The Effect of Global Gender Inequality and Female Employment on The Economic Growth: Panel ARDL

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Abstract

Purpose: This study aims to analyse whether global gender inequality and female employment have any short-term and long-term effects on economic growth in Organization for Economic Cooperation Development (OECD) countries and to explore the existence and direction of causality between global gender inequality, women's employment, and economic growth in OECD countries during the study period.

Design/methodology/approach: In the study, the dependent variable is the person Per Capita Growth, and the dependent variables are the Global Gender Gap Index (GGGI) and Female Labour Force Participation Rate (KIKO). The data set of the variables consists of the period 2006-2023. The relationship between the variables was tested with the Pooled Mean Group (PMG) Panel ARDL test. In addition, the Pairwise Dumitrescu Hurlin (PDH) Panel Causality test was used to measure homogeneous or heterogeneous causality between the variables.

Findings: According to the results of the PMG Panel ARDL test; while it was determined that only the KIKO data affected Economic Growth in the short term, it was concluded that both independent variables affected the dependent variable in the long term. According to the PDH Panel Causality Test, it was determined that there is a bidirectional heterogeneous causality relationship between gender inequality and economic growth. While women's employment is the heterogeneous cause of economic growth, economic growth is the homogeneous cause of women's employment. Finally, there is also a bidirectional homogeneous causality between women's employment and gender inequality.

Research limitations/implications: According to the results of the Pooled Mean Group Panel ARDL test; a 1% increase in the GGGI independent variable causes a decrease of approximately 2.83% in the dependent variable PERGDP in the long term. On the other hand, a 1% increase in the KIKO independent variable causes an increase of approximately 0.05% in PERGDP in long term. the short-term coefficients are examined as a group average, the KIKO independent variable affects PERGDP in the short term, while the GGGI independent variable does not affect PERGDP in the short term.

Social Implications: When the analysis results obtained in this report are evaluated, they provide extremely strategic results for policymakers in the decisions they will make. The effect of gender inequality on economic growth allows the evaluation of gender differences in economic, educational, health, and political outcomes between women and men based on existing data. On the other hand, this study can contribute to both the contribution to national income and social and gender equality, considering the contribution that the increase in women's employment rate will provide to the country's economy in both the short and long term.

Originality / Value: In line with its purpose, this study is thought to fill the gap in the literature in terms of the period it covers, the countries, the variables used and the method chosen.

Keywords: Gender Inequality, Women's Employment, Economic Growth, Panel ARDL, Global Gender Gap Index.

Introduction

Human capital is one of the most important production factors of a country. It plays a highly strategic role in sustainable economic growth. Providing competitive advantage, optimal use of human resources, and utilizing the

efficiency of human capital will be possible by ensuring gender equality with social responsibility awareness.

Gender equality is vital for economic growth and sustainable development. Gender equality is included in both the International Labour Organization's decent work agenda and the UNDP's Sustainable Development Goals (SDGs) (ILO, 2024). This goal is specifically dedicated to achieving gender equality and the empowerment of women and girls, which is set as Goal 5 of the SDGs.

In addition to economic injustice and inequality, there are also gender-based inequalities. Despite the rapid increase in women's employment, significant gender differences have continued in the labour market. The employment rates of women have remained lower than men. Women and men are seriously discriminated against by being employed in different occupations in different sectors and different occupational groups. It has also been observed that although women and men are often at the same level in terms of working hours, their annual earnings are at different rates. This situation shows that individuals doing the same job receive different levels of wages. In addition to gender discrimination in paid jobs, gender discrimination against women continues in terms of daily unpaid labour performed at home (Gornick, 1999). The participation of women, who make up almost half of the population, in the workforce will lead to a more optimal use of the country's economic resources. On the other hand, it is possible to say that the added value that women will create will also make very positive contributions to economic growth.

Research Questions
This study sought answers to the following questions in OECD countries between 2006-2023:
1. Is there any relationship between global gender inequality and economic growth in both the short and long term?
2. Is there any relationship between women's employment and economic growth in both the short and long term?
3. Is there any causal relationship between global gender inequality, women's employment, and economic growth? If so, what is the direction of this causality?

Research Objectives
1. To Examine the relationship between Global Gender Inequality and Economic Growth
o To analyse whether global gender inequality impacts economic growth in OECD countries in both the short and long term
2. To investigate the relationship between Women's Employment and Economic Growth
o To assess the effect of women's employment on the economic growth of OECD countries in both the short and long term
3. To determine the causal relationships between variables
o To explore the existence and direction of causality between global gender inequality, women's employment, and economic growth in OECD countries during the study period.

These objectives aim to provide a comprehensive understanding of how gender dynamics and employment patterns influence economic outcomes, thereby guiding policies aimed at promoting inclusive and sustainable economic growth.

It is thought that this study will contribute to the literature as a result of the answers it will give to the above research questions in terms of the period covered, countries, variables, and methods used. Therefore, in this study, the theoretical background of the study was first given. Then, a literature review on the relevant field was included. The data set, the methodology used, the method, and the findings were discussed.

Gender Inequality, Women's Employment and Economic Growth
Obtaining optimal efficiency from labour, which is one of the most important elements of production factors, is one of the most important building blocks of economic growth. Therefore, although men are in the majority in terms of participation in the labour force, the high rate of female participation in the labour force is equally important. Minimizing gender discrimination in the labour force and the efficient use of production factors with the participation of women, the other large majority of the population, in the labour force will contribute to economic growth.

In addition to fulfilling their traditional duties (house cleaning, cooking, giving birth to children, raising them, etc.) for women, who constitute a significant portion of the country's population, earning money by working in the market became widespread with the industrial revolution. The labour that was wasted in agriculture

with the transition to mass production during the industrial revolution later shifted to service sectors such as accounting, cleaning, and secretarial work. Thus, women's participation in the labour market as labour was also ensured. Subsequently, they began to take part in various other sectors (manufacturing, industry, etc.).

A significant increase in the role of women in the labour market was observed after World War II. During the years of war, since the majority of men were at war, the wages of the male workforce were higher than in previous periods and their numbers decreased, therefore, women's labour force was needed. In addition, since there were no men at home, there was not much housework and women had difficulty making ends meet during the war period and due to need of income women entered business life (Özer and Biçerli, 2003). Although sex distinction is common in many societies, for women to take care of housework and men to earn money by working outside, situation could not be eliminated. Today, a sexist attitude is displayed towards many occupational groups and it is continued to be accepted as 'women's work – men's work'.

