the following specification:

$$y_{it}=\mathrm{a}y_{it-1} + X_{it}\beta + \eta_i + \xi_t + \varepsilon_{it}, \tag{11}$$

where y is output in log form, X is a row vector of factors determining output, some of which are endogenous, η_i is the individual (country) fixed effect, and ξ_t is a time-specific effect. Applying the Arellano-Bond specification yields the following:

$$\Delta y_{it}=\mathrm{a}\Delta y_{it-1} + \Delta X_{it}\beta + \eta_i + \xi_t + \varepsilon_{it}. \tag{12}$$

In the model, human capital, gender inequality, capital formation, income group and fragility state index are treated as endogenous variables.

The Model

Different estimations are used to evaluate the true impact of gender inequality on economic growth. These models are presented below:

$$y_{it} = a + y_{it-1} + \beta_1(KL) + \beta_2(Edu) + \beta_3(GII) + \eta_i + \xi_t + \varepsilon_{it,} \quad (13)$$

$$y_{it} = a + y_{it-1} + \beta_1(KL) + \beta_2(Edu) + \beta_3(GII) + \beta_4(DInc\_grp) + \beta_5(IC\_GII) + \eta_i + \xi_t + \varepsilon_{it,} \quad (14)$$

$$y_{it} = a + y_{it-1} + \beta_1(KL) + \beta_2(Edu) + \beta_3(GII) + \beta_4(DSFI) + \beta_5(SFI\_GII) + \eta_i + \xi_t + \varepsilon_{it,} \quad (15)$$

$$y_{it} = a + y_{it-1} + \beta_1(KL) + \beta_2(Edu) + \beta_3(GII) +) + \beta_4(Dinc\_grp) + \beta_5(IC\_GII) + \beta_4(DSFI) + \beta_5(SFI\_GII) + \eta_i + \xi_t + \varepsilon_{it}, \quad (16)$$

where:

y_{it} = GDP *per capita*, β = Coefficient of the variable, η_i = Individual (country) fixed effect, ξ_t = Time-specific effect, KL = Gross capital formation, Edu = Education, GII = Gender inequality index, DInc_grp = Dummy variable for income group, IC_GII = Gender inequality index by income Group, DSFI = Dummy variable for state fragility index, SFI_GII = Gender inequality index by state fragility index.

Equation 13 describes the impact of gender inequality without controlling for any other external factors besides education, physical capital, and gender inequality. Equation 14 controls for gender inequality in low-income groups. Equation 15 controls for gender inequality for countries that are facing conflict, violence or war as classified by the Fragile State Index as countries that are in a warning and alert status. Equation 16, controls for gender inequality in low-income countries and those that face conflict, violence or war.

3.3 Data and Variable Description

The main aim of this research study was to evaluate the impact of gender inequality on economic growth in developing countries. Gender inequality was indexed using three proxies: education, labour force participation and health (maternal mortality ratio). Two control variables were used in the first estimation model: physical capital and human capital. The latter equations controlled for gender inequality in low-income groups and countries that face violence, conflict or war.

The selected data variables were guided by the existing literature. Data sources include the World Bank national accounts data, OECD National Accounts data, UNESCO Institute for Statistics,

International Labour Organization and the Fund for Peace Database. A panel approach was used to analyse the data over a specific period. There are two major issues that need to be considered when measuring data as stated by Trochim and Donnelly (2007). First, the researcher must understand the basic ideas involved in the calculations and the reliability of the measurements. Secondly, they need to understand the various types of measures that can be used in their study. Table 1 below further shows the variables selected for the model and their respective proxies.

Dependent Variable

GDP *per capita* is defined as Gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. Data are reported in constant 2010 US dollars (World Bank Database, 2019). Simply put, GDP *per capita* is the average income earned per person in a country/region for a specific year. In line with the definition cited above, this study used GDP *per capita* as a measure of output production, similar to previous studies such as Baliamoune-Lutz and McGillivray (2009) who assess the impact of gender inequality in Sub-Saharan and Arab countries.

Independent Variables

Gross capital formation is used as a proxy for physical capital in this study. Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and 'work in progress.' According to the 1993 SNA, net acquisitions of valuables are also considered capital formation. Data are reported in constant 2010 US dollars (World Bank Database, 2019). Gross capital formation has been used as a proxy for investments in previous studies. Chaudhary (2003) analysed the impact of gender inequality in education on economic growth in Pakistan and used gross capital formation as an index for economic growth. This variable shows how much value is invested into the country.

Education is the process of enabling learning or gaining knowledge. It is a process of acquiring a skillset, values, beliefs, or habits. Education has been used as a proxy for human capital in this study. School enrolment at primary, secondary and tertiary level was used to represent the level of education for individuals. The World Bank Database describes school enrolment at primary, secondary and tertiary level as: gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Primary education provides children with basic reading, writing, and mathematics skills along with an elementary understanding of such subjects. Secondary education completes the provision of basic education that began at the primary level and aims at laying the foundations for lifelong learning and human development, by offering more subject- or skill-oriented instructions using more specialised teachers. Tertiary education, whether or not to an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level (World Bank Database, 2019).

An education index was developed using school enrolment at primary, secondary and tertiary level with the use of principal component analysis. As formulated by Pearson (Wold *et al.*, 1987). the method involves finding

"lines and planes of closest fit to systems of points in space"

The aim of using principal component analysis was to be able to create an index that would capture all the variability of education across all education spectrums in one variable. As mentioned above, education consists of school enrolment at primary, secondary and tertiary level. It measures the gap of education across different educational levels between males and females. Formal education empowers individuals to provide for themselves and helps people escape poverty. Measuring education as a component of gender inequality is important because it will indirectly lower the number of children and increase women's living standards, which have proven to be beneficial, not only to women but also the family household.

