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THE IMPACT OF GENDER INEQUALITIES IN EDUCATION ON INCOME

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Abstract

Gender inequality in education, health, politics and employment is considered as a global problem. The development of human capital thanks to education is expected to increase efficient individuals in quantity and quality. It is stated that as the education rate of women and participation rate of the educated women in the labor force increase, the quality of the labor force and the rate of healthier and well-fed children will increase as well and consequently the human capital of the countries will have a positive effect on the economic development in the long term. In this study, the effect of gender inequality in primary and secondary education on income was investigated by panel data analysis for high and upper-middle-income countries in the period of 1998-2017. According to the results, the effect of capital accumulation and fertility on income was positive and the effect of gender inequality in education on income was negative. It is seen that gender inequality, especially in primary education, has significantly negative effect on income, and that inequality in primary education is transferred to the next education levels and it is important to eliminate inequality of opportunity in terms of income inequality and growth potential in the long term. Therefore, it is necessary to take into account the importance of long-term and stable policies, in particular in primary education, and to create the necessary arrangements and awareness to increase the education and job opportunities of women in order to eliminate inequality of opportunity in education.

Keywords: Education, Gender Inequalities, Income, Fixed Effect, Random Effect

1. Introduction

There are many factors that affect the economic growth and development. The researchers who consider education as one of the most important (Romer, 1986, 1990; Barro and Lee, 1993) revealed the fact that human capital is a crucial element in explaining the long-term economic growth. According to Lucas (1988), whereas the sustainable growth is an important result of labor force, education is regarded to be the main factor, which influences the human capital.

Education is a phenomenon that enables the development of human knowledge, skills and abilities. Education is regarded as a means to adapt to the changing and developing society and individuals. Human capital is expected to develop with the education of human beings, who

are considered as an element of economic growth and human capital. Therefore, it is believed that more efficient, effective and productive individuals will increase in quantity and quality.

The difference between the concept of sex and gender is that sex is an inborn phenomenon, but gender is a consequence. The concept of gender is an idea created by individuals, and it can vary extensively according to the way it is regarded in societies and cultures. In this respect, gender can be described as the differences that men and women face in different communities, cultures, regions and religions. Although gender inequality is known to manifest itself in different sectors or areas, the inequality in education, health, politics and employment is considered a global problem.

In this context, the fact that the right to education cannot be applied equally due to gender causes the countries not to increase the quality of human capital at the desired level. Consequently, economic development cannot be increased. It is stated that as the education rate of women rises, the quality of the workforce rises with the growth in the participation rate of educated women, the ratio of healthier and well-nourished children increases. Ultimately, the human capital of countries will have a positive effect on the economy in the long run.

According to Klasen (2002), who has on gender inequality in education, this inequality affects the human capital in the society and, therefore, countries experience serious economic difficulties. Klasen (2000) and Lutz and McGillivray (2007) asserted that gender inequality in education would directly and negatively influence economic growth since it decreases the average quality of human capital. It is suggested that education of women would lead increase in national income; and high level of income, in turn, would create more gender equality in different spheres of life in the society (Dollar and Gatti, 1999). In this respect, the relationship between gender equality and economic development is just like the relationship of “win-win”. According to this relationship, women have influence on economic development and the social gender equality in education and employment promote development. Therefore, the effect of high human capital which involves women and higher fertility on development will be much higher (Esquivel, 2017).

The issue of women education has been debated by many views such as westernization, modernization, and traditional approach. Women’s being deprived of right to education is considered to be a problem in many countries. Positive outcomes of women education show the necessity of studying the reasons of this problem. Gender inequality in education is measured by several variables and indices such as the rates of literacy among men and women, their schooling rates, rates of employment by their level of education, and their unemployment rates (Ozsoy and Atlama, 2009). Rates of literacy, enrolment in schools and time spent in school are also considered to be other indices (Hill and King, 1993).

In the historical process, expanding the knowledge and skills of citizens by encouraging investment in human capital to increase the level of growth has been highly emphasized by policymakers and countries. Studies have been carried out from past to present to fight gender inequality, and countries have been encouraged to eliminate it. For more than two decades, the goal of reducing gender inequality has held a prominent place in international organizations and in national strategy statements (UNDP, 2013). The leading studies in this regard include the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), the Millennium Development Goals (MDG3), the Beijing Declaration and Action Plan. Still, these studies could not produce the planned effect at the desired time, and the problem has extended until today. Although it is stated in research on education that the educational situation has improved in a global context, it is believed that the equality between the genders is not at the desired level despite the increasing schooling rate.

In this direction, the principal purpose of the study was to reveal the effect of gender inequality in primary and secondary education on income in terms of high and upper-middle income countries in the 1998-2017 period[1]. The rest of the paper is organized as follows. In the second part of the study, a summary of some studies on the subject was included, and then the data set, models and methodology to be applied in the analysis were introduced. Finally, results and suggestions reached in line with the findings obtained by evaluating the empirical findings were included.