Equality of opportunities and treatment in the labour market plays a critical role in a decent life. Despite this, when evaluated globally, women still face many obstacles in finding jobs, reaching decision-making positions in certain sectors as they prefer. This horizontal and vertical gender segregation of employment leads to a wage gap between women and men.

One of the indicators expressing gender inequality is the Global Gender Gap Index. The Global Gender Gap Index was first introduced by the World Economic Forum in 2006 to benchmark progress toward gender parity across four dimensions: economic opportunities, education, health, and political leadership (Economic Participation and Opportunity, Educational Attainment, Health and Survival, and Political Empowerment). The index focuses on measuring equality between women and men. Full equality means that the index value is equal to 1. The widening of the gap between women and men means that the index value is moving away from 1. As a result, the lower the index value, the higher the gap between women and men. It is the longest-standing index tracking the progress of numerous countries' efforts towards closing these gaps over time since its inception in 2006 (Pal et al., 2024). An increase in gender inequality in a country also affects the level of development of that country. While gender inequality is seen as an important development indicator, it also reflects the economic profile of that country. It is generally possible to say that countries with high gender inequality are developing countries that are lagging in terms of economic growth. Therefore, it can be said that countries with high gender inequality have lower economic growth figures.

Review of Literature

Table 1 below shows the studies conducted on the relevant subject. As examined, studies on economic growth, gender inequality, and women's employment have been handled with quite different analyses and different relationships in different periods. It is thought that this study will contribute to the literature in terms of the effect of women's labour force participation rate and gender inequality on economic growth.

Table 1. Research conducted in the relevant field

Research Imprint	Country/Region	Method	Results
Whitehouse (1992) Legislation and Labour Market Gender Inequality: An Analysis of OECD Countries	OECD (1974-1986)	Time series regression analysis and statistical analysis were performed	While gender equality measures are likely to make female participation in the labour market highly favourable, the relative and public employment pattern of total employment suggests that women are the most likely to achieve relatively high earnings.
Gornick (1999) Gender Equality in the Labour Market: Women's Employment and Earnings	Luxembourg, Denmark, Finland, Norway, Sweden, Spain, Belgium, France, Germany, Italy, Luxembourg, Netherlands, Australia, Canada, United Kingdom and USA	Variation analysis	As a result of the three different variation analyses applied, gender is a strong source of differentiation.

	(1989-1992)		
Özer & Bicerli (2003) Türkiye'de kadın işgücünün panel veri analizi Panel Data Analysis of Female Labour Force in Turkey	Türkiye (1988 – 2001)	Fixed effects and random effects are modeled with unit-specific fixed terms using restricted OLS regression.	In the models, it was concluded that female labour force participation is not directly sensitive to macro variables, but rather to micro variables in sociological dimensions.
Fortin (2005) Gender Role Attitudes and the Labour-market Outcomes of Women across OECD Countries	25 OECD (1990-1995-1999)	Survey	Non-egalitarian views were found to have the strongest negative association with female employment rates and the gender wage gap. The inevitable conflict between family values and egalitarian views is another obstacle on the path to gender equality in the labour market, taking the form of an internal conflict for many women.
Jütting et al. (2008) Measuring Gender (In) Equality: The OECD Gender, Institutions and Development Data Base	OECD (1990-2006)	Comparative Regression Analysis	The OECD Development Centre shows that there is a negative correlation between gender inequality and female labour force participation. The most important factor here is the low literacy rate among women.
Engelhardti et al. (2008) Fertility and women's employment reconsidered: A macro-level time-series analysis for developed countries, 1960–2000	France, West Germany, Italy, Switzerland, England and the USA (1960-2000)	Vector error correction model, time series, and Granger-causality tests	This is consistent with simultaneous movements of both variables brought about by common exogenous factors such as social norms, institutions, financial incentives, and contraceptive availability and acceptability. There is a negative and significant correlation until the mid-1970s and a nonsignificant or weaker negative correlation thereafter.
Dedeoglu (2012) Equality or Discrimination? Social State, Gender Equality Policies and Women's Employment in Turkey	Türkiye and AB countries	Situation analysis	Equality policies encourage women's employment and fail to provide equality to women in employment, and some norms have the effect of discouraging employed women from working.
Ince (2010) Women's Employment and Demand for Women's Labour The Example of Türkiye	Türkiye (1990-2007)	Regression Analysis using Generalized Method of Moments	It has been concluded that the determined variables have an impact on the demand for female labour.
Kabeer (2005) Gender equality and women's empowerment: A critical analysis of the third millennium development goal	192 member countries of the UN (1990-2015)	Situation analysis	It is explained that the policies determined in the Millennium Development Goals Plan are inadequate for Gender Equality and women's empowerment, contrary to the achievement of the goals.

Hegewisch & Gornick (2012) The impact of work-family policies on women's employment: a review of research from OECD countries	Developed countries such as EU countries, the USA, Japan and Transition countries	Comparative Current Situation Analysis	It discusses the growing literature on the negative and unintended consequences of work-family policies for gender equality and highlights existing knowledge gaps by reviewing the research literature on leave policies, flexible and/or alternative work arrangements, and childcare supports.
Nıeuwenhuıs et al. (2012) Institutional and Demographic Explanations of Women's Employment in 18 OECD Countries, 1975 – 1999	OECD (1975-1999)	Analysis with Multilevel Logistic Regression	It shows that over time, women are increasingly likely to combine motherhood and employment in many but not all countries. Both mothers and childless women are more likely to be employed in societies with large service sectors and low unemployment.
Kizilgol (2012) Determinants of Female Labour Force Participation: An Econometric Analysis	Türkiye (2002-2008)	Logit Model	Among the factors affecting women's labour force participation decisions, the variables determined have the most important role.
Kılıç & Ozturk (2012) Obstacles to Women's Labour Force Participation in Turkey and Solutions: An Empirical Application	Türkiye (2002-2008)	Probit Model	It has been determined that women's education, economic and marital status, place of residence, and gender perception factors have an impact on employment.
Heintz (2013) The Absence of Women: G20, Gender Equality and Global Economic Governance	G20 countries (2012)	Situation analysis	When determining the policies to be created in G20 countries, the consequences for women and men are not seriously taken into consideration.
Ozguler (2013) Comparative Analysis of the European Union and Turkish Labour Markets	UN Countries and Türkiye (1993-2010)	Current Comparative Situation Analysis	Especially since 2008, the contraction in production, population changes, and technological transformations directly affect employment and unemployment.
Kuçuksen (2013) Female Labour Force Participation and Economic Development A Study of the U-shaped Female LabourForce Participation Hypothesis for Heterogeneous Country Groups	130 countries (1980-2009)	EKK, System-GMM, and AMG methods	It has been determined that all methods used are following the relevant theories.
Cornwall & Rivas (2015) From 'gender equality and 'women's empowerment' to global justice: reclaiming a transformative agenda for gender and development	192 member countries of the United Nations	Situation analysis	It is emphasized that women's full and equal participation in political, civil, economic, social, and cultural life at national, regional, and international levels and the elimination of all forms of discrimination on the grounds of gender should be a priority in the international arena.