Gender inequality index: The UNDP developed an index to measure gender inequalities across three different aspects of human development being: reproductive health, empowerment, and economic status (UNDP, 2019). The index aimed to expose the gender differentials between men and women and the human development cost of gender inequality. This variable was not used in this study because it contained information for a limited period. Principal components analysis

was used in this study to develop a similar index that would measure gender inequality in the population. The index developed includes the same aspects of human development: reproductive health, measured by maternal mortality ratio, empowerment, measured by the school enrolment and economic status, measured by the labour force participation rate. These will be explained further below:

Maternal mortality ratio: The World Bank Database describes the maternal mortality ratio as the number of women who die from pregnancy-related causes while pregnant or within 42 days of pregnancy termination per 100,000 live births. The data are estimated with a regression model using information on the proportion of maternal deaths among non-AIDS deaths in women aged 15-49, fertility, birth attendants, and GDP measured using purchasing power parities (PPPs) (World Bank Database, 2019).

The maternal mortality ratio was selected as a proxy for healthcare. The rationale behind using this model as a proxy for health is that countries with a high maternal mortality ratio would not differ in their inability to establish opportunities and resources for maternal health. Countries with low maternal mortality ratios are expected to prioritise maternal healthcare.

Labour force participation rate: The labour force participation rate is defined by the International Labour Organisation (ILO) as the portion of the country's working-age population that engages actively in the labour market, either by working or looking for work; it provides an indication of the size of the supply of labour available to engage in the production of goods and services, relative to the population at working age (ILO, 2019). The economically active proportion of the population aged 15-64 is used in this study. This includes all citizens who provide labour for the production of goods and services over a given time as the participation rate of the labour force. The inclusion of labour participation in gender inequality is to evaluate the gender differentials in the labour market. Through the inclusion of women in the labour force, it will empower them to provide for their families and give them bargaining power in their households. These three elements in the gender inequality index allow for gender differences to be exposed should they exist across different countries.

In addition to the independent variables used in the study to evaluate the impact of gender inequality, three additional variables were included to evaluate the impact of gender inequality in

developing countries, fragile states and across time. The introduction of these variables has addressed the measurement error of bias.

Income group: The different countries in this study were classified into two different groups. The data was sourced from the World Bank Database which included four-country classifications, namely: low, lower-middle, upper-middle and high-income. The World Bank used the World Bank Atlas method to classify the countries into the different income groups. Low-income countries are defined as those with a:

"GNI *per capita* of $1,025 or less in 2018; lower-middle-income countries are those with a GNI *per capita* between $1,026 and $3,995; upper-middle-income countries are those with a GNI *per capita* between $3,996 and $12,375; high-income countries are those with a GNI *per capita* of $12,376 or more" (World Bank, 2019).

Countries are further grouped into low-income and high-income which consisted of low and lower-middle for low-income and upper-middle and high for high-income countries. Low-income countries are further classified as developing countries in this study in which high-income countries are developed.

By incorporating income groups as a control variable into the analysis, we can define the relationship and the degree of gender inequality in developing nations.

Fragile states index: The fragile states index was sourced from the Fund for Peace Database. It has been identified as a critical tool in highlighting normal pressures that all states experience as well as identifying when those pressures are outweighing a states' capacity to manage those pressures. In weight pertinent vulnerabilities which contribute to the risk of state fragility, the index makes political risk assessment and early warning of conflict accessible to policymakers and the public (Fund for Peace, 2019). The countries are identified as: sustainable, stable, alert and warning. In the research analysis, the countries are further grouped into 'alert' and 'stable' where alert represents alert and warning and stable represents stable and sustainable.

The purpose of including the fragile states index is to recognise the areas of concern about gender inequality. O'Connell (2011) suggests that some progress is being made in women's participation in elections and formal politics, in conflict-affecting and vulnerable states; however, involvement

in small-scale economic activity, gender disparity with the household remains understandable.

Time: The time variable has been included as a control variable to assess the impact of gender inequality over time.

Government effectiveness: This variable is defined as

"Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5" (World Bank Database, 2019).

The variable is used to evaluate the relationship between government effectiveness in low- and high-income countries on gender inequality. Table 1 presents the variables and measurements. Table 1A, 1B, 1C and 1D present list of countries in each income group (that is, low-, lower-middle, upper-middle and high-income countries) and by fragility state index (that is, the countries on sustainable, stable, waring and alert), respectively.

3.4 Estimation Techniques

This study used the dynamic panel data model using the dynamic panel Generalized Method of Moments (GMM) estimator. This estimator fit when the number of cross-sectional units (N) exceeds the time period (T). We used the dynamic panel GMM estimator because of the following reasons which include; (i) controlling for unobserved individual heterogeneity; (ii) to take care of endogeneity problem; (iii) simultaneity bias/reverse causality; (iv) measurement error; and (v) omitted variable bias/Nickell bias and heteroskedasticity. The model was first proposed by Arellano and Bond (1991) and later extended by Blundell and Bond (1998).

TABLE 1 - *Variables and Measurements*

Variable	Proxy	Measurement
Log GDP *per capita* (World Bank national accounts data)	GDP *per capita* (Constant 2010 US$)	GDP *per capita* (Constant 2010 US$)
Log Gross Capital Formation (World Bank national accounts data)	Gross capital formation (constant 2010 US$)	Gross capital formation (constant 2010 US$)
Human Capital (UNESCO Institute for Statistics)	Ind. Var 1: School enrolment, primary (% gross) Ind. Var 2: School enrolment, secondary (% gross) Ind. Var 3: School enrolment, tertiary (% gross)	
Gender Inequality Index (author's computation)	Ind. Var 1: Education Ind. Var 2: Labour force participation rate (% of female population ages 15-64) (modelled ILO estimate) Ind. Var 3: Maternal mortality ratio (modelled estimate, per 100,000 live births)	
Income Group Dummy (World Bank national accounts data)	Dummy Income Group	Dummy Income Group
Gender Inequality Low income	Income Group Dummy multiplied by Gender Inequality Index	Income Group Dummy multiplied by Gender Inequality Index
Fragile State Index Dummy (Fund for Peace)	Fragile State Index Dummy	Fragile State Index Dummy
Gender Inequality Fragile State Index	Fragile State Index Dummy multiplied by Gender Inequality Index	Fragile State Index Dummy multiplied by Gender Inequality Index
Gender Inequality Time	Gender inequality by year	Gender inequality by year

Source: Author's own compilation.