[1] This article is based on the thesis titled "The Impact of Gender Inequalities Education on Income".

2. Literature review

The thought that human capital affects economic development and the existence of opinions that regard education as the main factor affecting human capital in this sense make education necessary. There are many studies stating the effect of gender inequality in education on income. Although these studies vary in terms of data, period, country and methodology, they have proved that inequality is related directly and indirectly to income and economic development.

Discussing the relationship of gender inequality in education with income and economic development with various country groups and methodology, Sadeghi (1995), Dollar and Gatti (1999), Klasen (2000, 2002), Klasen and Lamanna (2003), Lutz and McGillivray (2007 and 2015), Dahal (2011), Pervaiz *et al.* (2011) and Hakura *et al.* (2016) demonstrated that gender inequality has direct and indirect effects on economic development. As gender inequality in education affects human capital, inequality has a direct negative effect on income. Besides, gender inequality in education indirectly affects income as it affects the development of the population and investments. Sadeghi (1995) conducted to identify how the increase in per capita income is affected by gender inequality in school enrollment and literacy levels, and to find the effects of gender inequality on economic development in OPEC and EAC countries, found that as gender inequality in primary and/or secondary education decreased, per capita income increased.

Dollar and Gatti (1999), who studied gender inequality, obtained findings parallel to earlier studies in their research. However, they evaluated gender inequality as a function of regional factors, religious preferences, per capita income and civil liberties or economic policies.

Klasen (2000) found an inverse relationship between gender inequality and income as a result of fixed effects estimation for Sub-Saharan Africa, East and South Asia and Middle East countries. Klasen (2002) in a study on South Asia and Sub-Saharan Africa countries found that gender inequality in education hindered economic development. Klasen and Lamanna (2003) concluded that gender inequality in education adversely affected economic growth in the Middle East, North Africa and South Asia countries.

Lutz and McGillivray (2007), in their study investigating the relationship between development and gender inequality in Arab countries and Sub-Saharan Africa countries, pointed out that gender inequality at the literacy level had significant adverse effects. It was stated that women's not being educated affected the human capital level, and accordingly, inequality had a negative effect on economic development. Also, it was stated that gender inequality had a more substantial effect on economic development due to the greater inequality in Arab countries. Dahal (2011) stated in his study on Nepal that gender inequality in education would negatively affect per capita income significantly. Still, he drew attention to the fact that the economic development would accelerate, the population growth rate would slow down, the living standards would improve, and the quality of life would improve in countries with a large number of educated women.

Pervaiz *et al*. (2011) studied the negative impact of gender inequality in education in the context of Pakistan, and they concluded that labor growth, investment and openness of the economy positively affected economic development, and that gender inequality had a negative effect. Lutz and McGillivray (2015), in their study on Sub-Saharan Africa and Middle East countries, stated that gender inequality in primary and secondary education had a significant negative effect on income. Hakura *et al.* (2016) pointed out that there was a negative relationship between gender inequality and income growth in Sub-Saharan African countries, and that inequality was an obstacle for the development, and stressed that inequality had an adverse effect on income and income distribution.

In their study on the Millennium Development Goals and gender equality, which is among the studies that discuss gender inequality according to its effects on various economic and social indicators, Abu-Ghaida and Klasen (2002) stated that gender inequality affected malnutrition, child mortality rates and fertility rates. Knowles *et al.* (2002) have questioned whether gender inequality in education could create a break on economic development. According to the study covering Asian and African countries, it was stated that women's education had a significant positive effect on workforce productivity. Besides, it was noted that life expectancy was associated with health and would have an impact on the increase in productivity of the workforce.

Subrahmanian (2002) mentioned the contribution of women's education to motherhood and its effect on fertility and child mortality rates, and stated that educated women would raise healthy and well-nourished individuals.

The study of Klasen and Lamanna (2009), in which they examined to what extent gender inequality in education and employment affected development, differs from the study of Klasen (2000, 2002) in terms of the currency of the data. Seguino (2000) and Ahang (2014) pointed out that gender inequality in education supported inequality in wages, showing a different dimension of the negative effect, unlike other studies. They emphasized that as the gender inequality in education increased, there would be a difference in the wages of educated men and uneducated women, and that women with no education were mainly employed in the agricultural sector and received lower salaries.

