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Research Article

The Dynamics of Women's Labor in Developing Countries: Effects of Economic Growth, Digitalization and Institutional Factors

Gelişmekte Olan Ülkelerde Kadın Emeğinin Dinamikleri: Ekonomik Büyüme, Dijitalleşme ve Kurumsal Faktörlerin Etkileri

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Highlights:

- This study focuses on the place and importance of women in the labor market.
- In addition to socioeconomic and institutional factors, the impact of digitalization on women's labor is examined.
- In selected countries, women's participation in the labor market is important in terms of achieving economic goals, increasing the level of welfare and accelerating the development process.

Abstract: This study inquired into how socioeconomic, institutional, and digitalization factors relate to women's participation in the labor force. Using data gathered from 28 developing nations between 1997 and 2022, Dumitrescu-Hurlin (2012) causality test and the fixed effect panel estimate method were employed to examine the relationship between the variables. The analysis results certified that, at low quantiles, women's labor force participation and economic growth uphold a positive but statistically insignificant relationship. In the opposite direction, it was discovered that the impact of inflation on women's participation in labor force is negative at medium and high quantiles while it is statistically insignificant at low quantiles. Despite being proven to exert a positive influence on the participation of women in the labor force, the model's gross fixed capital accumulation has been determined to be statistically insignificant at very high quantiles. At every quantile degree, it was also detected that the number of women in parliament, the internet use, and urbanization all had a positive impact on women's participation in labor force. Dumitrescu-Hurlin (2012), on the other side, manifested that there was a bidirectional causality between economic growth, inflation, internet usage, urbanization, the number of women in parliament, and the female labor force. Nonetheless, the findings indicated that there was a unidirectional causal relationship between female labor force and gross fixed capital accumulation.

Keywords: Female Labor Force Participation Rate, Socioeconomic, Institutional Factors, Digitalization, Panel Data Analysis.

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Öne Çıkanlar:

- Bu çalışmada kadınların iş gücü piyasasındaki yeri ve önemine değinilmiştir.
- Sosyoekonomik ve kurumsal faktörlerin yanı sıra dijitalleşmenin kadın emeği üzerindeki etkisi incelenmiştir.
- Seçilmiş ülkelerde kadınların iş gücü piyasasına katılımı ekonomik hedeflerinin gerçekleştirilmesinde, refah seviyesinin arttırılmasında ve kalkınma sürecinin hızlandırılmasında önem arz etmektedir.

Öz: Çalışmada kadınların iş gücüne katılımı ile sosyoekonomik, kurumsal faktörler ve dijitalleşme arasındaki ilişki incelenmiştir. Gelişmekte olan 28 ülkede 1997-2022 dönemi verilerini kullanarak değişkenler arasındaki ilişki sabit etkili panel tahmin yöntemi ve Dumitrescu-Hurlin (2012) nedensellik testi ile analiz edilmiştir. Analiz bulguları düşük kantillerde kadınların iş gücüne katılımı ile ekonomik büyüme arasında pozitif yönlü ancak istatiksel olarak anlamsız ilişki olduğunu göstermiştir. Buna karşın enflasyonun düşük kantillerde kadınların iş gücüne katılımı üzerindeki etkisi istatistiki olarak anlamsızken, orta ve yüksek kantillerde negatif bulunmuştur. Modelde yer alan brüt sabit sermaye birikiminin kadınların iş gücüne katılımı üzerindeki etkisi pozitif olmasına karşın, çok yüksek kantillerde istatistiki açıdan anlamsızlaşmıştır. Ayrıca tüm kantil düzeylerinde internet kullanımının, parlamentodaki kadın sayısının ve kentleşmenin kadınların iş gücüne katılımı üzerindeki etkisi pozitif olarak tespit edilmiştir. Dumitrescu-Hurlin (2012) nedensellik sonuçları ise ekonomik büyüme, enflasyon, internet kullanımı, kentleşme ve parlamentodaki kadın sayısı ile kadın işgücü arasında çift yönlü bir nedensellik olduğunu ortaya koymuştur. Bununla birlikte, bulgular kadın işgücü ile brüt sabit sermaye birikimi arasında tek yönlü bir nedensellik olduğunu göstermiştir.

Anahtar kelimeler: Kadınların Iş Gücüne Katılım Oranı, Sosyoekonomik, Kurumsal Faktörler, Dijitalleşme, Panel Veri Analizi.

Genişletilmiş Özet

Tarihsel süreç içerisinde kadınlar üretimin bir parçası olmuşlardır. Kadınların üretim faaliyetleri ve iş gücüne katılımı zamanla farklılaşmıştır. Tarım ekonomisinin yer aldığı ve eril yapının hakim olduğu toplumlarda kadınlar tarımda, hayvancılıkta ve el işçiliği faaliyet alanlarında üretime katkı sunmuşlardır. Sanayi devrimine kadar geçen sürede kadınlar her zaman üretime katkı sağlamış ancak kadın emeği uzun süre görünmez hale gelmiştir. Sanayi devrimiyle birlikte görünmez olan kadın emeği görünür hale gelerek, kadınlar iş gücü piyasasında aktif olarak yer almıştır. 1960'lı yıllardan sonra ise feminizm akımı savunucuları kadınların yalnızca ev işlerinden sorumlu tutulmasına karşı çıkarak, ekonomik, sosyal ve kamusal alanlarda kadınlara yer verilmesini ifade etmiştir. Böylelikle feminist akımlar kadınların ekonomik hak edinmesinin yanında, kadın erkek eşitliğini öngören toplumsal ve yasal dönüşümlere zemin hazırlamıştır. Günümüzde ise kadınlar her sektörde yer almakta ancak iş gücüne katılım oranı erkeklerin gerisinde kalmaktadır. Örneğin OECD ülkelerinde kadınların ortalama iş gücüne katılım oranı

yaklaşık %53 iken, Avrupa Birliği'nde % 52, gelişmekte olan ülkelerde ise bu oran %20'nin altına düşebilmektedir (Dünya Bankası, 2024). Dünya nüfusunun büyük bir kısmını oluşturan kadınların, iş gücüne katılımının, erkeklerin gerisinde ve beklenen seviyede olmaması ülkelerin dikkatini çeken bir konu haline gelmiş ve birçok ülke çözüm arayışı içine girmiştir. Özellikle gelişmekte olan ülkelerin büyüme ve kalkınma süreçlerinde kadınların iş gücü piyasasında aktif olarak yer alması hayati önem taşımaktadır. Gelişmekte olan ülkelerin en önemli makroekonomik hedeflerinden biri, ekonomik büyümedir. Kadınların ekonomik faaliyetlerde yer alması yalnızca bireysel olarak gelirini arttırmakla kalmaz aynı zamanda yoksullukla mücadeleyi güçlendirir, ailelerin yaşam standartlarını yükseltir ve ülke ekonomisinin büyümesine katkı sağlar. Büyümenin gerçekleşmesi eğitime, sağlık hizmetlerine erişimlerini artırarak toplumsal refahı da olumlu yönde etkiler. Toplumsal refah düzeyindeki artış ise iktisadi ve sosyal boyuta sahip kalkınmanın gerçekleşmesini hızlandırır. Bundan ötürü gelişmekte olan ülkelerde kadın istihdamını arttırmaya yönelik politikalar, ekonomik çıkar elde etmenin yanında, uzun vadede sürdürülebilir kalkınmanın temel taşlarından birini oluşturmaktadır.