This study employed the system GMM estimator because it is superior to first difference GMM estimator proposed by Arellano and Bond (1991). The system GMM estimator utilises the level and first difference series to overcome the problem of weak instruments, thus providing more efficient estimates (Blundell and Bond, 1998)[1]. Hence, this study largely relied on the results of the system GMM estimator. For this study, gender inequality was composed using *principal component analysis*, whereby the maternal mortality ratio, the gap between men and women in education and the labour force participation rate were combined to compute an index that will measure the gender inequality gap across different income groups. This theoretical model will assist in answering the research question: "*Is gender inequality a significant determinant of economic growth in developing countries and/or those faced with conflict, violence and war*"?

4. Results and findings

This section presents the results and finding for the analysis performed to determine the relationship between gender inequality and economic growth.

4.1 Descriptive Statistics

Table 2 provides descriptive statistics of the dependent and independent variables used in the analysis. Table 2 below shows that the mean ln_GDP is US$8.63 at constant 2010 prices and is highest for high-income countries compared to low-income ones. Physical capital, proxied by gross capital formation in US dollars at constant 2010 prices, has a mean of US$23.34. High income countries have a higher average capital than low-income ones. The table shows that the mean for the index of gender inequality is 0.082, indicating a gap between males and females. The results indicate that on average the gap between males and females is 0.082 female to 1 male. This means that there are 8.2 females for every 100 males in school, health and workforce. As stated in Table 1E and 1F of the appendix, the difference is greater in low-income countries relative to high-income ones. A similar observation is seen in high-risk countries; the gender gap is largest compared to those that are stable (see Table 1G and 1H at the appendix).

[1] The details of this methodology have been extensively discussed in the literature to warrant detailed discussion here. However, for details and steps involved in the use of this methodology, one may consult Bond *et al.* (2001), Windmeijer (2005), Blundell *et al.* (2001), Roodman (2009a,b) among others.

TABLE 2 - *Descriptive Statistics*

Variables	Obs.	Mean	Std Dev.	Min	Max
In_GDP *per capita*	437	8.630	1.542	5.386	11.604
ln_GCF	437	23.338	2.083	18.408	28.937
Human Capital	437	0.339	0.451	-2.178	1.349
Gender Inequality	437	0.082	0.811	-3.521	2.311
Income Group Dummy	437	0.380	0.486	0	1
Gender Inequality Low Income	437	-0.133	0.726	-3.521	2.311
Fragile State Index Dummy	437	0.6	0.491	0	1
Gender Inequality Fragile State	437	-0.075	0.762	-3.521	2.311
Gender Inequality over Time	437	166.160	1629.644	-7073.722	4666.38

Source: Author's computations.

4.2 Diagnostics Testing – Correlation Analysis (Collinearity)

Table 3 shows the correlation matrix between the variables that were used in this study. The results illustrate that capital formation, human capital, gender inequality in low-income group, fragility state index dummy, gender inequality in fragile and gender inequality through time are positively related to the log of GDP *per capita*, while the other variables have a negative relationship with the dependent variable. The log of GDP *per capita* has a strong relationship with gross capital formation as investments directly impact the economy's performance. This is because investment creates liquidity for businesses to borrow money and increase production. The relationship between gender inequality and *per capita* GDP is negative, which means that *per capita* GDP will decrease as gender inequality increases. Human capital, which consists of school enrolment at various education levels, demonstrates a positive relationship with the dependent variable. It is likely that increases in school enrolments will have a positive effect on GDP through an increase in skilled personnel that can participate in the workforce and ultimately influence production, as per findings of Mbelle and Katabaro (2003) and Stevens and Weale (2004). Although the correlation matrix table provides a good initial sketch of the relationships among variables, it does not take care of endogeneity issues that may exist between the variables. Hence, the need to carry out a dynamic panel model that accounts for endogeneity

TABLE 3 - *Correlation Matrix Results*

Variables	*Log GDP per capita*	*Log Gross Capital Formation*	*Human Capital*	*Gender Inequality Index*	*Income Group Dummy*	*Gender Inequality Low Income*	*Fragile State Index Dummy*	*Gender Inequality Fragile State*	*Gender Inequality over Time*
Log GDP per capita	1.000								
Log Gross Capital Formation	0.616*** (0.000)	1.000							
Human Capital	0.488*** (0.000)	0.301*** (0.000)	1.000						
Gender Inequality Index	-0.864*** (0.000)	-0.512*** (0.000)	-0.468*** (0.000)	1.000					
Income Group Dummy	-0.809*** (0.000)	-0.481*** (0.000)	-0.470*** (0.000)	0.703*** (0.000)	1.000				
Gender Inequality Low Income	0.224*** (0.000)	0.229*** (0.000)	0.702*** (0.000)	-0.273*** (0.000)	-0.181*** (0.000)	1.000			
Fragile State Index Dummy	-0.764*** (0.000)	-0.350*** (0.000)	-0.271*** (0.000)	0.756*** (0.000)	0.613*** (0.000)	-0.114*** (0.000)	1.000		
Gender Inequality Fragile State	0.227*** (0.000)	0.243*** (0.000)	0.694*** (0.000)	-0.278*** (0.000)	-0.235*** (0.000)	0.961*** (0.000)	-0.037** (0.010)	1.000	
Gender Inequality over Time	0.425*** (0.000)	0.319*** (0.000)	0.722*** (0.000)	-0.471*** (0.000)	-0.381*** (0.000)	0.935*** (0.000)	-0.293*** (0.000)	0.953*** (0.000)	1.000

Note: ***p < 0.01; **p < 0.05, and *p < 0.1 are significance level, respectively. Author's computations.

problems that may exist among the variables (Saba and Ngepah, 2019a, 2019b, 2020, 2021; Ngepah *et al.,* 2021; Saba and David, 2022; Saba, 2022).