Thévenon & Pero (2015) Gender Equality for Economic Growth? Effects of Reducing the Gender Gap in Education on Economic Growth in OECD Countries	OECD countries (1960-2008)	Comparative Regression Analysis	The increase in women's level of education has a higher positive and significant effect on GDP per capita than the increase in men's level of education in recent periods.
Yavuz (2016) Women's Employment and Economic Violence in the Axis of Gender Inequality	OECD and Türkiye (2013- 2014)	Situation analysis	Women are subject to discrimination in all economic fields. The biggest factor in gender equality and discrimination in women's employment is the lack of equal educational opportunities.
Taşseven et al. (2016) The Determinants of Female Labour Force Participation for OECD Countries	OECD (1990-2013)	Panel Binary Qualitative Preference Method	It was found that unemployment rate, gross domestic product per capita and fertility rate positively and significantly affect the female labour force participation rate.
Durmaz (2016) Women in the Labour Market and the Obstacles They Face	World (2014)	Statistical Analysis Techniques	It has been suggested that the gender approach is a significant obstacle to women's employment in the world and that this situation can be prevented by implementing studies to increase the level of education.
Trapp et al. (2017) Gender budgeting in OECD countries	OECD countries (2016)	Survey	As the introduction of gender budgeting is relatively new in many countries, it is likely to have a wider range of impacts in the future. Useful areas for further work and policy action include: embedding gender-specific approaches into normal annual budgeting routines, with routine availability of sex-disaggregated data, and executive-led approaches complemented by external quality assurance.
Ducan & Polat (2017) The Effect of Female Employment on Economic Growth: Panel Data Analysis for OECD Countries	OECD (2004-2014)	Panel Unit Root Test, Panel Data Regression Analysis F Test, and Hausman Test	In OECD countries, the increase in the female/male labour force participation rate has a negative effect on GDP growth, and this effect is greater for G7 countries than for other OECD countries.
Ilalan (2017) Female Labour Force Participation in OECD Countries: Analysis in Terms of Economic Development and Tax Burden	OECD (2000-2012)	Panel Unit Root and Cointegration Methods with Heterogeneous Panel Data Estimations and OLS	As a result of the estimations applied using the existence of the U-shaped relationship and the tax burden and fiscal freedom variables, it was concluded that there is a positive relationship between the female labour force participation rate and fiscal freedom and a negative

			relationship with the tax burden on labour costs.
Guris et al. (2019) Examining the Factors Affecting Female Labour Force Participation in OECD Countries Using Panel Qualitative Choice Models	OECD (2004-2016)	Random Effects and Fixed Effect Unbalanced Panel Logit Estimation, Walt Test, Hausman Test	The determined variables have an increasing effect on women's employment.
Akdemir et al. (2019) The Place of Women in the Labour Market in Turkey and Selected Countries	Norway, Sweden, Denmark, Mexico, Türkiye, Yemen, Afghanistan and Egypt (2017)	Comparative Current Situation Analysis	In developed countries, the female and male labour force participation rates are approximately equal, while in countries with lower levels of development, the female labour force participation rate is lower than the male participation rate.
Colak (2021) Econometric Analysis on Gender Inequality and Economic Growth Relationship in Turkey	Türkiye (2005-2019)	LS-Least Squares (NLS ve ARMA)	Economic growth had the greatest impact on the gender wage gap mostly among employees and then graduates of high or equivalent schools. It has been revealed that economic growth is a factor that decreases the gender wage gap in favor of women, both among employees and high school graduates.

Research Methodology

In this study, the effects of the gender equality index and female labour force participation rate on economic growth between 2016-2023 in 38 OECD countries were investigated with the help of Panel Data Analysis. These countries are; Turkey, United States, Germany, Australia, Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, the Republic of Korea, Netherlands, England, Ireland, Spain, Israel, Sweden, Switzerland, Italy, Japan, Iceland, Canada, Colombia, Costa Rica, Latvia, Lithuania, Luxembourg, Hungary, Mexico, Norway, Poland, Portugal, Slovakia, Slovenia, Chile, New Zealand, Greece. In the established model, while the Global Gender Gap Index (GGGI) and Female Labour Force Participation Rate (KIKO) data were used as independent variables, the data set of GDP per capita growth (annual %) variable was used as the dependent variable. The data sets used in the analysis were the gender inequality index data obtained from the Global Gender Gap Report prepared by The World Economic Forum and the female labour force participation rate data obtained by The International Labour Organization. In addition, all tests and analyses were made using the E-Views 10 econometric program.

Table 2. Variables, their symbols in the Study, and Data Set Sources

Variables	Symbol	Year	Source
Per Capita Growth	PERGDP	2006-2023	World Bank Group, 2024
Global Gender Gap Index	GGGI	2006-2023	World Economic Forum, 2024
Female Labour Force Participation Rate	KIKO	2006-2023	International Labour Organization, 2024

Panel Data Analysis

In econometric analyses, data are divided into three classes time, cross-section, and mixed data consisting of a combination of both types of data. Cross-section data provides information about only one period for many units, while time series data includes information about only one unit according to periods. When information according to periods and units is investigated together, panel data is used. Panel data allows for more complex behavioural models to be made and tested by bringing together cross-section data belonging to units such as

individuals, countries, firms, and households in a certain time interval (Tatoğlu, 2018). Information on the dynamic responses of units is very important in understanding economic events. Panel data can meet the need for a very long time series by using existing information on the dynamic responses of different units. Some of the features of panel data are as follows:

1. In any cross-sectional data, countless unmeasured explanatory variables affect the behaviour of the units under study (households, firms, countries, etc.). Excluding these variables leads to biased estimates. Panel data allows this problem to be overcome.
2. Panel data reduces multicollinearity by combining the change between periods with the change between micro units, creating variability.
3. Panel data can be used to examine issues that cannot be evaluated with cross-sectional or time series data alone.