In his study on the relationship between women's empowerment and economic development, Duflo (2012) emphasized that women's empowerment was closely related to economic growth, and stated that empowerment of women would eliminate inequality between women and men, and thus development would be positively affected. Ferrant (2015) investigates how gender inequality hinders economic and human development in low, lower middle, upper middle and high-income countries. According to the study, gender inequality may then explain differences in economic development and provides evidence of a vicious circle between gender inequality and long-term income. Tansel and Gungor (2016) stated that men's and women's education in Turkey would consistently have a positive and significant impact and they emphasized the fact that women's education would have a substantial effect on workforce productivity. In their study, Minasyan *et al.* (2019) report a statistically significant positive relationship between gender equality in education and economic growth. The results of Bertay *et al.* (2020)'s study which aimed to find out the effects of higher gender equality on economic growth revealed that gender inequality has close association with real economic outcomes. According to Evans *et al.* (2020), there is negative correlation between gender gaps and male educational attainment. Their results also showed that the countries with great gender gaps have poor performance on other measures of development such as life expectancy and GDP per capita. Matthew *et al.* (2020), in their research in Nigeria aiming at exploring the relationship among gender inequality, maternal mortality and inclusive growth in the country, reported the negative impact of gender inequality on inclusive growth.

3. Data and model specification

In this section, the data and model used to analyze the impact of gender inequality in education on income will be introduced.

3.1. Data

The impact of gender inequality in education on income was analyzed using annual data for 26 high and 11 upper-middle income countries for the period between 1998-2017[2]. In this context, the data applied in the study were obtained from World Bank Development Indicators, and the way they were used in the model is given in Table 1. The missing data in the specified period for primary and secondary education enrollment rates were completed by the linear interpolation method[3]. In the study, in parallel with the study of Lutz and McGillivray (2015), regarding the inequality data on primary and secondary education between genders, the situation where the female and male school enrollment rates were equal to each other was accepted as absolute equality (the value is equal to 1), and therefore, it was calculated by the ratio of female enrollment rates in primary and secondary education to the female enrollment rates and by subtracting the obtained value from 1. Among the empirical estimations of this study, are the commonly studied variables such as fertility rate, human capital, investment rate, openness to trade. These are

[2] The country names used in the analysis are given in Annex.

[3] The countries whose data are completed are as follows, respectively: Brazil, Colombia, Malaysia, Mexico, South Africa, Thailand and Turkey.

among the issues most widely dealt with by the research aiming to examine the influence of gender inequality on growth or income. We decided to focus on investment and fertility rate in the light of the studies by Dollar and Gatti (1999), Klasen (2002), Klasen and Lamanna (2003), Lutz and Ndikumana (2007) and, Lutz and McGillivray (2015). The study also concerned with the variables human capital as in Pervaiz *et al.* (2001), Esquivel (2017) and Klasen and Minasyan (2017) and openness as in Lutz and McGillivray (2015). Besides, the logarithms of income per capita and investment variables were taken and included in the analysis. In the study, analyses could not be made for low-middle and low-income countries due to the effects of inequality in higher education on income and the lack of data.

Table 1. Variables used in the study and their sources

Variable	Description
lny	GDP per capita (at 2010 Constant Prices, US $).
lninv	Gross fixed capital formation (2010 constant prices, US $).
flabor	The ratio of female workforce over the age of 15 to the total workforce.
fertility	Total fertility rate (number of births per woman).
openness	The ratio of total export and import to GDP.
fpri_enrol	The gross enrollment rate in primary education (The ratio of the total enrollment rate for men and women, regardless of age, to the population in the age group corresponding to the officially shown education level).
fsec_enrol	The gross enrollment rate in secondary education (the ratio of the total enrollment rate for women and men, regardless of age, to the population in the age group corresponding to the officially shown education level).
democ	Democracy index between 1 and 10

3.2. Model specification

The models in this study were created based on the studies of Knowles *et al.* (2002), Klasen and Lamanna (2003) and Lutz and McGillivray (2015) investigating the relationship between gender inequality in education and economic development. The models created in the study to determine the effect of gender inequality on income at the primary education level (Model 1a) and then at the secondary education level (model 2a) are given below. Besides, to determine the impact of democracy, it was expanded by adding the democracy variable to the models (Models 1b and 2b).

Model 1a: $$lny_{i,t} = \beta_0 + \beta_1\, lninv_{i,t} + \beta_2 flabor_{i,t} + \beta_3\, fertility_{i,t} + \beta_4\, opennes_{i,t} + \beta_5 fpri\_enrol_{i,t} + \beta_6\, pri\_gap_{i,t} + e_{i,t}$$

Model 1b: $$lny_{i,t} = \beta_0 + \beta_1\, lninv_{i,t} + \beta_2 flabor_{i,t} + \beta_3\, fertility_{i,t} + \beta_4\, opennes_{i,t} + \beta_5 fpri\_enrol_{i,t} + \beta_6\, pri\_gap_{i,t} + \beta_7 democ_{i,t} + e_{i,t}$$

Model 2a: $$lny_{i,t} = \beta_0 + \beta_1\, lninv_{i,t} + \beta_2 flabor_{i,t} + \beta_3\, fertility_{i,t} + \beta_4\, opennes_{i,t} + \beta_5 fsec\_enrol_{i,t} + \beta_6 \mathrm{sec}\_gap_{i,t} + e_{i,t}$$

Model 2b: $$lny_{i,t} = \beta_0 + \beta_1\, lninv_{i,t} + \beta_2 flabor_{i,t} + \beta_3\, fertility_{i,t} + \beta_4\, opennes_{i,t} + \beta_5 fsec\_enrol_{i,t} + \beta_6 \mathrm{sec}\_gap_{i,t} + \beta_7 democ_{i,t} + e_{i,t}$$

Here*: i=1, 2…..N* represents the cross-section units, *t=1, 2…..T* indicates time, and $e_{i,t}$ shows error term with zero mean and constant variance.