4.3 Empirical Findings

The first column of Table 4 shows the impact of gender inequality on economic growth before controlling for gender inequality in low-income and fragile countries. The single statistically significant variable is the lag dependent variable of GDP *per capita*. The other independent variables show that, except for gender inequality, there is a positive relationship between them and the dependent variable. However, these results are statistically insignificant and are therefore inconclusive as the model in column 1 failed the Hansen test. The second column of Table 4 controls for gender inequality in low-income countries. The lag of GDP *per capita,* capital formation and education continued to report a positive relationship with GDP *per capita* and the results are statistically significant at the 5% level.

Column 2 shows that a percentage increase in capital formation will lead to a 0.07% increase in GDP *per capita*, *ceteris paribus*, with the results being significant at the 5% level. The findings suggest that, in the short term, stimulating the market with capital results in a positive effect on the economy. The rise in capital accumulation would contribute to high rates of production through job development and eventually lead to higher levels of economic growth. Consequently, capital can be used as a stimulant to increase the pace of economic growth, but this would only be successful in the short term.

Education has a positive relationship with GDP *per capita* in column 2 from Table 4 below. A percentage increase in the school enrolment rate will result in an increase in GDP *per capita* of 0.27%, *ceteris paribus*, with the result being statistically significant at the 5% level. Such results support the fact that increasing the level of enrolment at school by offering educational access to individuals would have a positive impact on *per capita* GDP, regardless of the level of education. When income group and gender inequality in the low-income group are controlled for, as seen in column 2, gender inequality becomes positive and statistically significant at the 5% level. These findings are consistent with the findings of Kim *et al.,* 2016, who demonstrated that improving gender parity contributes significantly to economic growth in Asian economies by means of

varying their time allocation and accelerating human capital. Bertay *et al.*'s (2020) study also shared similar findings.

Column 2 findings indicate that reducing inequality will lead to a higher *per capita* GDP overall, regardless of income level, but the opposite effect is seen for low-income countries. In low income-countries, a 1% increase in gender inequality would lead to a decline of 0.46% in GDP *per capita* in comparison to high income countries, *ceteris paribus*. These results are consistent with the findings of Karoui and Feki (2018b) for the case of African countries and Matthew *et al.* (2020) for the case of Nigeria. Gelard and Abdi (2016) shared similar findings for countries with a high human development index. For our empirical study, this suggests that women are gradually becoming better off in high-income countries than those in low-income countries. Although women in developed countries have a greater advantage than those in developing countries in raising GDP *per capita*, the findings confirm that increasing gender inequality in low-income countries will lead only to a repressed economy as compared to high income countries. Similar findings can be seen when accounting for the Fragile States Index, specifically fragile countries. This further highlights additional challenges faced by women in developing countries, such as poor infrastructure and the environment in which production is carried out.

The last column in Table 4 below shows the system GMM results after controlling for countries in low-income groups, fragile countries, and gender inequality over time (time-variant). Even after controlling for other variables in the model, capital formation is positively related to GDP *per capita* in the short run and is statistically significant at the 5% level. A percentage change in capital formation is associated with a 0.05% increase in GDP *per capita* in the short run, at the 5% significance level. Education also continued to demonstrate a positive relationship with economic growth after controlling for gender inequality in low-income and fragile countries. A percentage increase in education is associated with a 0.23% increase in economic growth in the short run, at the 5% significance level. Gender inequality index has a positive relationship on an overall level as seen in the model in Table 4 in column 5. It illustrates that a 1% increase in gender inequality is associated with a 9.68% increase in the economic growth level, at the 10% significance level. The results are largely impacted by the inequality gap in developed countries which is smaller than developing countries. When low-income countries are controlled for and the effect of gender inequality in low-income countries is observed, the results show that gender

TABLE 4 - *Gender Inequality and GDP per capita using System GMM results*

VARIABLES	(1) lnGDP per capita_con	(2) lnGDP per capita_con	(3) lnGDP per capita_con	(4) lnGDP per capita_con	(5) lnGDP per capita_con[1]
L.lnGDP per capita_con	0.806***	0.626***	0.595***	0.739***	0.685***
	(0.161)	(0.126)	(0.155)	(0.115)	(0.145)
lnGCF_con	0.0577	0.0685**	0.0937**	0.0928**	0.0545**
	(0.0510)	(0.0270)	(0.0394)	(0.0420)	(0.0238)
Education	0.268	0.265**	0.420**	0.287**	0.232**
	(0.211)	(0.103)	(0.165)	(0.138)	(0.113)
Gender Inequality	-0.0307	0.385**	0.235	7.051	9.684*
	(0.0410)	(0.186)	(0.259)	(7.098)	(5.825)
Income Group Dummy		-0.578***			-0.307*
		(0.219)			(0.164)
Gender Inequality Low Income		-0.457**			-0.234**
		(0.207)			(0.114)
Fragile State Index Dummy			-0.616**		-0.349**
			(0.242)		(0.173)
Gender Inequality Fragile State			-0.310		-0.0112
			(0.277)		(0.161)
Year				-0.00295*	0.000935
				(0.00157)	(0.00226)
Gender Inequality over Time				-0.00349	-0.00472
				(0.00354)	(0.00285)
Constant	0.330	1.743***	1.566**	6.018*	-0.146
	(0.316)	(0.642)	(0.633)	(3.084)	(3.869)
Observations	437	437	434	437	434
Number of Countries	141	141	140	141	140
Number of instruments	6	8	8	8	12
AR(2) test (p-value)	0.362	0.978	0.841	0.215	0.728
Hansen test	0.002	0.607	0.425	0.908	0.779

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Author's computations.