Toplumların ekonomik, sosyal ve kurumsal dinamikleri kadınların iş gücüne katılımını etkilemektedir. Ekonomik unsurlar kadınların iş gücüne katılımını doğrudan etkilemesine rağmen, eğitim, toplumsal cinsiyete bakış, kreş ve bakım hizmetleri, gelişen teknoloji ve yasal düzenlemeler gibi birçok unsurda kadınların iş gücüne katılımını doğrudan ya da dolaylı olarak etkilemektedir. Literatürde birçok çalışmada kadınların iş gücüne katılımını etkileyen faktörlerin ne olduğu ve hangi yönde etkilediği tartışılmıştır.

Bu çalışmada ise Dünya Bankası'nın gelir düzeyi sınıflandırması esas alınarak, veri seti uygun olan aynı zamanda kadınların iş gücüne katılımının ekonomik ve sosyal anlamda kritik öneme sahip olduğu gelişmekte olan üst-orta 28 ülkede 1997-2022 dönemi yıllık verileri kullanılarak sosyoekonomik ve kurumsal faktörlerin yanı sıra dijitalleşmenin kadınların iş gücüne katılımı üzerindeki etkisi sabit etkili panel yöntemi ve Dumitrescu-Hurlin (2012) nedensellik testi ile incelenmiştir. Yapılan analiz sonucunda düşük kantillerde ekonomik büyümenin kadınların iş gücüne katılımını arttırdığı ancak istatistiki olarak bu oranın anlamsız olduğu tespit edilmiştir. Buna karşın enflasyonun düşük kantillerde kadınların iş gücüne katılımı üzerindeki etkisi istatistiki olarak anlamsızken, orta ve yüksek kantillerde negatif olduğu gözlemlenmiştir. Araştırma çerçevesinde yer verilen brüt sermaye birikiminin, kentleşmenin, parlamentodaki kadın sayısının ve internet kullanımının kadınların iş gücüne katılımını arttırdığı sonucuna ulaşılmıştır. Dumitrescu-Hurlin (2012) nedensellik testi bulgularına göre ise gelişmekte olan 28 ülkede kadınların iş gücüne katılımı ile makroekonomik, sosyal, kurumsal ve dijitalleşme arasındaki ilişki ayrıntılı bir şekilde ortaya koymaktadır. Elde edilen bulgular, kadınların iş gücüne katılımı ile

ekonomik büyüme, enflasyon, kentleşme, internet kullanımı, parlamentodaki kadın sayısı arasında çift yönlü, brüt sermaye birikimi ile tek yönlü nedensellik olduğunu göstermiştir. Ampirik bulgulardan yola çıkarak eşit işe eşit ücret verilmesi, esnek çalışma saatleri, işletmelere kadın çalışan sayısı sınırı getirilmesi, hizmet sektöründe ağırlıklı olarak kadınlara yer verilmesi, girişimci kadınlara düşük faizli kredi ve kreş vb. politikaların devlet ve özel kesim tarafından benimsenmesi ile kadınların iş gücüne katılımını arttırmak mümkün olacaktır.

Introduction

From the earliest days of humanity to the present, changes in political, social, and economic processes have had an impact how people conceive gender and the roles of men and women. Throughout history, women have been considered as inferior beings, living beneath society and in the shadow of the male hierarchy. Their sociological identity was limited to providing care. In accordance with the framework of this evaluation, women are unable to participate in social life or the labor market. Even so, women's involvement in social and economic life became a priority as a result of Western scientific advancements and the Age of Enlightenment (Acar-Savran, 2008:10-12; Heywood, 2012:64). The Industrial Revolution marked the beginning of women's significant participation in social and economic life. In addition to altering the economic system, the Industrial Revolution also brought about a number of other changes, such as the inclusion of women's labor in the labor market and the redefinition of gender roles in society. Women started working in industries, particularly in the textile industry. Additionally, migration from rural to urban regions came about because of the establishment of housework as a profession for women in urban areas (İzgi and Suna, 2024:15). As a result of all these advancements, women gained economic rights and began to actively participate in the job market (Winkler, 2016:1; Aydınbaş and Ünlüoğlu, 2022:4).

Women make up a third of the labor force, a tenth of the income earned, and more than half of its population. The presence of women in this market has brought some social and economic outcomes (Che and Sundjo, 2018). Women's active participation in the labor market helps to enhance economic development, reduce poverty by expanding production capacity, and employ high-capacity workforce (İzgi and Suna, 2024:15-16). Additionally, the way that society views gender and family relations is altered by rising incomes and educational attainment. Consequently, there are social ramifications including making people more aware, increasing the likelihood of single parenthood because of the challenges of working, and elevating women in society (Elneel & Almulhim, 2024:192; Hosney, 2016:10). Women's labor force participation has steadily expanded as a result of these implications. Yet, women face the challenge of working for lower

wages and participating in the labor force at a lower rate compared to men because of their part-time employment from household caregiving, their participation in informal economic activities, and their limited access to vocational training (Winkler, 2016:1; Aydınbaş and Ünlüoğlu, 2022:4). According to predictions from the International Labor Organization (ILO) for 2024, the ratio of labor force participation for men over the age of 15 constitutes 73%, while the women's labor force participation rate includes 48.9%. Figure 1 expresses the labor force participation rate data by gender and age worldwide.