The panel data regression model can be shown in its most general form as follows:

$$y_{it} = \beta_{1it} + \beta_{2it} X_{2it} + ... \beta_{kit} X_{kit} + e_{it} \qquad i = 1, 2, ..., N ; t = 1, 2, ..., T$$

In the model, k is the number of variables, i = 1, 2, …, N is the cross-sectional unit, and t = 1, 2, …, T is the time. The train coefficients from B_{2it} to β_{kit} may differ for different units and different periods as unknown response coefficients.

Panel ARDL Model is an analysis applied on the condition that variables are stationary at different levels (stationary at level value or first difference) as a result of unit root tests, but second-order stationarity is not accepted. It allows us to test the short-term and long-term relationship between variables.

Model Selection
The Hausman test was used to choose between fixed effects and random effects models in econometric analysis. The preference of these two models depends on the characteristics of the analysed panel data and what the regression model was. The Hausman test confirms whether there is a relationship between the independent variables and the error terms in a regression model (endogeneity). The relationship is critical in terms of the distribution of some conditions. Fixed effect model (FE): It is preferred to run it as it is between the independent variables and the error term. The model controls individual characteristics and prevents the estimates of these characteristics from being distorted. Random effect model (RE): Non-expansive changes are preferred between the independent variables and the error condition. It contains fewer parameters and provides more efficient estimates.

H_0: Random Effect Model is suitable
H_1: Fixed Effect Model is suitable

Table 3. Hausmann Test

Test Summary	Chi-Sq. value	df	Prob
Cross-section random	11.990303	2	**0.0025***

* Statistically significant at a 1% significance level

According to the Hausmann Test result, the probability value (0.0025) was found to be less than a 5% significance level. Therefore, the Null hypothesis was rejected and the Alternative hypothesis was accepted. In that case, our Panel model established was determined as a fixed effect. Below in Table 4, the Fixed Effect Model, which was decided after the Hausmann Test and determined by the Panel Least Squares method, is given.

Table 4. Fixed Effect Model with Panel Least Squares Method

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	3.9199	4.1931	0.9349	0.3502
GGGI	-17.5980	6.2651	-2.8089	**0.0051***
KIKO	0.2076	0.0498	4.1722	**0.0000***
Effects Specification				

Cross-section fixed (dummy variables)			
F-statistic	2.2376	Durbin-Watson stat	1.8641
Prob(F-statistic)	0.000037*	Schwarz criterion	5.6984
Akaike info criterion	5.4336	Hannan-Quinn criteria	5.5361

* Statistically significant at a 1% significance level

When the Fixed Effect Model estimation was examined, the probability values of GGGI and KIKO were found to be statistically significant at the 1% significance level. Therefore, first of all, a 1% increase in GGGI reduced PERGDP by 17.59%. Finally, a 1% increase in KIKO increased PERGDP by 0.20%. Since the probability value of the F statistic was also found to be significant at the 1% significance level, the established Fixed Effect Model was also statistically significant.

Panel Unit Root Tests
Panel unit root tests are tests used to determine whether variables in panel data sets are stationary. Stationarity is an important feature in time series analysis and plays a critical role in linear regression models in economic analysis. Panel Unit Root Tests are used to determine whether a variable has a constant mean and variance over time. If a variable is not stationary, it can lead to spurious regression problems in the analysis. This can lead to misinterpretation of model estimation. The following tests, which are among the Panel Unit Root Tests and are frequently used in the literature, were preferred: Im, Pesaran, and Shin W-stat, ADF - Fisher Chi-square, and PP - Fisher Chi-square Unit Root Tests.

H_0: The series contains a unit root and is not stationary
H_1: The series does not contain a unit root and is stationary

Table 5. Panel Unit Root Tests (Level- I(0))

	TESTS	Statistic	Prob.	Cross-sections	Obs
Individual Effects					
PERGDP	Im, Pesaran and Shin W-stat	-15.8026	**0.0000***	38	608
	ADF - Fisher Chi-square	370.944	**0.0000***	38	608
	PP - Fisher Chi-square	590.686	**0.0000***	38	646
GGGI	Im, Pesaran and Shin W-stat	1.20608	0.8861	38	608
	ADF - Fisher Chi-square	68.0050	0.7318	38	608
	PP - Fisher Chi-square	82.0448	0.2975	38	646
KIKO	Im, Pesaran and Shin W-stat	7.12245	1.0000	38	608
	ADF - Fisher Chi-square	27.2852	1.0000	38	608
	PP - Fisher Chi-square	53.5959	0.9761	38	646
Individual Effects and Trend					
PERGDP	Im, Pesaran and Shin W-stat	-13.5483	**0.0000***	38	608
	ADF - Fisher Chi-square	303.901	**0.0000***	38	608
	PP - Fisher Chi-square	566.174	**0.0000***	38	646
GGGI	Im, Pesaran and Shin W-stat	-1.20467	0.1142	38	608
	ADF - Fisher Chi-square	91.2344	0.1122	38	608
	PP - Fisher Chi-square	69.0025	0.7024	38	646
KIKO	Im, Pesaran and Shin W-stat	3.45092	0.9997	38	608
	ADF - Fisher Chi-square	39.6535	0.9998	38	608
	PP - Fisher Chi-square	42.5441	0.9993	38	646

* Statistically significant at a 1% significance level

According to the results of Panel Unit Root Tests performed on level values according to Table 5, only PERGDP probability values are significant at 1% in both individual effects and individual effects and trend values. Therefore, the PERGDP variable does not contain a unit root at I(0). So, it is stationary at I(0). Since the probability values of other variables are not significant at 1% and 5% significance levels, they are not stationary.