[1] Regression model controlled for time effect.

inequality in low-income countries is negatively associated with a 0.23% decrease in the economic growth level, at a 5% level of significance.

In fragile countries, gender inequality is negatively associated with economic growth when controlled, but these results are not statistically significant, and can therefore be disregarded. These findings indicate that as the disparity between gender inequalities rises in low-income countries, whereby women tend to be side-lined and discriminated against, it will continue to have a negative impact on economic growth rates. Therefore, females need to be prioritised to reduce the gender inequality gap in low-income countries. Hence, to reduce the gap in inequality in low-income countries, females need to be prioritised over males. This is inline with Minasyan *et al.*'s (2019) findings. Gender equality increases GDP; however, being in a low-income country is associated with lower increases in GDP *per capita* compared to high-income countries. Thus, if women get more of an advantage in developed countries, *per capita* GDP will do better than if more of an advantage is given to women in developing countries.

Table 5 below illustrates the impact of gender inequality in low- and high-income countries. Column 1 shows that the lag dependent on GDP *per capita*, capital formation and education are positively related to GDP *per capita* in low-income countries and are statistically significant at the 5% level. Gender inequality for low-income countries is negatively associated with GDP *per capita* at the 10% significance level, as illustrated in the first column. Column 2 shows results for countries with high income, the results are however insignificant. When time is controlled for, as seen in columns 3 and 4, respectively for low- and high-income groups, gender inequality, in favour of females, is positively associated with GDP *per capita*. Gender inequality is only statistically significant for high income countries at the 5% level. The findings in columns 3 and 4 in Table 5 further show that gender inequality is higher in high-income countries than low-income countries. These results underline that because GDP is high in developed countries relative to developing countries, women in developing countries have a greater chance of increasing GDP *per capita* compared to developed countries. This highlights the lack of infrastructure and poor institutions in developing countries. Even if all the available advantages were given to women in developing countries, they would still face certain constraints that affect the economy in a way that will not be as effective as in developed nations. This was also pointed out by the study of Elson (2009).

TABLE 5 - *Gender inequality in Low- and High-Income Countries*

Variables	(1) Log GDP per capita	(2) Log GDP per capita	(3) Log GDP per capita	(4) Log GDP per capita
L. Log GDP per capita	0.788***	0.521**	0.863***	0.753***
	(0.0975)	(0.226)	(0.164)	(0.113)
Log Gross capital Formation	0.0391**	0.0897	0.0329	0.0454*
	(0.0176)	(0.0540)	(0.0236)	(0.0251)
Education	0.190**	0.0613	0.129	-0.0199
	(0.0893)	(0.264)	(0.132)	(0.0949)
Gender Inequality Index	-0.0522*	0.494	3.736	31.64**
	(0.0261)	(0.323)	(4.680)	(15.15)
Year			-0.00193	0.00328
			(0.00209)	(0.00307)
Gender Inequality over time			-0.00187	-0.0156**
			(0.00234)	(0.00750)
Constant	0.710	2.292*	4.217	-5.318
	(0.434)	(1.155)	(3.754)	(5.886)
Observations	164	273	164	273
Number of Countries	59	82	59	82
Number of instruments	6	6	8	8
AR(2) test (p-value)	0.146	0.329	0.153	0.983
Hansen test	0.509	0.547	1.000	0.420

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 are significance level, respectively. Columns (1) and (3) are low-income countries and Columns (2) and (4) are high-income countries. Author's computations.

Table 6 below shows the results of gender inequality on GDP growth. Lag dependent variable on output per worker and education are the only significant variables for the overall and high-income model (columns 1 and 3). Gender inequality has a negative impact on the GDP growth rate as shown in the overall model. A one percent increase in gender inequality will lead to a 0.22% decline in GDP growth, although the results are not statistically significant. In terms of income groups, a 1% increase in gender inequality in low-income countries will lead to a 0.06% increase in the GDP growth rate. On the other hand, a 1% increase in gender inequality will lead to a 0.03% increase in GDP growth in high-income countries. Therefore, for GDP growth to increase, low-income groups need to increase gender inequality by 0.06% and high-income countries by 0.03%. However, it is important to note that these results are not statistically significant.

TABLE 6 - *GDP Growth and Gender Inequality*

Variables	Overall Log GDP growth	Low Log GDP growth	High Log GDP growth
L. Log GDP growth	0.299**	0.470	0.295*
	(0.150)	(0.406)	(0.164)
Log capital formation	-0.212	-0.111	-0.260
	(0.196)	(0.223)	(0.250)
Education	1.057***	0.149	1.329*
	(0.378)	(0.367)	(0.760)
Gender Inequality Index	-0.221	0.0654	0.0331
	(0.151)	(0.118)	(0.430)
Constant	-8.602***	-6.797	-8.419***
	(2.432)	(5.773)	(2.678)
Observations	399	151	248
Number of Countries	136	57	79
Number of instruments	17	17	17

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 are significance level, respectively. *Source:* author's computations.