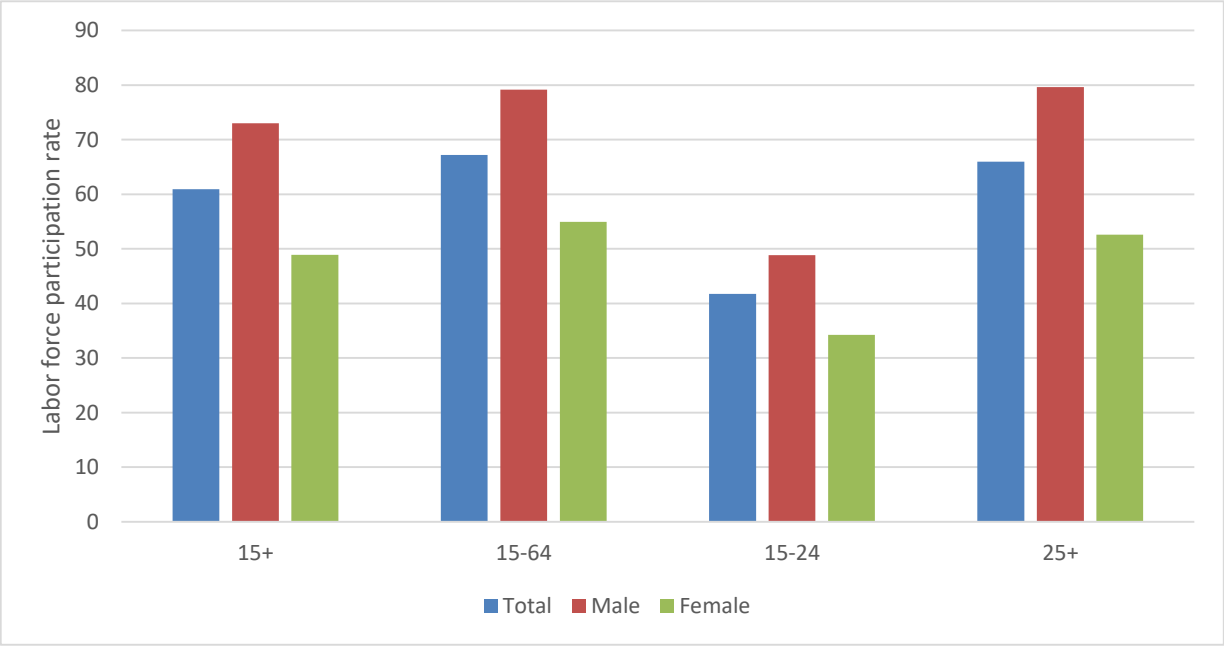

Figure 1.
Labor force participation rate by gender and age
Source: Created by the author from ILO (2024) data.

Figure 1 depicts that the rate of labor force participation differs by gender and age worldwide. The overall labor force participation rate for the 15+ age group is 60.9%. Of this, the male rate is 73%, while the female rate is roughly 49%. Furthermore, the labor force participation rate for the 15–64 age group is 67.2% overall, with 79.1% of men and 54.9% of women participating. The labor force participation rate for the 15–24 age group is 41.7%, with 48.3% of men and 35.2% of women participating. Notwithstanding, the overall labor force participation percentage for the 25+ age group is 65.9%, with the male labor force participation rate being 79.6% and the female labor force participation rate being 52.5% (ILO, 2024).

Women are becoming increasingly prominent in developing nations. Women's participation in manufacturing is one of the key components that guarantees social and economic advancement. When women participate in labor markets, they acquire both social and economic autonomy. They also contribute to the development of more conscious population and the attainment of social benefits for their families and communities. This serves as a catalyst for

progress. Even so, this process stands out based on the labor market features, social norms, cultural traits, and demographic structure of developing nations (Che and Sundjo, 2018:88).

This research covers 28 developing countries in the World Bank's upper-middle income group, which provide complete and comparable data on female labor force participation, digitalization, and institutional indicators for the period 1997–2022. The purpose of selecting this group of developing countries is to obtain more reliable results with a long-term dataset and to assess the impact of macroeconomic, sociological, and institutional factors on women's employment in developing countries. In this context, the study expands the existing literature, which generally examines female labor force participation through macroeconomic and demographic indicators, by incorporating institutional and digitalization factors into the analysis. It aims to contribute using modern methods, as opposed to traditional ones. This is how the study has been organized: The "Introduction" section contains general information about women's labor force participation. Next, the results of empirical research concerning the topic are supplied in the "Literature" section. The "Data and Econometric Method" section introduces the empirical model, the estimate technique and the data sources used to explore the relationship between variables. Empirical results on how the factors in the model affect women's labor force participation are illustrated in the "Findings" section. Finally, the "Conclusion" section covers the evaluation of the findings obtained as a result of the estimation and presents policy recommendations.

Literature Review

There are multiple socioeconomic aspects that influence women's participation in the labor force. Among the most prominent social determinants influencing women's labor force participation are education, parenting, fertility rate, marital status, religious beliefs, social standards, and legal independence. Additionally, several macroeconomic variables directly impact on women's employment, including income, inflation, growth, investment, and unemployment rates (Bullough et al., 2012; Bussolo et al. 2024:128; Verick, 2018:1; Altuzzara et al. 2019:1). This section incorporates studies on the topic and provides a thorough evaluation of the relevant literature.

Using data from 1995 to 2002, Fatima and Sultana (2009) investigated how Pakistani women's labor force participation was affected by economic growth, marital status, earnings, and the unemployment rate. As a result of the study, wages and marital status were found to have the reverse effect, lowering women's labor force participation, whereas economic growth, education, and a growth in the male unemployment rate were found to raise women's labor force participation. It was also underlined that women's labor force participation could move from the agricultural to

the industrial sectors as their educational attainment improved. Besamusca et al. (2015) conducted panel data analysis to investigate how gender structure, family, and economic growth affected the labor force participation of 11-year-old girls in 117 different countries by utilizing data from 1990 to 2015. The study found that care arrangements, paid maternity leave, and better education levels all enhanced women's labor force participation. Likewise, it turned out that religious convictions reduced women's engagement in the labor field. It was observed that women's labor force participation positively affected economic growth and that women's labor force participation varied according to age factors and sectors. It has been stated that women under the age of 20 and over the age of 60 work intensively in the agricultural sector, women under the age of 25 and over the age of 55 find little place in the manufacturing sector, and all age groups are employed in the service sector. The impact of age and educational attainment on women's labor force participation in Northern Cyprus was investigated by Usman and Sanusi (2016) applying data from 2011. According to the researchers, women's labor force involvement is positively impacted by age up to a particular age. Additionally, the study determined that while education has a positive impact on women's labor market participation, age has an adverse impact and an inverted U-shaped association with it beyond the threshold level. Marital status, non-work income, and the number of children were also found to have a detrimental impact on women's labor force participation. Using panel data analysis, Nikulin (2016) calculated how information and communication technology affected women's labor force participation in 60 developing nations between 2000 and 2014. In accordance with the analysis, it was noticed that the fertility rate was not statistically significant, and women's labor force participation climbed as a result of information and communication technology (such as the internet use and mobile phone subscriptions), whereas it fell as a result of GDP growth. Tasseven (2017) performed panel data analysis with data from 1995-2017 to investigate the factors influencing women's labor force participation in G8 countries. Based on the study, it was figured out that education and GDP per capita boosted women's labor force participation rates and lowered unemployment rates. Altuzarra et al. (2019) employed data from 1990 to 2016 to investigate the relationship between women's economic development and labor force participation in 15 EU nations with the help of the Generalized approach of Moments (GMM) approach. Based on what was ascertained, it was reported that the education component reduced unemployment and fertility rates and raised women's labor force participation in all nations. A decline in economic growth per capita was also mentioned, although it was not statistically significant. In their 2019 study, Shittu and Abdullah applied panel data analysis to investigate the relationships between women's labor force participation, unemployment, education, and fertility rates in ASEAN-7 nations from 1990 to 2015. The fertility rate was evinced