4. Methodology

It is known that unobservable unit effects can occur in each unit with the use of panel data. If effects are treated as a random variable, such as an error term, there are *"random effects";* if each cross-section is treated as an estimated parameter for the observation, there are *"fixed effects."* In this section, fixed and random effects methods will be introduced.

4.1. Fixed effects model

In the fixed effects (FE) model, the differences in the behavior of the units are presented with the differences in the fixed term. In this model, the slope coefficients are assumed to be constant. The constant characterization here indicates that the coefficient can vary according to units, but is constant over time. In the FE model, it is accepted that unobserved individual effects are related to the explanatory variables in the model (Sayilgan and Suslu, 2011). For instance, panel data studies conducted for a group of country unions such as OECD or country groups formed by the geographical assignment are examined applying the fixed effects model (Erlat, 2014). The structure of the fixed effects model is as follows:

$$y_{it} = \bar{\beta} + \mu_i + \beta_1 X_{1it} + \cdots + \beta_k X_{kit} + e_{it} \qquad i = 1,2,\ldots.,N \; ve \; t = 1,2,\ldots.,T$$

Here $\bar{\beta}$ shows the mean constant term and the difference from the mean constant term μ_i, for the *i* section (Toramanoglu and Gormus, 2018). The most critical assumptions of the fixed effects model are that the independent variables and the unit effect are not correlated with the error term, there are no multiple linear connections between the independent variables, the conditional variances are fixed, and the conditional covariances are zero (Yerdelen, 2012). The model containing only unit or only time effect is defined as a one-way model, and the model, including both unit and time effect, is defined as a two-way fixed effect model.

4.2. Random effects model

If the units in the sample are chosen randomly throughout the data creation process, the differences between units are random. Suppose the cross-sectional dimension is taken from a large main mass randomly; in that case, random effects occur, and the structure of the random effects model is expressed as follows:

$$y_{it} = \beta_0 + \beta_1 X_{1it} + \cdots + \beta_k X_{kit} + \mu_i + e_{it} \qquad i = 1,2,\ldots.,N \; ve \; t = 1,2,\ldots.,T$$

Key assumptions of the RE model: The panel data model is correctly defined, it is studied with a random sample taken from the cross-section, there is no correlation between unit effects and explanatory variables, there is no exact multi-linear connection, the unit error element and residual error element are fixed variances (homoscedastic) and error terms are not autocorrelated (Yerdelen, 2012). Therefore, the most crucial difference between the FE model and the RE model is that, while in the RE model, the correlation between the unit effects and the explanatory variables are assumed to be zero (E($\mu_i|X_i$)=0), in the fixed effects model, the correlation is allowed to be different from zero (E($\mu_i|X_i$)≠0). The random effects model that includes only unit or only time effect is defined as one-way. In contrast, the model that consists of both unit and time effects is defined as a two-way random effects model.

4.3. Hausman test

In general, if the cross-section dimension is taken randomly from a large population, estimation should be made with the random effects model. However, externality, in other words, the assumption E($\mu_i|X_i$=0) is significant for the consistency of the RE model, and whether this assumption is valid should be tested. This is because, if the externality assumption cannot be achieved, the feature of the RE model is distorted. However, the externality assumption is not so important for the FE model. In this case, the Hausman test (HT) can be used to determine the model with better efficiency. HT statistics is in the form of

$$\text{HT}=s'[Cov\ (s)]^{-1}s \sim \chi_g^2$$

The *HT* statistics is asymptotically distributed χ^2 with degrees of freedom equal to the number of parameters (= k). In the Hausman test, the null hypothesis "*E($\mu_i|X_i$)=0;* no correlation

between individual effects and explanatory variables" is tested. If the H_0 hypothesis is accepted, the consistent and effective RE model, if rejected, still compatible FE model must be used.

4.4. Heteroscedasticity

Changing variance means that the variance of the error term is different for all sections due to the changes in the independent variable, and its covariances are not equal to zero. The problem of changing variance in the econometric analysis is mostly a difficulty that occurs in the cross-sectional analysis.

The assumption that "conditional variances are constant and conditional covariances are zero" can be distorted since the conditional and unconditional variance matrices are sometimes not equal to each other in the FEM model. Even if the conditional and unconditional variance matrices are similar, occasionally the unconditional variance matrix is not constant. In the REM model, on the other hand, $E(v_i v_i' | X_i)$, may not be constant (($E(v_i v_i' | X_i) \neq (v_i v_i')$), and the error element may be distorted due to its variance that changes over time (Yerdelen, 2012).