Government Effectiveness was used to also assess the impact of both formal and informal institutions in regulating human interactions and gender disparities transactions. A covariate analysis was performed and the results are seen in the Table 7 that shows that government effectiveness is positively correlated to gender inequality in the short run. In an effective government where policies are being applied and the government system is conducive, the gap

between men and women in the workplace, healthcare system and education levels is minimised. The more effective the government system is the lower the ratio of gender inequality in the workplace. In low-income countries gender inequality remains a problem as indicated in the previous analysis above.

TABLE 7 - *Impact of Government Effectiveness in Regulating Gender Equality in Low-Income Countries*

Variables	Gender Equality	P-value	Std. Error
Government Effectiveness	0.232***	0.000	0.048
Low Income countries	-0.389***	0.000	0.095
Constant	0.200***	0.000	0.053

Note: *** p<0.01, ** p<0.05, * p<0.1 are significance level, respectively.
Source: author's computations.

Table 8 evaluates the long run effects of the statistically significant explanatory variables on economic growth as observed in Table 4 above. One lag period was used for this analysis. Capital formation has a larger effect on economic growth in the long run (0.17%) than in the short run (0.05%). Capital formation is positively correlated with economic growth. As population grows and there is a higher demand for goods and services, the supply portion of the economy would have to produce goods and offer services that would meet the demands while addressing scarcity. If there are more capital formation ingested into the economy it will allow for more goods and services to be sold and offered, respectively. Therefore, increased production will positively impact the economy in the long run with higher population rates. Government policy to continue rendering capital formation is important to encourage productivity and economic growth in the long run. In education, a percentage increase in education is associated with a 0.74% increase in economic growth in the long run, significant at the 1% level. While in the short run, education is associated with a 0.23% increase in the economic growth level. Gender inequality in low-income countries continues to be negatively associated with economic growth in the long run (-0.74%) compared to the short-run (-0.23%), and at a larger scale.

TABLE 8 - *Long Run Panel Autoregressive Distributive Lag model (ARDL)*

Variables	Coef.	Std Err.	z	P>|z|	[95% Conf. Interval]	
Log gross capital formation	0.173	0.027	6.39	0.000	0.120	0.226
Education	0.737	0.160	4.60	0.000	0.424	1.051
Gender Inequality Index	30.777	16.630	1.85	0.064	-1.818	63.372
Income Group Dummy	-0.976	0.136	-7.16	0.000	-1.243	-0.709
Gender Inequality Low income	-0.744	0.252	-2.96	0.003	-1.237	-0.251
Fragile State Index Dummy	-1.111	0.173	-6.43	0.000	-1.449	-0.772
Year	0.003	0.006	0.49	0.624	-0.009	0.015
Gender Inequality over Time	-0.015	0.008	-1.82	0.069	-0.031	0.001

Source: Author's computations.

The regression model in column 5 from Table 4 above shows that the results were statistically significant for the data analysed in the study. The results indicate that GDP *per capita* is positively influenced by the lag dependent variable of GDP, gross capital formation, education, gender inequality index and gender inequality in fragile states. GDP *per capita* is positively related to gender inequality on an overall level and this is impacted by the high equality ratio in high-income countries. In reference to low-income countries, the results show that there is a negative relationship between GDP *per capita* and gender inequality. Therefore, governments in low-income countries/developing countries should decrease the level of gender inequality as it harms the economy.

If the results that relate to gender inequality in developing countries are interpreted with understanding, access to education, basic healthcare and inclusion into the labour market, then these factors need to be considered for women in these countries. In developing countries, the dynamics that surround women and how they access education, healthcare and the labour market vary from their male counterparts. This may be driven by cultural and historical aspects that are beyond the scope of this study, but unless addressed, it may be detrimental to the development of the economies of developing countries.

5. Conclusions and recommendations

This study was motivated by the growing interest in the impact of gender inequality on economic growth, particularly in developing countries. The study runs for the period 1960 – 2019 and is spread out in five-year intervals. The study focused on gender inequality, mainly in education, the labour force and access to healthcare, areas where women have been largely discriminated against to a great extent. The reduction of gender inequality could, in theory, increase economic growth where there is a considerable disparity between men and women. Barro and Lee (1994) and Barro and Sala-i-Martin (1995) found that increasing the level of education in women led to positive economic growth. Additional supporting literature has shown that including females in the labour force has led to various benefits for economic growth (Hill and King, 1995; Knowles *et al.*, 2002). The main objective of this study has been to determine the impact of gender inequality on economic growth in developing countries, in both the short and long run. Furthermore, the aim has also been to highlight the challenges women face should the relationship exist in developing countries. A system GMM regression was used to test objectives.

The findings of this study suggest that gender inequality accounted for a significant variability in GDP *per capita* and further show a significant negative relationship with economic growth. The results presented in this study confirm that capital formation is an important and statistically significant factor for the development of the economy. Education is a vital variable for stimulating the economy, and findings support those found in previous literature. Yumusak *et al.* (2013) and Pegkas and Tsamadias (2017) reported a positive relationship between education and economic growth for Turkey and Greece respectively. As an important factor for development and economic growth, country governments need to invest in education to increase the level of growth. This could be done by encouraging people to educate themselves and empower them by enrolling in school. Government can also improve services by building more schools for people unable to access schools. Another way to invest in education would be to reduce the educational gender gap, particularly in low-income countries. Overall, gender equality has a positive impact on economic growth, due in large part to the high gender equality ratio in high-income countries. Consequently, gender discrimination is not an area of concern in developed countries but one that needs attention in developing countries.

Results from this study show that gender inequality in low-income countries has a negative effect on economic growth. Due to the large gap between males and females in terms of access to

education, the labour force, and the healthcare system, it has a negative impact on the economy for low-income countries. Strategies and policies need to be set in place to reduce the gender gap, and this can be achieved by ensuring that more women are educated, leading to a higher proportion of skilled workers entering the labour force in the long term. Government should also strengthen the healthcare system for women by investing in improvements to the conditions for maternity patients to ultimately reduce the maternal mortality ratio.