to display a bidirectional causal relationship with women's labor force participation. Women's labor force participation was also estimated to have intensified due to the female population and the unemployment rate. Time series analysis was employed by Özkök and Polat (2020) to investigate the relationship between women's labor force participation, inflation, urbanization, and economic growth in Türkiye. The data they applied covered the years 1990–2018. The empirical results of the study pointed out that a 1% increase in economic growth expanded women's labor force participation by 0.459%, a 1% progress in urbanization rates strengthened women's employment by 0.057% and a 1% increase in inflation rates raised women's labor force participation by 0.047%. Nieuwenhuis et al. (2020) surveyed data from 1971 to 2013 for analyzing the relationship between poverty and women's labor force participation in 15 OECD nations using panel data analysis. The analysis determined that women's labor force participation magnified by 10% for every 1% decrease in the poverty rate. In their study, Savrul and Hazar (2020) assessed the effect of foreign direct investments on women's labor force participation in Türkiye using quarterly data from 2016 to 2018. The findings of the study indicated that foreign direct investments had a positive, long-term impact on women's labor force participation in both the long and short term. The effects of earnings, educational attainment, and economic growth on women's labor force participation were investigated by Sasongko et al. (2020) employing data from 2014–2018 for 34 Indonesian provinces. According to the study, women's labor force participation expanded in response to the minimum wage and education, but economic growth had no discernible impact. The ARDL method was used by Nazah et al. (2021) to investigate the relationship between women's labor force participation, education, and birth rate in 39 Asian nations. The data they reviewed covered the period from 1990 to 2018. The study uncovered no meaningful relationship over the long run, although the fertility rate displayed a short-term detrimental impact on women's labor force involvement. Moreover, although no meaningful correlation was shown in the near term, it was claimed that education enhanced women's labor force involvement over the long run. The determinants that influence women's labor force participation in Türkiye were investigated by Aydınbaş and Ünlüoğlu (2022) analyzing time series data from 1990 to 2020. The analysis concluded that women's labor force participation augmented in response to the rise in GDP per capita and the pace of urbanization, whereas the unemployment rate had no effect on women's labor force participation. The Vector Error Correction (VECM) model was used by Omran and Bilaan (2022) to analyze data from 1990 to 2019 and investigate the relationship between Egypt's economic development and the factors influencing women's labor. The researchers concluded that there was no statistically significant relationship in the short term, but they did obtain that women's labor force participation might go up over time as a result

of fixed capital investments and yearly GDP escalate. By applying panel data analysis, Viollaz and Winkler (2022) explored the relationship between the internet usage and women's labor force participation in Jordan utilizing data spanning from 2010 to 2016. The study assessed the influence of the Internet on unemployment, employment, and job search. The findings suggested that while married women's the internet use had no statistically significant impact on labor force participation, it did amplify the labor force participation and reduce the unemployment rate among unmarried and highly educated women. Bawazir et al. (2023) conducted panel data analysis involving data from 1996–2018 to look at how women's labor force participation was impacted by education, urbanization, fertility rate, and GDP per capita in Middle Eastern nations. The study revealed that while secondary education, urbanization, and the fertility rate reduced women's labor force participation, higher education and GDP per capita increased it. Kusumawardhani et al. (2023) used data from the period 2008–2018 and probed the effect of the internet use on women's labor force participation in various age groups in Indonesia. As a result of the research, it was observed that the internet use boosted the labor force participation of younger and less educated women, but no effect was determined on the labor force participation of highly educated women over the age of 45. Shuangshuang et al. (2023) studied data from 1990 to 2020 to assess the effects of economic growth, education, digitalization, and fertility rate on women's labor force participation. In addition to lessening the fertility rate, the researchers noticed that education, growth in the economy, and digitization all raised women's labor force involvement. Voumik et al. (2023) investigated the relationship between South Asian nations' female labor force participation, male employment, urbanization, GDP per capita, education, and trade openness using data from 1990 to 2020. The scientists uncovered that while GDP per capita and urbanization diminished female labor force participation, education and trade openness raised it over the long run. Li et al. (2024) employed the GMM technique to look into the impact of energy availability on women's labor force participation leveraging data from 2000–2020 in 78 developing countries. Conclusions highlight that while access to cooking technologies and clean energy boosts women's labor force involvement in small island developing nations, access to electricity in Sub-Saharan Africa claims positive effects on women's labor force participation and mitigates unemployment rates. Panel data analysis was carried out by Marjanović et al. (2024) to analyze the data for the years 2000–2021 countries from the European Union and explore the factors influencing women's employment. The study identified that women's labor force participation climbed when the variables of GDP per capita, birth rate, equal retirement age for men and women, annual net earnings, the number of women in parliament, and upper-secondary education improved. Conversely, discriminatory practices against women were found to decrease women's labor force

participation. On top of that, it was emphasized that increasing women's education level and improving their earnings levels were decisive in women's employment. Rahmawan and Aisyah (2024) analyzed data from 2011–2021, and their research used the Fixed Effects Model (FEM) to find the ways in which women's labor force participation in developing Asian countries was affected by their participation in parliament, education, fertility rates, unemployment, and entrepreneurship. Based on the analysis, it became apparent that women's labor force involvement rose when they were enrolled in parliament, whereas the unemployment rate had the reverse effect. Fertility rates, women's entrepreneurship, and education were found to cover no statistically significant effects. The impacts of female life expectancy, fertility rate, female parliamentary involvement, and literacy rate on women's labor force participation in OIC nations were investigated by Sari and Aisyah (2024) exercising data from 2019–2021. According to the results of the Fixed Effect Model (FEM), women's labor force participation has been demonstrated to be adversely impacted by their presence in parliament. The female life expectancy, fertility rate, and literacy rate have also been shown to exhibit no statistically significant impact on women's labor force participation.

Method

The econometric approach and data set are presented under subheadings in this section. The countries that make up the sample and the data collection are introduced in the data section. Methodologies for estimating the variables influencing women's labor force participation are discussed in this section related to the econometric approaches.

Data Set

Women's labor force participation holds significance for accomplishing economic objectives in emerging nations. Further, implementing sustainable development goals, gender equality, and social justice depend on women's labor force participation. In this vein, the study selected 28 developing nations appropriate for the 1997–2022 dataset, using panel data analysis estimators to investigate the relationship between women's labor force participation and socioeconomic institutional determinants and digitization. The study countries are presented in Table 1.

Table 1.
Research countries

➢ Algeria	➢ Colombia	➢ Indonesia	➢ North Macedonia
➢ Armenia	➢ Costa Rica	➢ Iran	➢ Paraguay
➢ Azerbaijan	➢ Dominican Republic	➢ Kazakhstan	➢ Peru
➢ Belize	➢ Ecuador	➢ Malaysia	➢ South Africa
➢ Botswana	➢ El Salvador	➢ Mauritius	➢ Thailand
➢ Brazil	➢ Georgia	➢ Mexico	➢ Türkiye

➢ China	➢ Guatemala	➢ Moldova	➢ Ukraine

The 28 World Bank-classified developing countries that constitute the focus of the study are compiled in Table 1. The data set was considered when determining the study countries, and those with insufficient data sets were excluded from participating in the analysis. Table 2 reveals the research variables.