Table 6. Panel Unit Root Tests (First Difference- I(1))

	TESTS	**Statistic**	**Prob.**	**Cross-sections**	**Obs**
Individual effects					
D(PERGDP)	Im, Pesaran and Shin W-stat	-20.6362	**0.0000***	38	570
	ADF - Fisher Chi-square	476.018	**0.0000***	38	570
	PP - Fisher Chi-square	3111.42	**0.0000***	38	608
D(GGGI)	Im, Pesaran and Shin W-stat	-9.38576	**0.0000***	38	570
	ADF - Fisher Chi-square	229.516	**0.0000***	38	570
	PP - Fisher Chi-square	414.285	**0.0000***	38	608
D(KIKO)	Im, Pesaran and Shin W-stat	-7.86757	**0.0000***	38	570
	ADF - Fisher Chi-square	193.248	**0.0000***	38	570
	PP - Fisher Chi-square	427.309	**0.0000***	38	608
Individual effects and trend					
D(PERGDP)	Im, Pesaran and Shin W-stat	-16.0145	**0.0000***	38	570
	ADF - Fisher Chi-square	349.834	**0.0000***	38	570
	PP - Fisher Chi-square	744.820	**0.0000***	38	608
D(GGGI)	Im, Pesaran and Shin W-stat	-5.42048	**0.0000***	38	570
	ADF - Fisher Chi-square	156.441	**0.0000***	38	570
	PP - Fisher Chi-square	360.191	**0.0000***	38	608
D(KIKO)	Im, Pesaran and Shin W-stat	-9.92323	**0.0000***	38	570
	ADF - Fisher Chi-square	230.143	**0.0000***	38	570
	PP - Fisher Chi-square	512.928	**0.0000***	38	608

* Statistically significant at 1% significance level

When the results of the unit root tests performed on the 1st difference are examined, the probability values of all variables were statistically significant at the 0.01 significance level in both the individual effects and trend values. Therefore, when the first differences of the variables are taken, it is determined that they are stationary. In that case, while the dependent variable PERGDP is stationary at level I(0), the independent variables GGGI and KIKO are also stationary at the first level I(1).

Estimating PML (Pooled Mean Group) Panel ARDL (2, 1, 1)
It is investigated to determine the short and long-term causality relationship between the independent variables and the dependent variable. Table 7 below shows the estimated PML (Pooled Mean Group) Panel ARDL (2, 1, 1) Model. The ARDL Model was determined as (2,1,1). The dependent variable had a lag value of 2 and the independent variables had a lag value of 1. On the other hand, Long and Short-Term Equations were also included.

Table 7. Estimating PML (Pooled Mean Group) Panel ARDL (2, 1, 1)

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
Long Run Equation				
GGGI	-2.827166	0.925216	-3.055684	**0.0024***
KIKO	0.048690	0.012774	3.811609	**0.0002***
Short Run Equation				

COINTEQ01	-1.151718	0.061589	-18.70000	**0.0000***
D(PERGDP(-1))	0.179207	0.035287	5.078565	**0.0000***
D(GGGI)	24.31509	24.79180	0.980771	0.3272
D(KIKO)	1.544044	0.143683	10.74619	**0.0000***
Akaike info criterion	4.136294			
Schwarz criterion	5.155747			
Hannan-Quinn criteria	4.530793			

* Statistically significant at a 1% significance level

When the ARDL (2,1,1) test results were examined, the long-term probability values of the KIKO and GGGI independent variables were less than 0.01, and a statistically significant relationship was detected. Therefore, it was seen that a 1% increase in the GGGI independent variable caused a decrease of approximately 2.83% in the dependent variable PERGDP. On the other hand, a 1% increase in the KIKO independent variable caused an increase of approximately 0.05% in PERGDP. Therefore, the long-term equation could be formed as follows:

$$PERGDP = (-2.827166)\ GGGI + (0.048690)\ KIKO$$

When the short-term test results between the variables were examined, it was determined that the Error Correction Coefficient (COINTEQ01 (-1.151718)) was negative and the probability value was significant at a 1% significance level. Therefore, the existence of a cointegration relationship between the variables was determined. On the other hand, when the short-term coefficients are examined as a group average, the KIKO independent variable affected PERGDP in the short term, while the GGGI independent variable did not affect PERGDP in the short term. The short-term equation was as follows:

$$PERGDP = (0.179207)\ D(PERGDP(-1)) + (1.544044)\ D(KIKO) – (1.151718)COINTEQ01$$

Table 8 below shows the short-term coefficient estimates for each country and the error correction coefficient giving the cointegrated relationship.

Table 8. Cross-Section Short Run Coefficient For Each Country

Country	Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	United States	-0.719368	0.033713	-21.33796	**0.0002**
D(pergdp(-1))		-0.087346	0.014949	-5.843091	**0.0100**
D(GGGI)		40.68027	488.3239	0.083306	0.9389
D(KIKO)		1.491305	0.043882	33.98444	**0.0001**
COINTEQ01	Germany	-1.708346	0.081122	-21.05899	**0.0002**
D(pergdp(-1))		0.370556	0.033371	11.10420	**0.0016**
D(GGGI)		-24.70052	2456.514	-0.010055	0.9926
D(KIKO)		2.431796	0.828605	2.934808	0.0608
COINTEQ01	Belgium	-1.344695	0.045244	-29.72065	**0.0001**
D(pergdp(-1))		0.276817	0.018860	14.67755	**0.0007**
D(GGGI)		-27.38435	417.1093	-0.065653	0.9518
D(KIKO)		1.981164	0.146983	13.47889	**0.0009**
COINTEQ01	Czechia	-1.460925	0.027959	-52.25180	**0.0000**
D(pergdp(-1))		0.124467	0.012344	10.08341	**0.0021**
D(GGGI)		189.6475	2461.879	0.077034	0.9434
D(KIKO)		3.332499	0.271780	12.26174	**0.0012**
COINTEQ01	Estonia	-1.295418	0.043122	-30.04054	**0.0001**
D(pergdp(-1))		0.246304	0.030118	8.177990	**0.0038**
D(GGGI)		-67.59673	3004.286	-0.022500	0.9835
D(KIKO)		2.126718	0.436920	4.867518	**0.0166**
COINTEQ01	France	-1.307419	0.134126	-9.747704	**0.0023**
D(pergdp(-1))		0.265855	0.037759	7.040862	**0.0059**
D(GGGI)		-9.230424	584.4890	-0.015792	0.9884
D(KIKO)		1.396939	0.299529	4.663790	**0.0186**
COINTEQ01	Netherlands	-1.544638	0.041535	-37.18864	**0.0000**
D(pergdp(-1))		0.497168	0.020405	24.36479	**0.0002**