The results show that, for low-income countries, gender inequality is negatively associated with economic growth. To reduce the gap in gender inequality in low-income countries, women need to be given priority over men. The findings also show that GDP growth is lower in developing countries relative to developed ones. Being in a low-income country is associated with a lower increase in GDP *per capita* compared to being in a high-income country. Thus, if women in developed countries get more of an advantage, the GDP *per capita* in developed countries will do better than if the advantage was given to women in developing countries. Women in developing countries are faced with challenges such as poor infrastructure and institutions as well as a lack of adequate healthcare systems that impede the economic growth even if they were given an advantage over men in developed countries. These challenges make it more difficult for women in developing countries to succeed compared to those in developed countries where their voices are heard, and the education and workplace gender gap is not as wide as in developing countries. Policymakers should address other issues that will impede their success and impact economic growth before reducing the gender gap by giving women a fair chance compared to males in developed countries.

This study used the expanded Solow (1956) model by Mankiw *et al.* (1992) to account for human capital. The empirical findings indicate that, for low-income nations, there is a negative correlation between the gender inequality ratio and GDP *per capita*. This implies that the government should focus on reducing the gap in gender inequality in low-income countries to achieve higher output levels. These results highlight the current impact of gender disparities on economic growth in low-income countries. It is proposed that governments try to reduce the gap in education between men and women. A detailed evaluation of the human capital structures, functions, interventions, initiatives, and policies can be enforced to improve the level of economic development. The following findings can be taken from an empirical view of gender disparity on economic growth, which should be of interest to sustainable development policy makers:

- Adequate infrastructure and institutions should be established in developing countries to enhance economic growth.
- Access to education for women should be enhanced in developing countries.
- Female health conditions should be improved.
- Private and public sectors should employ more women in the labour market.
- Education/ training aimed at increasing employability should be increased, which will have a long-term effect on labour force participation.
- Women should be encouraged to be self-employed and generate wealth for themselves.
- Sustainable strategies should be drafted to empower women and improve their economic status in developing countries.

In conclusion, it is suggested that women should be provided with better healthcare, education, and nutrition to engage in the labour market and give a positive contribution to the economy. This would lead to higher economic growth, better living standards and lower levels of poverty.

Gender inequality is a topical issue, with extensive literature covering the topic. The study confronted the limitation of data availability across the various variables. Proxies were used in the study and thus the degree of distortion to the findings was inevitable, with certain variables being averages and aggregations of a small population. Many low-income countries lack institutions to constantly monitor their data, so obtaining a comprehensive dataset with data across all variables was challenging and resulted in variables being averaged at five-year intervals. Averages across the variables were determined to ensure synchronisation of the data and timelines.

The gender inequality index from the UNDP did not have an index for all countries, hence the compilation of the gender inequality index in the study. The Barro-Lee dataset for average years of education would have been the ideal variable to use in the model. However, the dataset only consisted of data until 2010, hence enrolment of education was used as a proxy for human capital to compile the gender inequality index. Using principal component analysis to compile the gender inequality index led to a loss of some variability in the variables although we were able to provide reliable results.

As the gender inequality index data becomes available for more countries, a follow-up study can be done to assess the relationship between gender inequality and economic growth using the index from UNDP. Subsequently, the following can be examined: research can be done in fragile

states as this study failed to prove a significant relationship between gender inequality and economic growth in fragile states; a study on whether there is a causal and long-term relationship between gender inequality and economic growth across regions, i.e. Sub-Saharan Africa; and the impact of gender equality in developing nations where there is a higher ratio of females to males. Is there a reverse inequality on males? Future studies should seek an answer to this question. The readers of this article should be reminded that the data used for this study is pre-COVID-19 pandemic in nature. Therefore, future studies should use data that covers the period of the pandemic to observe/reflect current exacerbated effects that the pandemic must have had on gender inequality and economic growth nexus in developing countries.

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APPENDIX

TABLE 1A - *List of Countries in each Income Group*

Low Income	Lower Middle Income
Afghanistan	Angola
Benin	Bangladesh
Burkina Faso	Bhutan
Burundi	Bolivia
Central African Republic	Cabo Verde
Chad	Cambodia
Democratic Republic of the Congo	Cameroon
Eritrea	Comoros
Ethiopia	Congo, Republic
Gambia	Cote d'Ivoire
Guinea	Djibouti
Guinea-Bissau	Egypt
Haiti	El Salvador
Korea, Democratic Republic	Eswatini
Liberia	Ghana
Madagascar	Honduras
Malawi	India
Mali	Indonesia
Mozambique	Kenya
Nepal	Kiribati
Niger	Kyrgyz Republic
Rwanda	Lao PDR
Sierra Leone	Lesotho
Somalia	Mauritania
South Sudan	Moldova
Syrian Arab Republic	Mongolia
Tajikistan	Morocco
Tanzania	Myanmar
Togo	Nicaragua
Uganda	Nigeria
Yemen	Pakistan
	Papua New Guinea
	Philippines
	Senegal
	Solomon Islands
	Sudan
	Timor-Leste
	Tunisia
	Ukraine
	Uzbekistan
	Vanuatu
	Vietnam
	Zambia
	Zimbabwe

Source: World Bank Income Group (2019).