LM test statistics developed by Greene (2008) can be used to test whether there is a variance problem in error terms in both FE and RE models. The test statistics is as follows:

$$LM_h = \frac{T}{2}\sum_{i=1}^{N}\left[\frac{\hat{\sigma}_{\varepsilon i}^2}{\hat{\sigma}_{\varepsilon}^2} - 1\right]^2 \sim \chi^2_{(N-1)}$$

During the test process, the hypotheses are "$H_0: \hat{\sigma}_{\varepsilon 1}^2 = \cdots = \hat{\sigma}_{\varepsilon N}^2 \; and \; H_a: \hat{\sigma}_{\varepsilon i}^2 \neq \hat{\sigma}_{\varepsilon j}^2 \; at \; least \; one$". If H_0 is accepted, it is decided that there is a constant variance; if it is rejected, there is a variance problem (Erlat, 2014).

4.5. Autocorrelation

In other words, if the error term of any observation affects the error term of another observation, the autocorrelation problem exists. If the estimation is made by neglecting autocorrelation, since the parameters are consistent but not effective, *t* and *F* statistics are deviated due to standard errors.

In this study, the existence of autocorrelation for FE and RE models were investigated with Baltagi and Li (1995) LM_ρ and Baltagi and Li (1991, 1995) $LM_{\mu\rho}$tests, respectively. *LM* test statistics are as follows (Erlat, 2014):

$$LM_\rho = \frac{NT^2}{T-1}\left[\frac{\sum_{i=1}^{N}\sum_{t=2}^{T}\tilde{\varepsilon}_{it}\tilde{\varepsilon}_{i,t-1}}{\sum_{i=1}^{N}\sum_{t=1}^{T}\tilde{\varepsilon}_{it}^{\,2}}\right]^2 \sim \boldsymbol{\chi_1^2}$$

$$LM_{\mu\rho} = \frac{NT^2}{2(T-1)(T-2)}[E^2 - 4EF + 2TF^2] \sim \boldsymbol{\chi_2^2}$$

The test hypotheses are "$H_0: \rho = 0$: *no autocorrelation*" for the FE model and "no autocorrelation due to individual effects and error terms" $H_0: \delta_\mu^2 = 0, \rho = 0;$ for the RE model. If the H_0 hypothesis is rejected in both test processes, it is decided that there is an autocorrelation problem.

4.6. Cross-section dependency

Testing the cross-section dependency (CSD) between countries is one of the critical issues in the panel study (Gocer *et al.* 2012). CSD is when the shock that occurs in one country at any time affects another country then or in the future. It is essential to determine whether the shock affecting a country affects other countries or not in terms of determining the appropriate test and prediction methods. Considering the high level of globalization today, the highly integrated

structures of countries make it essential to consider cross-section dependency in the empirical analysis (Nazlioglu *et al.* 2011).

Cross-section dependency in panel data analysis can be investigated with Breusch-Pagan (1980) CD_{LM} in case of *T>N*, or when $N > T$ or $T > N$, with Pesaran (2004) CD_{LM} test. Breusch-Pagan (1980) LM statistics can be calculated as follows:

$$LM = T \sum_{i=j}^{N-1} \sum_{j=i+1}^{N} \rho_{ij}^2 \sim \chi^2_{(N(N-1)/2)}$$

Here, ρ_{ij} is the simple correlation coefficient between the residues obtained from the estimation of each equation using the least-squares method. The *LM* test is asymptotically of chi-square distribution with $N(N-1)/2$ degrees of freedom. However, this test cannot be used when $N \to \infty$. To overcome this difficulty, Lagrange multiplier statistics, developed by Pesaran (2004), is applied in cases where $N > T$ or *T*> N (Nazlioglu *et al.* 2011). Pesaran (2004) CD_{LM} statistics is calculated as follows:

$$\mathrm{CD_{LM}} = \left(\frac{2T}{N(N-1)}\right)^{1/2} \sum_{\mathrm{I}=1}^{N-1} \sum_{J=\mathrm{I}+1}^{N} \hat{\rho}_{ij}$$

CD_{LM} test is *N(N-1)/2* when *N>T* and *N(0, 1)* distributed when *N*→∞ and *T*→∞. In these test processes, the hypotheses are "$H_0 = Cov\ (u_{it}u_{jt})$*=0; no cross section dependency"* and "$H_a = Cov\ (u_{it}u_{jt})$*≠0; cross section dependency".* If the H_0 hypothesis is accepted as a result of the test, it is assumed that there is no cross-sectional dependency between sections.

4.7. Robust estimators

If the model has a varying variance, autocorrelation and/or cross-section dependency, the variance-covariance matrix of the error term is not equal to the unit matrix, and the efficiency is affected. In other words, the standard errors, *t* and *F* statistics, R^2 and the validity of the confidence intervals are affected. Thus, robust predictions should be performed with appropriate methods if one or more of the situations mentioned exist.