D(GGGI)		-72.68641	1225.748	-0.059300	0.9564
D(KIKO)		1.280153	0.084745	15.10594	**0.0006**
COINTEQ01		-0.892357	0.054417	-16.39862	**0.0005**
D(pergdp(-1))	Spain	0.306362	0.024018	12.75575	**0.0010**
D(GGGI)		42.24908	1442.083	0.029297	0.9785
D(KIKO)		1.348143	0.080852	16.67426	**0.0005**
COINTEQ01		-1.807311	0.101802	-17.75326	**0.0004**
D(pergdp(-1))	Sweden	0.475189	0.037385	12.71068	**0.0011**
D(GGGI)		-23.82918	9963.233	-0.002392	0.9982
D(KIKO)		0.082843	0.079518	1.041822	0.3741
COINTEQ01		-1.133246	0.053372	-21.23280	**0.0002**
D(pergdp(-1))	Italy	0.237829	0.024254	9.805797	**0.0023**
D(GGGI)		-17.22709	834.0121	-0.020656	0.9848
D(KIKO)		2.982781	0.226474	13.17053	**0.0009**
COINTEQ01		-1.322799	0.123205	-10.73658	**0.0017**
D(pergdp(-1))	Japan	0.140053	0.052137	2.686236	0.0747
D(GGGI)		30.55929	8848.117	0.003454	0.9975
D(KIKO)		1.229517	0.463924	2.650256	0.0770
COINTEQ01		-1.332779	0.009895	-134.6933	**0.0000**
D(pergdp(-1))	Latvia	0.102959	0.008165	12.60990	**0.0011**
D(GGGI)		95.82281	2017.281	0.047501	0.9651
D(KIKO)		3.647487	0.189403	19.25785	**0.0003**
COINTEQ01		-1.907297	0.095176	-20.03975	**0.0003**
D(pergdp(-1))	Luxembourg	0.408884	0.028260	14.46854	**0.0007**
D(GGGI)		-50.03186	1745.248	-0.028667	0.9789
D(KIKO)		-0.240926	0.166801	-1.444397	0.2444
COINTEQ01		-1.010413	0.082075	-12.31084	**0.0012**
D(pergdp(-1))	Mexico	0.077993	0.032235	2.419509	0.0942
D(GGGI)		-48.50384	2594.387	-0.018696	0.9863
D(KIKO)		1.449446	0.143227	10.11995	**0.0021**
COINTEQ01		-0.639945	0.019589	-32.66931	**0.0001**
D(pergdp(-1))	Poland	0.120623	0.027031	4.462305	**0.0210**
D(GGGI)		40.11842	3749.180	0.010701	0.9921
D(KIKO)		2.334491	0.234967	9.935390	**0.0022**
COINTEQ01		-0.878037	0.038311	-22.91895	**0.0002**
D(pergdp(-1))	Slovakia	-0.080362	0.021422	-3.751386	**0.0331**
D(GGGI)		-52.49934	8308.627	-0.006319	0.9954
D(KIKO)		1.213724	0.142248	8.532430	**0.0034**
COINTEQ01		-0.834857	0.019649	-42.48956	**0.0000**
D(pergdp(-1))	Chile	-0.179458	0.009617	-18.66146	**0.0003**
D(GGGI)		-72.55938	572.4440	-0.126754	0.9072
D(KIKO)		1.492324	0.024312	61.38288	**0.0000**
COINTEQ01		-1.137396	0.030850	-36.86817	**0.0000**
D(pergdp(-1))	New	0.236995	0.016439	14.41664	**0.0007**
D(GGGI)	zealand	-65.08482	291.9763	-0.222911	0.8379
D(KIKO)		0.959610	0.027945	34.33916	**0.0001**
COINTEQ01		-0.508633	0.142894	-3.559513	**0.0378**
D(pergdp(-1))	Colombia	-0.258902	0.079178	-3.269893	**0.0468**
D(GGGI)		-149.4873	3827.335	-0.039058	0.9713
D(KIKO)		0.060935	0.744467	0.081851	0.9399
COINTEQ01		-1.228475	0.046503	-26.41728	**0.0001**
D(pergdp(-1))	Slovenia	0.188207	0.025080	7.504360	**0.0049**
D(GGGI)		2.364684	1223.914	0.001932	0.9986
D(KIKO)		2.412817	0.313011	7.708405	**0.0045**
COINTEQ01		-0.976379	0.041933	-23.28440	**0.0002**
D(pergdp(-1))	Türkiye	0.029100	0.026008	1.118892	0.3447
D(GGGI)		527.3781	37187.57	0.014182	0.9896
D(KIKO)		1.683546	0.156405	10.76403	**0.0017**