Table 2.
Research variables

Variables	Explanation	Type	Data Source
FEMLABOR	Female labor force	The ratio to the total labor force was taken.	World Bank
LnGDP	Real GDP per capita	The natural logarithm was taken.	World Bank
INVEST	Physical capital stock	The ratio of gross fixed capital accumulation to GDP was taken.	World Bank
URB	Urbanization	The ratio of urban population to total population was taken.	World Bank
INT	Internet use	The ratio of individuals using the internet to the total population was taken.	World Bank
INF	Inflation	The annual change rate in consumer prices was taken.	World Bank
PARL	Number of female seats in parliament	The ratio of the number of women's seats in parliament to the total number of seats was taken.	World Bank

As given in Table 3, the correlation relationship between the variables was examined using Pearson correlation analysis. The results of the analysis show that there is a positive correlation between women's participation in the workforce and internet use (digitalization) and institutional structure. There is a negative correlation between physical capital investments, urbanization, economic growth and inflation and women's participation in the labor force. Correlation coefficients are within acceptable limits. Therefore, there is no multicollinearity problem in the predicted model.

Table 3.
Correlation analysis

	FEMLABOR	LNGDP	INVEST	URB	INT	PARL	INF
FEMLABOR	1						
LNGDP	-0.233	1					
INVEST	-0.144	-0.012	1				
URB	-0.192	0.396	-0.078	1			
INT	0.124	0.525	-0.009	0.319	1		
PARL	0.209	0.337	-0.041	0.210	0.456	1	
INF	-0.199	-0.045	-0.029	0.070	-0.151	-0.183	1

The dependent variable in the study was the ratio of female labor force over the age of 15 to the total labor force. The number of female seats in parliament was taken as an institutional indicator, urbanization and the internet use as a social indicator, physical capital stock and inflation variables as an investment indicator, and real GDP per capita as a macro indicator of economic growth. When identifying the variables, the empirical literature was consulted (Altuzarra et al., 2019; Sasongko et al., 2020; Viollaz and Winkler, 2022; Voumik et al., 2023; Rahmawan and Aisyah, 2024; Sari and Aisyah, 2024).

Econometric Method

While taking the econometric relationship into account among the variables, the research adhered to the empirical literature (Dücan and Polat (2017), Omran and Bilaan (2022), Bawazir et al. (2023), Voumik et al. 2023, Rahmawan and Aisyah (2024), Marjanović et al. (2024)). Both theoretical and applied research were considered for the objectives this study, and accordingly the linear representation of the determined model is as follows:

$$FEMLABOR_{it} = \alpha_0 + \beta_1 LnGDP_{it} + \beta_2 URB_{it} + \beta_3 INT_{it} + \beta_4 INF_{it} + \beta_5 PARL_{it} + \beta_6 INVEST_{it} + \varepsilon_{it} \quad (1)$$

Here "i and t" represent time and unit dimensions, "α" explains the constant slope, "β" exhibits the coefficient parameters, "ε" gives the error term. FEMLABOR is the dependent variable of female labor force, LnGDP, URB, INT, INF, PARL and INVEST are the representations of economic growth, urbanization rate, digitalization, gross fixed capital accumulation, inflation and institutional structure. In the estimated model, the natural logarithm of real GDP per capita data was taken to make large differences more balanced. Because in the sample where annual data is used, GDP data may differ between countries. The percentage of other variables was taken.

In empirical studies, decisions are taken based on the time dimension and cross-sectional dimension of the panel while testing cross-sectional dependency (CD). As for the case where the time dimension of the panel, T, is large and CD, N, is small (T>N), the Breusch and Pagan (1980) LM test is made use of. However, for the case where CD, N, is large (N>T, T>N), the Pesaran (2004) CD test is employed, which is appropriate (Tatoğlu, 2017:237). The calculation of CD test is as follows:

$$CD = \sqrt{\frac{2N}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{p}_{ij}\right) \quad (2)$$

In panel data analysis, when the number of observations exceeds the time dimension (N>T), the CD test yields accurate results. Additionally, the stationarity of the series in the study was tested through the panel unit root, which allows structural breaks developed by Karavias and Tzavalis (2014). The test statistic consists of two models, namely the first and second. In the initial model, if there is a break at the intersection points of the series, Unit root tests and breakpoint detection methods are usually used to test the null hypothesis of a random walk against the alternative hypothesis of a stationary series. There are two main hypotheses in this type of analysis (Kuokštis et al., 2024; Chen et al., 2022):

$$H_0: y_{i,t}=y_{i,t-1}+\mu_{i,t}$$
$$H_1: y_{i,t}=\varphi y_{i,t-1}+(1-\varphi)\,[\alpha_{1,i}\,I(t\leq b)+\alpha_{2,i}\,I(t>b)]+\mu_{i,t} \quad (3)$$

Alternatively, the latter model tests the null hypothesis of a biased random walk against the alternative of a trend-stationary panel process with a break in the intercepts and linear trends at time b:

$$H_0: yi, t= yi, t-1+\beta i+\mu_{i,t} \quad (4)$$

ve

$$H_1: y_{i,t}=\varphi yi,_{t-1}+\varphi\,[\beta_{1,i}I(t\leq b)+\beta_{2,i}I(t>b)]+(1-\varphi)\,[\alpha_{1,i}I(t\leq b)+\alpha_{2,i}I(t>b)]+(1-\varphi)\,[\beta_{1,i}tI(t\leq b)+\beta_{2,i}tI(t>b)]+\mu_{i,t} \quad (5)$$

The study adopted the Pesaran-Yamagata (2008) Delta test to investigate slope coefficients' heterogeneity. The following is how this test is computed (Bersvendsen and Ditzen, 2021):

$$\tilde{\Delta}=\frac{1}{\sqrt{N}}\left(\frac{\sum_{i=1}^{N}\tilde{d}_i-k_2}{\sqrt{2k_2}}\right) \quad (6)$$

Pesaran-Yamagata (2008) Delta test does not take the presence of autocorrelation and heteroskedasticity in the calculation. Therefore, Delta (HAC) test was created. Slope heterogeneity was checked using the Delta (HAC) test, which provides reliable results against autocorrelation and heteroskedasticity in the econometric model of Blomquist and Westerlund (2013). The Delta (HAC) test is delivered below:

$$\tilde{\Delta}_{HAC}=\sqrt{N}\left(\frac{N^{-1}S_{HAC}-k_2}{\sqrt{2k_2}}\right) \quad (7)$$

The study employed the fixed effect panel quantile estimator to estimate the relationship between the variables. Koenker and Bassett's (1978) quantile estimator is based on the extension of median regression analysis to quantiles (Koenker and Hallock, 2001). Panel quantile regression

developed by Koenker (2004) including CD and time effects was adapted to the data. The representation of the fixed effect panel quantile estimator, which grants the regression relationship between the variables, is as follows (Koenker, 2004; Cheng et al., 2019):

$$Q_{Yi,t}(c|X_{i,t}) = \alpha(c)'X_{i,t} + \beta i,\ i=1,..,\ N,\ t=1,\ldots,\ T \quad (8)$$

Granger causality by Dumitrescu and Hurlin (2012) was employed in the subsequent phase of the study to quantify causality between variables in heterogeneous panel data sets. The estimated test is furnished below:

$$Y_{it} = a_i + \sum_{k=1}^{(k)} \gamma_i^k Y_{i,t-k} + \sum_{k=1}^{k} \beta_i^{(k)} X_{i,t-k} + \varepsilon_{i,t} \quad (9)$$

In Dumitrescu-Hurlin (2012) causality analysis, the null homogeneous causality (HNC) hypothesis is as follows:

$$W_{N,T}^{HNC} = \frac{1}{N} \sum_{i=1}^{N} W_{i,T} \quad (10)$$

Findings

Descriptive statistics of the variables used in the study before the econometric analysis are presented in Table 4.