Robust estimators are applied to finding reliable results in the case of non-homogeneous distribution of safe observations in the data set and to reduce the effect of deviating values. In this study, estimation was made using the Period SUR-PCSE (Panel Corrected Standard Errors) correction method developed by Beck and Katz (1995), which produces robust standard errors due to varying variance, autocorrelation and the presence of cross-section dependency, and corrects panel standard errors.

5. Findings and discussions

In this part of the study, pre-test results of the models created to determine the effect of gender inequality in primary and secondary education on income for high and upper-middle income countries would be included. In the study, it was concluded that the random effects model would be suitable since the data were obtained from a large population randomly, and the tests were designed considering this situation.

F, LM and Honda tests tested the existence of unit and time effects for high-income countries, and the following results were reached respectively: It was determined that there are both unit and time effects in Model 1a and Model 1b. Model 2a and Model 2b have both unit and time effects according to *F* and Honda tests, unit and time effects for Model 1a according to *LM* test and only unit effects for Model 2b. Hausman test was performed to control the externality assumption (E($\mu_i|X_i$=0)) required for the consistency of the random effects model, and the null hypothesis was accepted because the probability value was higher than the critical value (1%). In other words, it was decided that the random effects model was more effective than the fixed

effects model. Therefore, it was concluded to estimate with two-way random effects for Model 1a, Model 1b and Model 2a, and one-way random effects for Model 2b (See Table 2).

The existence of variance, autocorrelation and cross-section dependence in random effects models was examined to select the robust estimator, and test results are given in Table 2. Greene (2008) LM_h and Baltagi and Li (1991, 1995) $LM_{\mu\rho}$tests were performed to test the existence of variance and autocorrelation problems, respectively, and the hypothesis that variance and autocorrelation did not exist in the models was rejected. On the other hand, cross-section dependency Pesaran (2004) CD_{LM} test was considered, and according to the test statistics, H_0 hypothesis was rejected. Thus, it was determined that horizontal cross-section dependency was present. Therefore, due to the existence of varying variance, autocorrelation and cross-section dependence in the models, estimates were made by correcting panel standard errors with the PCSE method.

Table 2. Pre-test results for high-income countries

Test	Model 1a		Model 1b		Model 2a		Model 2b	
	Statistic	p-val	Statistic	p-val	Statistic	p-val	Statistic	p-val
$F_{individual}$	975.79	0.00	826.78	0.00	908.41	0.00	804.48	0.00
F_{period}	1700.68	0.00	1431.94	0.00	1564.99	0.00	1375.83	0.00
$F_{indvidual+period}$	4.83	0.00	4.42	0.00	3.95	0.00	3.54	0.00
$LM_{individual}$	4432.12	0.00	3581.35	0.00	4199.76	0.00	3625.24	0.00
LM_{period}	6.21	0.01	4.60	0.03	1.85	0.03	2.35	0.13
$LM_{individual+period}$	4438.33	0.00	3585.95	0.00	4203.20	0.00	3627.58	0.00
$Honda_{individual}$	66.57	0.00	59.84	0.00	64.81	0.00	60.21	0.00
$Honda_{period}$	2.49	0.01	2.14	0.02	1.85	0.03	1.53	0.06
$Honda_{individual+period}$	34.53	0.00	30.99	0.00	33.33	0.00	30.87	0.00
Hausman	9.37	0.15	19.71	0.01	11.42	0.08	19.43	0.01
Heteroscedasticity: LM_h	292.25	0.00	392.01	0.00	348.68	0.00	409.03	0.00
Autocorrelation: $LM_{\mu\rho}$	4462.43	0.00	3596.28	0.00	4221.23	0.00	3639.51	0.00
CSD: Pesaran CD	8.11	0.00	7.33	0.00	6.64	0.00	5.78	0.00

The existence of unit and time effects for upper-middle income countries was tested with *F, LM* and Honda tests, and it was found that both unit and time effects were present in all models. Hausman test was performed to control the assumption of externality (E($\mu_i|X_i$=0)) necessary for the consistency of the random effects model. The null hypothesis was rejected since the probability value was less than the critical value (1%). It was determined that the fixed effects model that allowed the relationship between individual effects and explanatory variables in all the models was more effective than the random effects model. Thus, it was determined to make estimations with the two-way fixed effects model in all models (See Table 3).

The existence of variance, autocorrelation and cross-section dependence in random effects models was investigated to select the robust estimator, and test results are given in Table 3. Greene (2008) LM_h and Baltagi and Li (1995) LM_ρtests were performed to test the existence of varying variance and autocorrelation problems, respectively, and the hypothesis that there is no variance and autocorrelation in the models was rejected. On the other hand, the Breusch-Pagan (1980) CD_{LM} test was examined, and the H_0 hypothesis was rejected according to the test statistics, and it was concluded that horizontal cross section dependency was present. Therefore, due to the existence of varying variance, autocorrelation and cross-section dependence in models, estimates were made by correcting panel standard errors with the PCSE method.