COINTEQ01	Greece	-0.892011	0.029783	-29.95066	**0.0001**
D(pergdp(-1))		0.271506	0.022912	11.85019	**0.0013**
D(GGGI)		56.42031	5397.974	0.010452	0.9923
D(KIKO)		1.724284	0.097658	17.65640	**0.0004**
COINTEQ01	Costa Rica	-0.523177	0.081267	-6.437727	**0.0076**
D(pergdp(-1))		-0.255759	0.050351	-5.079556	**0.0147**
D(GGGI)		-25.09735	7249.757	-0.003462	0.9975
D(KIKO)		0.214523	0.082467	2.601338	0.0803
COINTEQ01	Lithuania	-1.075841	0.044965	-23.92633	**0.0002**
D(pergdp(-1))		0.220690	0.029935	7.372229	**0.0052**
D(GGGI)		59.80342	4725.620	0.012655	0.9907
D(KIKO)		2.122849	0.565219	3.755799	**0.0330**
COINTEQ01	Hungary	-0.943007	0.056287	-16.75369	**0.0005**
D(pergdp(-1))		0.194451	0.034206	5.684634	**0.0108**
D(GGGI)		-15.24580	8590.225	-0.001775	0.9987
D(KIKO)		1.706415	0.160141	10.65573	**0.0018**
COINTEQ01	Norway	-0.909935	0.087496	-10.39970	**0.0019**
D(pergdp(-1))		0.030471	0.057499	0.529932	0.6329
D(GGGI)		-56.52611	958.0451	-0.059002	0.9567
D(KIKO)		0.239528	0.053557	4.472390	**0.0208**
COINTEQ01	Portugal	-1.305281	0.035856	-36.40328	**0.0000**
D(pergdp(-1))		0.384167	0.019747	19.45393	**0.0003**
D(GGGI)		-63.06763	1607.068	-0.039244	0.9712
D(KIKO)		2.080065	0.113092	18.39271	**0.0004**
COINTEQ01	Australia	-0.776830	0.098267	-7.905332	**0.0042**
D(pergdp(-1))		0.281786	0.033512	8.408403	**0.0035**
D(GGGI)		-17.86404	380.9000	-0.046900	0.9655
D(KIKO)		0.494270	0.021776	22.69768	**0.0002**
COINTEQ01	Austria	-1.699295	0.052252	-32.52101	**0.0001**
D(pergdp(-1))		0.624948	0.022095	28.28426	**0.0001**
D(GGGI)		-11.32650	487.0586	-0.023255	0.9829
D(KIKO)		1.865970	0.322019	5.794599	**0.0102**
COINTEQ01	United Kingdom	-0.975488	0.032611	-29.91309	**0.0001**
D(pergdp(-1))		0.192954	0.010522	18.33881	**0.0004**
D(GGGI)		5.812187	992.7962	0.005854	0.9957
D(KIKO)		1.784790	0.045313	39.38805	**0.0000**
COINTEQ01	South Korea	-0.559714	0.024197	-23.13183	**0.0002**
D(pergdp(-1))		-0.173989	0.025549	-6.809900	**0.0065**
D(GGGI)		52.48252	1156.021	0.045399	0.9666
D(KIKO)		1.382829	0.161234	8.576555	**0.0033**
COINTEQ01	Ireland	-0.740001	0.036618	-20.20846	**0.0003**
D(pergdp(-1))		-0.172652	0.026439	-6.530244	**0.0073**
D(GGGI)		694.4249	20762.48	0.033446	0.9754
D(KIKO)		2.671941	0.504676	5.294373	**0.0131**
COINTEQ01	Israel	-1.350816	0.020502	-65.88863	**0.0000**
D(pergdp(-1))		0.333958	0.011178	29.87683	**0.0001**
D(GGGI)		-30.48497	1031.333	-0.029559	0.9783
D(KIKO)		1.889187	0.050747	37.22736	**0.0000**
COINTEQ01	Denmark	-1.274580	0.052603	-24.23011	**0.0002**
D(pergdp(-1))		0.065125	0.023054	2.824831	0.0665
D(GGGI)		15.41757	720.2693	0.021405	0.9843
D(KIKO)		1.655621	0.103498	15.99664	**0.0005**
COINTEQ01	Finland	-1.578696	0.066619	-23.69755	**0.0002**
D(pergdp(-1))		0.429204	0.032177	13.33873	**0.0009**
D(GGGI)		-7.998792	1076.116	-0.007433	0.9945
D(KIKO)		0.872389	0.296442	2.942867	0.0604
COINTEQ01	Switzerland	-1.950139	0.077245	-25.24607	**0.0001**
D(pergdp(-1))		0.490078	0.029869	16.40762	**0.0005**

D(GGGI)		3.625376	477.3950	0.007594	0.9944
D(KIKO)		0.654841	0.095100	6.885791	**0.0063**
COINTEQ01		-1.149515	0.037778	-30.42844	**0.0001**
D(pergdp(-1))	Iceland	0.151889	0.030877	4.919216	**0.0161**
D(GGGI)		-56.67662	1720.323	-0.032945	0.9758
D(KIKO)		1.628283	0.213861	7.613730	**0.0047**
COINTEQ01		-1.070241	0.093284	-11.47298	**0.0014**
D(pergdp(-1))	Canada	0.241732	0.026869	8.996564	**0.0029**
D(GGGI)		32.27580	1243.329	0.025959	0.9809
D(KIKO)		0.988579	0.050772	19.47103	**0.0003**

When the probability values above were examined, those with a value smaller than the 5% significance level were statistically significant and there was a short-term relationship. In other words, there was a short-term causality relationship between the relevant variable and the dependent variable. On the other hand, in countries where the probability value of the error correction coefficient (CointeQ01) was both negative and had a value smaller than the 0.05 significance level, there was a cointegrated relationship and it was concluded that it was statistically significant.

Pairwise Dumitrescu Hurlin Panel Causality Tests
Pairwise Dumitrescu Hurlin Panel Causality Test is an extension of the Granger Causality test. This test considers the cross-sectional dependence among the countries in the sample (Dumitrescu and Hurlin, 2012).It can predict cross-section dependence and cross-section independence.

Null Hypothesis: Variable 1 does not homogeneously cause Variable 2
Alt Hypothesis: Variable1 does homogeneously cause Variable 2

If the p-value is more than 0.05, it cannot be reject null hypothesis which meant that heterogeneous causality s across the panel. If the p-value is less than 0.05, It can reject null hypothesis which meant that homogeneous causality exists across the panel.

Table 9. Pairwise Dumitrescu Hurlin Panel Causality Tests

Null Hypothesis	W-Stat	Zbar-Stat	Prob
GGGI does not homogeneously cause PERGDP	2.87004	0.85618	0.3919
PERGDP does not homogeneously cause GGGI	1.86988	-1.15586	0.2477
KIKO does not homogeneously cause PERGDP	1.82278	-1.25060	0.2111
PERGDP does not homogeneously cause KIKO	3.91519	2.95871	**0.0031***
KIKO does not homogeneously cause GGGI	3.88382	2.89559	**0.0038***
GGGI does not homogeneously cause KIKO	5.12709	5.39670	**7.E-08***

* Statistically significant at 1% significance level

Table 9 above shows the results of Pairwise Dumitrescu Hurlin Panel Causality Tests. The probability values of the first 3 hypotheses were greater than 0.05 and the Null Hypothesis was accepted. So heterogeneous causality exists across the panel.