Table 4.
Descriptive statistics

	FEMLABOR	LnGDP	INVEST	URB	INT	INF	PARL
Mean	40.042	8.490	22.914	61.402	31.937	7.074	16.860
Median	40.762	8.533	21.976	61.687	26.340	4.830	14.634
Maximum	54.767	9.550	52.881	87.555	97.398	96.096	50.000
Minimum	12.584	6.946	12.011	30.622	0.010	-8.525	0.000
Std. Dev.	8.892	0.507	6.466	12.419	27.384	9.740	10.807
Skewness	-1.140	-0.488	1.345	-0.108	0.448	4.672	0.959
Kurtosis	4.428	3.069	5.189	2.267	1.843	32.022	3.296
Jarque-Bera	218.175	28.934	362.397	17.596	64.525	28005.65	113.677
Prob.	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vif		1.52	1.01	1.24	1.62	1.06	1.32
Obs	723	723	723	723	723	723	723

As given in Table 4, the average female labor force ratio for the period, reflecting the involvement rates of women in the economy, was computed to be 40.042%. 54.767% and 12.584% were determined to be the FEMLABOR series' maximum and minimum values, respectively. The average values of the LnGDP, INVEST, URB, INT and INF and PARL series were found to be 8.490, 22.914, 61.402, 31.937, 7.074 and 16.860, respectively. However, the maximum values of these series are 9.550, 52.881, 87.555, 97.398, 96.096 and 50.00. The research sample consisted of a balanced panel data set consisting of a total of 723 observations (N_xT). In addition, the Vif

values calculated to evaluate the multicollinearity problem showed that all independent variables remained below their acceptable thresholds and there was no problem. In general, upon analyzing the series' skewness and kurtosis values, it turned out that they did not exhibit a normal distribution. In a similar vein, the series' Jarque-Bera Prob values verified that it lacked a normal distribution. In this regard, the following step used quantile distribution graphs to analyze the series' temporal evolution. The quantile distribution graph of the series is displayed in Figure 2.

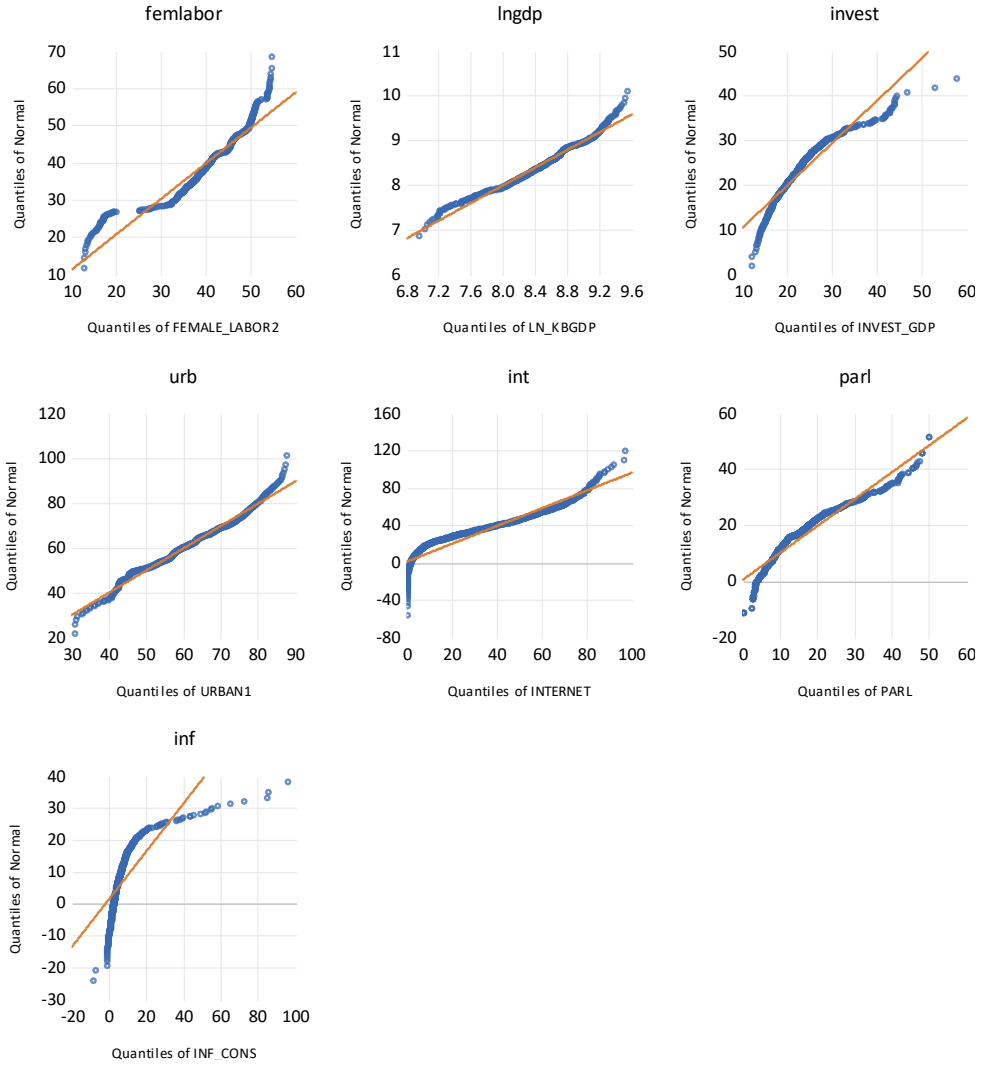

Figure 2.
Quantile Distribution Graph of Series

It is evident from Figure 2 that results from regression estimations using series that do not exhibit a normal distribution may be skewed and unreliable. This led to the use of panel quantile estimators, which were developed by Koenker (2004) for panel data sets and advocated by Basett-Koenker (1978), to analyze the regression relationship between the series.

The CD problem is commonly encountered while analyzing the stationarity of the series that make up the sample of the panel data set. Therefore, before testing the stationarity of the series,

whether they contain the CD problem or not is analyzed using the CD test suggested by Pesaran (2004) in Table 5.

Table 5.
Pesaran (2004)'s CD Test

Variables	Statistics	Prob.
FEMLABOR	25.301	0.000***
LnGDP	85.777	0.000***
INVEST	6.343	0.000***
URB	52.248	0.000***
INT	94.698	0.000***
INF	25.518	0.000***
PARL	58.483	0.000***

Note: ***,represent significance at p≤0.01 level.

According to the Pesaran (2004) CD test statistics in Table 5, all series in the Prob findings had a CD condition. Since the Karavias-Tzavalis (2014) panel unit root test accounts for the second generation and breaks with CD, it was implemented to analyze the series' stationarity. In the period covered by the research sample, many developing countries experienced serious economic crises or were affected by regional crises. In addition, the 2008 Global Financial Crisis and the 2019 COVID-19 pandemic, which affected the entire world, affected research countries. Therefore, the Karavias-Tzavalis (2014) unit root test is extremely useful both to consider considering CD and in detecting structural shocks. When applying the Karavias-Tzavalis (2014) test, it was automatically selected because the breaking dates of the countries were unknown. Table 6 presents the test findings.