TABLE 1B - *List of Countries in each Income Group*

Upper Middle Income	High Income	
Albania	Antigua and Barbuda	United Arab Emirates
Algeria	Australia	United Kingdom
Argentina	Austria	United States
Armenia	Bahamas	Uruguay
Azerbaijan	Bahrain	
Belarus	Barbados	
Belize	Belgium	
Bosnia and Herzegovina	Brunei Darussalam	
Botswana	Canada	
Brazil	Chile	
Bulgaria	Croatia	
China	Cyprus	
Colombia	Czech Republic	
Costa Rica	Denmark	
Cuba	Estonia	
Dominican Republic	Finland	
Ecuador	France	
Equatorial Guinea	Germany	
Fiji	Greece	
Gabon	Greenland	
Georgia	Hungary	
Grenada	Iceland	
Guatemala	Ireland	
Guyana	Israel	
Iran	Italy	
Iraq	Japan	
Jamaica	Kuwait	
Jordan	Latvia	
Kazakhstan	Lithuania	
Lebanon	Luxembourg	
Libya	Malta	
Malaysia	Netherlands	
Maldives	New Zealand	
Mauritius	Norway	
Mexico	Oman	
Montenegro	Palau	
Namibia	Panama	
Paraguay	Poland	
Peru	Portugal	
Romania	Puerto Rico	
Russian	Qatar	
Serbia	Republic of Korea	
South Africa	Saudi Arabia	
Sri Lanka	Seychelles	
St. Lucia	Singapore	
Suriname	Slovak Republic	
Thailand	Slovenia	
Tonga	Spain	
Turkey	Sweden	
Turkmenistan	Switzerland	
Venezuela	Trinidad and Tobago	

Source: World Bank Income Group (2019).

TABLE 1C - *List of countries by Fragility State Index*

Sustainable	Stable
Australia	Albania
Austria	Antigua and Barbuda
Belgium	Argentina
Canada	Bahamas
Denmark	Barbados
Finland	Brunei Darussalam
Germany	Bulgaria
Iceland	Chile
Ireland	Costa Rica
Luxembourg	Croatia
Netherlands	Cyprus
New Zealand	Czech Republic
Norway	Estonia
Portugal	France
Singapore	Greece
Slovenia	Greenland
Sweden	Grenada
Switzerland	Hungary
	Italy
	Japan
	Republic of Korea
	Kuwait
	Latvia
	Lithuania
	Malta
	Mauritius
	Mongolia
	Montenegro
	Oman
	Panama
	Poland
	Qatar
	Romania
	Slovak Republic
	Spain
	Trinidad and Tobago
	United Arab Emirates
	United Kingdom
	United States
	Uruguay

Source: Fund for Peace (2019).

TABLE 1D - *List of countries by Fragility State Index*

Waring		Alert
Algeria	Malaysia	Afghanistan
Angola	Maldives	Burundi
Armenia	Mexico	Cameroon
Azerbaijan	Moldova	Central African Republic
Bahrain	Morocco	Chad
Bangladesh	Mozambique	Cote d'Ivoire
Belarus	Namibia	Democratic Republic of the Congo
Belize	Nepal	Ethiopia
Benin	Nicaragua	Guinea
Bhutan	Papua New Guinea	Guinea-Bissau
Bolivia	Paraguay	Haiti
Bosnia and Herzegovina	Peru	Iraq
Botswana	Philippines	Kenya
Brazil	Russian	Korea, Democratic Republic
Burkina Faso	Rwanda	Liberia
Cabo Verde	Saudi Arabia	Libya
Cambodia	Senegal	Mali
China	Serbia	Mauritania
Colombia	Sierra Leone	Myanmar
Comoros	South Africa	Niger
Congo, Republic	Sri Lanka	Nigeria
Cuba	Suriname	Pakistan
Djibouti	Tajikistan	Somalia
Dominican Republic	Tanzania	South Sudan
Ecuador	Thailand	Sudan
Egypt	Timor-Leste	Syrian Arab Republic
El Salvador	Togo	Uganda
Equatorial Guinea	Tunisia	Venezuela
Eswatini	Turkey	Yemen
Fiji	Turkmenistan	Zimbabwe
Gabon	Ukraine	
Gambia	Uzbekistan	
Georgia	Vanuatu	
Ghana	Vietnam	
Guatemala	Zambia	
Guyana		
Honduras		
India		
Indonesia		
Iran		
Israel		
Jamaica		
Jordan		
Kazakhstan		
Kyrgyz Republic		
Lao PDR		
Lebanon		
Lesotho		
Madagascar		
Malawi		

Source: Fund for Peace (2019).

TABLE 1E - *Descriptive Statistics for Low-Income Countries*

VARIABLES	Obs.	Mean	Std Dev.	Min	Max
ln_GDP *per capita*	166	7.017	0.734	5.386	8.389
ln_GCF	166	22.016	1.785	18.408	27.500
Education	166	0.065	0.619	-2.178	1.349
GII	166	-0.351	1.147	-3.521	2.311

TABLE 1F - *Descriptive Statistics for High-Income Countries*

VARIABLES	Obs.	Mean	Std Dev.	Min	Max
ln_GDP *per capita*	271	9.618	0.964	7.493	11.604
ln_GCF	271	24.147	1.825	19.274	28.937
Education	271	0.507	0.141	-0.193	0.976
GII	271	0.348	0.265	-0.825	1.286

TABLE 1G - *Descriptive Statistics for Alert Countries*

VARIABLES	Obs.	Mean	Std Dev.	Min	Max
ln_GDP *per capita*	261	7.659	1.097	5.386	10.433
ln_GCF	261	22.735	2.071	18.408	28.873
Education	261	0.233	0.551	-2.178	1.349
GII	261	-0.126	0.984	-3.521	2.311

TABLE 1H - *Descriptive Statistics for stable countries*

VARIABLES	Obs.	Mean	Std Dev.	Min	Max
ln_GDP *per capita*	176	10.069	0.803	8.107	11.604
ln_GCF	176	24.232	1.760	20.393	28.937
Education	176	0.496	0.124	0.070	0.976
GII	176	0.391	0.196	-0.158	1.164