Discussion
First of all, the data sets created between the years 2006-2023 belonging to the variables and which Panel model would be preferred were determined with the Hausman Test. According to the obtained Hausman Test results, the appropriate Panel model was the Fixed Effect Model. Then, according to the results of the Fixed Effect Model with Panel Least Squares Method; It was determined that there was a significant relationship between KIKO and GGGI and economic growth. ADF, PP, and Im-Peseran-Shin Unit Root Tests were applied for the stationarity test of each variable. According to the results of all three unit root tests, it was concluded that the PERGDP variable was stationary at the level value I(0), while GGGI and KIKO variables were stationary at the first order I(1). Thus, it was decided that the analysis to be made should be PANEL ARDL since the variables were stationary at different levels. According to the results of the PML (Pooled

Mean Group) Panel ARDL (2, 1, 1) test, in which both short and long-term relationship between the variables was tested. In the short term, only women's employment has been found to have a positive effect on economic growth. The result we have reached in the long-term coefficients was that while gender inequality had a negative effect on economic growth, women's employment had a positive effect.

On the other hand, short-term coefficient estimates were made for 38 OECD countries one by one; no significant relationship was found between gender inequality and economic growth in the short term in any OECD country. On the other hand, in the short term, it was concluded that women's employment had an effect on economic growth in all OECD countries except Costa Rica, Luxembourg, Japan, Sweden, and Germany. Finally, according to the Dumitrescu Hurlin Panel Causality test results, allow causality analysis both in the presence and absence of a cointegrated relationship. GGGI does heterogeneous cause PERGDP. Also, PERGDP does heterogeneous cause GGGI. KIKO does heterogeneous cause PERGDP. But PERGDP does homogeneous cause KIKO. Also, there are homogeneous causes between KIKO and GGGI in two ways.

Conclusion

It is extremely essential for a society to ensure gender equality in many areas such as women taking an active role in working life, women participating in economic life, women being provided with equal opportunities as men, women and men benefiting from education under equal conditions, having equal health services and having equal political rights. The inclusion of women in society, who form almost half of the population of a country, allows for the optimal use of the resources required for the development and growth of that country.

In this study, the effect of gender equality index and female labour force participation rate on economic growth between 2016-2023 of 38 OECD countries was investigated. First, the appropriate panel data model was determined with the help of Hausman test and the stationarity of the series was analysed with panel unit root test. Then, PML (Pooled Mean Group) Panel ARDL analysis was applied to test the short and long-term relationship. On the other hand, the significance of the short-term coefficients of each country was tested. Finally, Pairwise Dumitrescu Hurlin Panel Causality test was applied to test homogeneous or heterogeneous causality between the variables.

When all country groups were evaluated, it was determined that as the difference between men and women increased, economic growth decreased in the long term. On the other hand, the more women took part in economic life in both the short and long term, the economic growth of that country increased.

It is also extremely important to integrate women into social life and provide them with various opportunities in the economic field and to remove obstacles in front of them. It is thought that concrete developments and decisions will be made by increasing women's employment to the same level as men's employment and will positively affect social development. Minimizing gender inequality and completely eliminating it in the future can be seen as a necessity for social welfare.

As a result, it is thought that increasing women's employment in OECD countries and focusing on efforts to combat gender inequality will contribute to the economic growth figures of these countries. Increasing the role of women in business life by bringing them to various senior positions and, considering women's other roles in life (such as cooking, childcare), introducing practices to increase their productivity in working life and enable them to lead a decent working life can contribute to social welfare.

Recommendations

Based on the findings of the study, the following recommendations are proposed to address gender inequality, enhance female employment, and promote economic growth in OECD countries:

1. **Policy Framework for Gender Equality**

Governments should design and implement comprehensive gender equality policies to ensure equal opportunities in all aspects of life, including education, healthcare, employment, and political participation. These policies should focus on reducing the gender gap in access to resources and opportunities.

2. **Encouraging Female Participation in the Workforce**

Efforts should be made to encourage women's active participation in the workforce. This can include:
- Providing access to skills training and education programs tailored for women.
- Creating awareness campaigns to challenge cultural and societal stereotypes about gender roles.
- Ensuring equal pay for equal work to reduce wage disparities between men and women.

3. Supportive Work Environments

Employers should create supportive work environments that facilitate women's inclusion and productivity. Measures could include:

- Introducing family-friendly workplace policies, such as flexible working hours and remote work options.
- Establishing on-site childcare facilities and providing maternity and paternity leave to support work-life balance.
- Preventing workplace discrimination and harassment by enforcing strict regulations and encouraging reporting mechanisms.

4. Leadership and Decision-Making Roles

Increasing the representation of women in leadership and senior decision-making roles is crucial. Companies and governments should implement affirmative action programs and mentorship initiatives to prepare women for such roles and ensure diversity at the top levels of organizations.

5. Investing in Education and Skill Development

Equal access to quality education for girls and women should be prioritized. Policies should aim to close gender gaps in education, particularly in STEM (Science, Technology, Engineering, and Mathematics) fields, where female representation remains low.

6. Addressing Social and Cultural Barriers

Programs to challenge deep-seated societal norms and attitudes that perpetuate gender inequality should be introduced. Advocacy campaigns and educational initiatives can promote the idea that gender equality benefits everyone in society, not just women.

7. Legal Reforms

Legal barriers that hinder women's participation in economic and social life should be removed. This includes reforming inheritance laws, property rights, and labour laws that disproportionately affect women.

8. Monitoring and Accountability

Regular monitoring and evaluation of gender equality policies and initiatives are essential to track progress and make necessary adjustments. OECD countries should establish standardized metrics to assess their performance in reducing gender inequality and promoting female employment.

9. International Collaboration

OECD countries should collaborate to share best practices and successful strategies for reducing gender inequality. Initiatives like international conferences, partnerships, and joint research projects can provide insights and solutions applicable across different contexts.

10. Targeted Programs for Vulnerable Groups

Special programs should be designed for marginalized women, such as those in rural areas, minority groups, and low-income households. Tailored interventions can help bridge the gaps in access to resources and opportunities for these groups.

By implementing these recommendations, OECD countries can address gender inequality more effectively, increase female participation in the labour force, and ultimately enhance their economic growth. Integrating women into all aspects of societal and economic life not only promotes fairness but also unlocks the potential of half the population, contributing to greater prosperity and social welfare.

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