Table 6.
Karavias-Tzavalis (2014)'s Unit root test

Variables	Statistics	Bootstrap Critical Value	Prob.	Date of Break
FEMLABOR	-13.426	3.7660	0.000***	2021
LnGDP	-24.691	12.714	0.000***	1998
INVEST	-6.158	-3.839	0.000***	2021
URB	-19.645	11.242	0.000***	1998
INT	-34.504	26.235	0.000***	2021
INF	-20.587	-9.897	0.000***	2001
PARL	-20.499	8.165	0.000***	1998

Note: ***, ** and * represent significance at p≤0.01, p≤0.05 and p≤0.10 levels.

According to the findings of the unit root test, displayed in Table 6, all series were identified to be stationary at the level since the statistical values computed for them are less than the Bootstrap critical values and the Prob values are significant (p≤0.05). An analysis of the series' break dates revealed that there was a structural break in the female labor force, gross fixed capital accumulation, and the internet use in 2021. The number of women's seats in parliament, urbanization rates, and economic development all contain structural breaks in 1998 and 2001,

respectively. In the following step, the Delta test was used to determine the estimated model's slope-heterogeneity. The results of the estimation are displayed in Table 7.

Table 7.
Slope-Heterogeneity Analysis

	Pesaran-Yamagata (2008)		Blomquist-Westerlund (2013)	
	Statistics	Prob.	Statistics	Prob.
Δ	21.004	0.000***	18.298	0.000***
Δadj	25.282	0.000	22.025	0.000

Note: ***,represent significance at p≤0.01 level.

However, the findings of the Delta test proposed by Blomquist-Westerlund (2013) and Pesaran-Yamagata (2008), which are displayed in Table 7, verified that the estimated model had heterogeneous features. The relationship between the series was initially estimated using the fixed effect (FE) standard errors estimator proposed by Driscoll-Kraay (1998) so that the estimation results could be compared within the study context. Hausman (1978) specification test demonstrated that fixed effects were more effective than random effects. Moreover, the F Unit test statistic Prob value confirmed the presence of unit effects in the estimated model. The results of the diagnostic tests indicated that the estimated model had problems with autocorrelation, heteroscedasticity, and CD. The Driscoll-Kraay (1998) FE standard errors estimator, which is dependable in the presence of autocorrelation, heteroscedasticity, and CD, was thus employed for estimating the econometric relationship between the variables. The findings are yielded in Table 8.

Table 8.
Driscoll-Kraay (1998) FE

	Coefficient	Std. Error	t-Statistic	Prob.
LnGDP	0.644	0.422	1.52	0.139
INVEST	0.028	0.014	1.99	0.056*
URB	0.089	0.008	10.79	0.000***
INT	0.013	0.005	2.44	0.022**
PARL	0.058	0.007	8.13	0.000***
INF	-0.011	0.008	-1.45	0.158
CONS	38.064	3.658	10.40	0.000***
F (6, 661)	7.39			
Prob.	0.000***			
	Diagnostic Tests			
FBİRİM	1066.66 (0.000)			
HAUSMAN chi2	15.79			
Prob.	0.014			
MODIFIED WALD chi2	1194.90 (0.000)			
PESARAN (2004) CD	2.707 (0.006)			
DURBIN-WATSON	0.233			
BALTAGI-WU LBI	0.383			

VIF_{MEAN}	1.29

Note: ***, ** and * represent significance at p≤0.01, p≤0.05 and p≤0.10 levels.

The results given in Table 8 indicate that inflation has an opposing impact on the female labor force, while economic growth has a positive effect, although this difference is statistically limited. In contrast, the factors of the internet use, urbanization, gross fixed capital accumulation, and the number of female parliamentary seats are found to have a positive influence. The F test Prob value, which shows whether the models are significant as a whole, was found to be significant (p≤0.05).

Despite coming up with consistent results when autocorrelation, heteroscedasticity, and CD are present, the fixed effect (FE) standard errors estimator put forth by Driscoll-Kraay (1998) may become unreliable when the normal distribution problem is prevalent. Therefore, the relationship between the female labor force and explanatory variables was estimated using the Fixed Effect Quantile estimator. The estimation results are presented in Table 9.

Table 9.
Fixed Effect Quantile Estimation

	ϛ=0.20	ϛ=0.40	ϛ=0.50	ϛ=0.60	ϛ=0.70	ϛ=0.80	ϛ=0.90
LnGDP	0.308	0.563**	0.685***	0.780***	0.886***	0.966***	1.059***
	(0.428)	(0.283)	(0.259)	(0.271)	(0.311)	(0.356)	(0.418)
INVEST	0.032**	0.029***	0.028***	0.027***	0.0264**	0.025*	0.024
	(0.016)	(0.010)	(0.009)	(0.010)	(0.011)	(0.013)	(0.015)
URB	0.116***	0.095***	0.085***	0.078***	0.069***	0.063***	0.055**
	(0.026)	(0.017)	(0.016)	(0.016)	(0.019)	(0.022)	(0.025)
INT	0.005	0.011***	0.013***	0.016***	0.018***	0.020***	0.022***
	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)
INF	-0.006	-0.010	-0.012*	-0.013**	-0.015**	-0.016*	-0.017*
	(0.010)	(0.007)	(0.006)	(0.006)	(0.007)	(0.008)	(0.010)
PARL	0.073***	0.061***	0.056***	0.051***	0.047***	0.043***	0.039***
	(0.015)	(0.100)	(0.009)	(0.009)	(0.011)	(0.012)	(0.014)

Note: Values in parentheses represent standard errors. ***, ** and * represent significance at p≤0.01, p≤0.05 and p≤0.10 levels.

Table 9 analysis results determined that the effect of economic growth on the female labor force at low quantiles (ϛ=0.20) was statistically insignificant while it was positive at all other quantiles. In the aforementioned countries, women's labor force participation has been boosted by economic growth. Therefore, policies that promote sustainable growth and women's employment in countries that are developing are crucial. In a similar manner, the impact of inflation on the female labor force is found to be adverse at medium and high quantiles, but statistically negligible at low quantiles (where the female labor force share is low). This is a noteworthy conclusion because of indicating that women in developing nations are more negatively impacted by inflation as their economic engagement rises. To advance and maintain female employment, policies that

shield the female labor force from the destructive effects of inflation should be put in place. The findings confirm that the growth of digital technologies and urbanization favor the female labor force, and it appears that economic activity is concentrated in cities. Thus, implementing a sustainable and smart urbanization strategy will promote female employment even further. In a comparable vein, boosting and maintaining the female labor force in developing nations depends heavily on growing and fortifying the digital technology infrastructure. At very high quantiles (where the female labor force is very high), the beneficial impact of gross fixed capital accumulation on the female labor force becomes statistically insignificant. The investigation has produced some pretty remarkable results in this regard. Basic services, investments in infrastructure and superstructure, and the acquisition of machinery and equipment are all included in gross fixed capital accumulation. Considering this, it is imperative that these investments be directed toward initiatives that might promote female labor. Quantile estimation results submit that institutional structure is one of the main drivers of female labor force because the effect of women's parliamentary seat rates on female labor force has been identified to be positive in all quantiles (low, medium and high female labor force).