Table 3. Pre-test results for upper middle-income countries

Test	Model 1a		Model 1b		Model 2a		Model 2b	
	Statistic	p-val	Statistic	p-val	Statistic	p-val	Statistic	p-val
$F_{individual}$	107.69	0.00	104.53	0.00	78.28	0.00	68.52	0.00
F_{period}	156.04	0.00	150.40	0.00	147.66	0.00	133.50	0.00
$F_{indvidual+period}$	9.65	0.00	10.14	0.00	10.53	0.00	11.16	0.00
$LM_{individual}$	543.09	0.00	399.22	0.00	322.13	0.00	206.15	0.00
LM_{period}	68.21	0.00	68.66	0.00	14.03	0.00	10.69	0.00
$LM_{individual+period}$	611.30	0.00	467.88	0.00	336.16	0.00	216.83	0.00
$Honda_{individual}$	23.30	0.00	19.98	0.00	17.95	0.00	14.36	0.00
$Honda_{period}$	8.26	0.00	8.29	0.00	3.75	0.00	3.27	0.00
$Honda_{individual+period}$	15.78	0.00	14.13	0.00	10.85	0.00	8.81	0.00
Hausman	51.06	0.00	71.83	0.00	87.38	0.00	96.48	0.00
Heteroscedasticity: LM_h	92.40	0.00	100.97	0.00	79.35	0.00	82.66	0.00
Autocorrelation: LM_ρ	134.86	0.00	134.80	0.00	139.22	0.00	139.45	0.00
CSD:Breusch-Pagan LM	289.44	0.00	232.08	0.00	282.54	0.00	288.09	0.00

Estimation results for high and middle-income countries are given in Table 4 and Table 5. The findings obtained can be summarized as follows: It was determined that fixed capital investments and fertility rate had a positive and significant effect on income in high and middle-income countries, that the increase in foreign trade volume had a positive and significant impact on income in high-income countries, and a negative and significant effect in middle-income countries, unlike high-income countries. The findings are consistent with the theory and results of Dollar and Gatti (1999), Klasen (2002), Klasen and Lamanna (2003), Lutz and Ndikumana (2007) and Lutz and McGillivray (2015). On the other hand, the finding regarding openness was negative and significant, consistent with the findings of Lutz and McGillivray (2015). The difference in the effect of foreign trade volume on income by country groups is related to the foreign trade structure. The high share of imports in upper-middle income countries while the share of exports is high in the foreign trade volume in the high-income group can be considered as a reason for the differentiation of the effect.

Table 4. Estimation results for high-income countries

Variables	Model 1a		Model 1b		Model 2a		Model 2b	
	Coef.	p-val	Coef.	p-val	Coef.	p-val	Coef.	p-val
lninv	0.4266***	0.00	0.4086***	0.00	0.4110***	0.00	0.3930***	0.00
flabor	0.0057	0.39	0.0066	0.28	0.0039	0.57	0.0048	0.45
fertility	0.1878***	0.00	0.2161***	0.00	0.1879***	0.00	0.2190***	0.00
opennes	0.0032***	0.00	0.0031***	0.00	0.0031***	0.00	0.0030***	0.00
fpri_enrol	-0.0018	0.19	-0.0015	0.25	-	-	-	-
fsec_enrolf	-	-	-	-	0.0020***	0.01	0.0020***	0.00
pri_gap	-1.9748***	0.00	-1.8427***	0.00	-	-	-	-
sec_gap	-	-	-	-	0.4250**	0.07	0.3913*	0.08
democ	-	-	0.0281***	0.00	-	-	0.0294***	0.00
c	-0.9692	0.18	-0.9037	0.18	-0.8945	0.21	-0.8199	0.21
F	534.80	0.00	490.37	0.00	527.68	0.00	486.26	0.000
R2	0.862		0.870		0.861		0.869	
$\overline{R^2}$	0.861		0.868		0.859		0.867	

Note: ***, **, * indicate significance levels at the 1%, 5% and 10%.

It was determined that the increase in the female workforce had a positive but statistically insignificant effect on income in both country groups as expected. The findings obtained are consistent with the theory and the findings of Pervaiz *et al.* (2011), Esquivel (2017), Klasen and Minasyan (2017). While the effect of primary education enrollment rates on income is statistically insignificant in both country groups, the effect is negative in high-income countries and positive in upper-middle-income countries. While enrollment rates in secondary education have a positive impact in both country groups, the effect is statistically significant only in high-income countries. Gender inequality in primary education was found to have a significantly negative effect on income, and a statistically significant effect in high-income countries, but insignificant in upper-middle income countries. It is seen that the inequality in primary education will be transferred to later education levels. Therefore, it is crucial to eliminate the inequality of opportunity in terms of income inequality and growth potential in the long term. The effect of inequality in primary education on income is consistent with the theory, and the findings of Hill and King (1995), Lutz and McGillivray (2015).

While the effect of inequality in secondary education on income in high-income countries has a positive and significant impact on high-income countries, it has a negative but statistically insignificant effect in upper-middle income countries. It is important that the specified variable is not statistically significant, but that its indicators are consistent with theoretical expectations and the findings of Hill and King (1995) and Lutz and McGillivray (2015).

Table 5. Estimation results for upper-middle income countries

Variables	*Model 1a*		*Model 1b*		*Model 2a*		*Model 2b*	
	Coef.	*p-val*	*Coef.*	*p-val*	*Coef.*	*p-val*	*Coef.*	*p-val*
lninv	0.1932***	0.01	0.1850***	0.01	0.1799***	0.00	0.1769***	0.01
flabor	0.0120	0.30	0.0110	0.33	0.0082	0.47	0.0073	0.51
fertility	0.3513***	0.00	0.3622***	0.00	0.3825***	0.00	0.3842***	0.00
opennes	-0.0016	0.16	-0.0019*	0.09	-0.0020*	0.08	-0.0021*	0.07
fpri_enrol	0.0004	0.86	0.0001	0.95	-	-	-	-
fsec_enrolf	-	-	-	-	3.27E-05	0.98	-0.0006	0.67
pri_gap	-0.3735	0.66	-0.2833	0.72	-	-	-	-
sec_gap	-	-	-	-	-0.3338	0.21	-0.2660	0.28
democ	-	-	-0.0079	0.27	-	-	-0.0083	0.23
c	3.0646*	0.08	3.3944**	0.05	3.5334**	0.03	3.7697**	0.02
F	175.11	0.00	176.13	0.00	183.63	0.00	183.90	0.00
R2	0.971		0.972		0.972		0.973	
$\overline{R^2}$	0.965		0.966		0.967		0.968	

Note: ***, **, * indicate significance levels at the 1%, 5% and 10%.

Besides, it can be said that democracy that develops after a certain income level has a positive and significant effect on both inequality and income. The finding obtained is consistent with the theory, and the finding of Lutz and McGillivray (2015). Contrary to expectations, the impact of democracy in upper-middle income countries is insignificant. The finding obtained is consistent with the results of Lutz and Ndikumana (2007).

6. Conclusion

Education is a phenomenon that enables the development of human knowledge, skills and abilities. Failure to use the right to education equally according to gender may cause the countries not to increase the quality of human capital at the desired level. Consequently, economic development cannot be increased. In the historical process, expanding the knowledge and skills of citizens by encouraging investment in human capital to increase the level of growth has been highly emphasized by policymakers and countries. The fact that countries' educational

expenditures are increasing day by day can be seen as a consequence of this. Therefore, it is essential to try to provide equal opportunities in education by attaching importance to education policies and to supporting disadvantaged groups and especially women.

In this study, the effect of gender inequality in primary and secondary education on income was investigated by panel data analysis for high and upper-middle income countries in the 1998-2017 period. Due to the lack of consistency of the data on primary, secondary and higher education in low and low-middle income countries, the study could not investigate implications of gender inequality in education across these countries. On the other hand, according to our findings, the effect of gender inequality in education on income is found to be negative. It is observed that gender inequality in primary education has a significant negative effect on income, and that inequality in primary education will be transferred to later education levels. Moreover, it is crucial to eliminate opportunity inequality in terms of income inequality and growth potential in the long term. Therefore, it is necessary to consider the importance of long-term and stable policies especially in primary education and to create the required regulations and awareness to eliminate the inequality of opportunity in education and to increase the education and job opportunities of women. Thus, examining inequality from all aspects is a critical issue in terms of long-term policies.

The level of democracy has significant direct and indirect effects on education and income. As democracy develops, women's higher access to educational opportunities directly reduces gender inequality. Besides, the improvement in the democracy level is essential in terms of having positive effects on economic development thanks to the ability of the executive power to have accountability mechanisms for social and economic activities, its success in managing social conflicts and ensuring political stability, and the predictable and stable environment it will create by encouraging capital accumulation and investment. In this context, it should be ensured that the necessary mechanisms for the healthy development of democracy are established, and their functionality should be increased. Besides, the positive effects of democracy in high-income countries as opposed to the negative effect on upper-middle-income countries should be taken into account to develop alternative policies to reverse the impact of democracy on income in upper-middle income countries.

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Annex

The country names used in the analysis are as follows: **High-Income Countries:** Austria, Chili, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Israel, Italy, Latvia, Lithuania, Netherland, New Zeeland, Norway, Slovak Republic, Slovenia, Spain, Sweden, Swiss, United Kingdom, Poland and Portugal. **Upper Middle-Income Countries:** Argentina, Brazil, Bulgaria, Colombia, South Africa, Malaysia, Mauritius, Mexico, Romania, Thailand and Turkey.