The Granger-based causality test proposed by Dumitrescu-Hurlin (2012) for heterogeneous panel data sets was used in the subsequent stage of the study to evaluate the causality relationship among the variables. Table 10 displays the estimation the results.

Table 10.
Dumitrescu-Hurlin (2012)'s Causality Test

Null Hipotez	W-Statistics	Zbar-Statistics	Prob.
LnGDP ≠> FEMLABOR	4.821	5.435	0.000***
FEMLABOR≠> LnGDP	4.633	5.039	0.000***
INVEST≠> FEMLABOR	2.965	1.533	0.125
FEMLABOR≠> INVEST	3.798	3.284	0.001***
URB≠> FEMLABOR	6.441	8.840	0.000***
FEMLABOR≠> URB	5.079	5.977	0.000***
INT≠> FEMLABOR	3.190	2.005	0.044**
FEMLABOR≠> INT	4.249	4.229	0.000***
PARL ≠> FEMLABOR	3.953	3.602	0.000***
FEMLABOR ≠> PARL	4.298	4.326	0.000***
INF≠> FEMLABOR	3.993	3.694	0.000***
FEMLABOR ≠> INF	3.185	1.996	0.045**
INVEST≠> LnGDP	2.066	-0.355	0.722
LnGDP ≠> INVEST	4.197	4.128	0.000***
URB ≠> LnGDP	8.256	12.663	0.000***
LnGDP ≠> URB	5.477	6.818	0.000***
INT≠> LnGDP	3.566	2.795	0.005***
LnGDP ≠> INT	5.675	7.226	0.000***
PARL ≠> LnGDP	3.540	2.737	0.006***

LnGDP ≠> PARL	5.442	6.732	0.000***
INF ≠> LnGDP	2.222	-0.026	0.978
LnGDP ≠> INF	5.188	6.211	0.000***
URB≠> INVEST	7.484	11.041	0.000***
INVEST ≠> URB	4.600	4.974	0.000***
INT ≠> INVEST	3.035	1.679	0.093*
INVEST ≠> INT	4.333	4.406	0.000***
PARL ≠> INVEST	3.133	1.883	0.059*
INVEST ≠> PARL	2.448	0.443	0.657
INF≠> INVEST	4.631	5.039	0.000***
INVEST≠> INF	4.147	4.022	0.000***
INT ≠> URB	4.335	4.409	0.000***
URB ≠> INT	7.336	10.716	0.000***
PARL ≠> URB	3.227	2.081	0.037**
URB ≠> PARL	7.141	10.3004	0.000***
INF ≠> URB	11.419	19.318	0.000***
URB≠> INF	6.235	8.414	0.000***
PARL ≠> INT	4.818	5.415	0.000***
INT ≠> PARL	4.747	5.264	0.000***
INF≠> INT	2.426	0.398	0.690
INT ≠> INF	2.767	1.115	0.264
INF ≠> PARL	2.606	0.776	0.437
PARL ≠> INF	2.977	1.554	0.120

Note: ***, ** and * represent significance at p≤0.01, p≤0.05 and p≤0.10 levels.

The Dumitrescu–Hurlin (2012) causality analysis, presented in Table 10, reveals in detail the dynamic interactions between female labor force participation and macroeconomic, social, institutional, and digitalization indicators for 28 developing countries. The findings indicate the existence of a bidirectional causal relationship between female labor force participation and economic growth, inflation, urbanization, internet use, and female representation in parliament, while a unidirectional causal relationship exists with gross capital accumulation. These results indicate that growth in developing economies creates new employment opportunities and encourages women's participation in the labor market. Increasing female employment, in turn, supports productivity and, consequently, economic growth by expanding total labor supply and human capital accumulation. The rise in urbanization rates increases employment opportunities for women in areas such as education, healthcare, transportation, and care services, while the increase in female employment reinforces the urbanization trend by raising household incomes. Similarly, internet access strengthens labor force participation by providing women with opportunities such as remote working, online education, e-commerce, and digital entrepreneurship. Women's increasing labor force participation also accelerates the digitalization process by increasing demand for digital services. Inflation can reduce household purchasing power, triggering a search for additional income and increasing women's labor force participation. It can also erode real wages, limiting participation in employment. Female representation in parliament,

on the other hand, strengthens labor force participation by enabling the implementation of legal regulations that support women's employment, such as equal pay for equal work, flexible working models, and paid leave. Finally, increased female employment has been shown to enrich human capital, stimulate investment dynamics, and thus encourage gross capital accumulation.

Conclusion

There are direct or indirect repercussions of women entering the workforce in many sectors, particularly in the social and economic spheres. Women are not the only ones impacted by this circumstance; it also alters social balances, economic growth, and the general well-being of civilizations. The issue of women joining the workforce should not be viewed solely as one of employment. For this reason, women also play a key role in promoting social fairness, economic growth, and social change. Despite that, there are variations in women's labor force participation among nations due to factors such as economic development, educational attainment, infrastructure services, gender perspectives, and legal regulations. It is crucial to encompass women in the workforce, particularly in emerging nations to accomplish sustainable development objectives, improve social welfare, and meet economic goals.

This study focuses on 28 developing nations and examines the relationships between women's labor force participation, institutional and socioeconomic issues, and digitization. Owing to data limitations, the study covers the period 1997–2022. The findings of the analysis exposed that although statistically insignificant, economic growth has a positive effect on female labor force participation at low quantiles. The obtained results are consistent with the findings of the studies in the literature by Aydınbaş and Ünlüoğlu (2022), Omran and Bilaan (2022), Bawazir et al. (2023), Shuangshuang et al. (2023), Marjanović et al. (2024). There are numerous explanations for why women's labor force participation has multiplied in emerging nations as a result of economic growth. The first is that economic progress has made the service sector more prominent than the agricultural and industrial sectors, and women's active involvement in the service sector can be regarded as an indicator of this. The second explanation can be evidenced by the fact that growth in the economy and improvements in the education sector have a considerable impact on the development of more environmentally conscious generations and the employment of women in skilled occupations. The distribution of funds, credit policies, and sociopolitical policies like equal pay for equal labor, maternity leave, and kindergarten for women's entrepreneurship in developing nations can all be considered toward this end. However, at low quantiles, the impact of inflation on women's labor force participation was statistically insignificant; at medium and high quantiles, nonetheless, the effect was detrimental. This result is comparable to the research

of Dücan and Polat (2017) and Liyanage (2021). The contrary effect of inflation on women's labor force participation can be explained by the supply-side nature of inflation. Due to the supply-side nature of inflation, women's involvement in the labor force has been negatively impacted. In developing nations, the rising cost of manufacturing inputs or the frequent usage of imported inputs in the face of high exchange rates can lead to a decline in employment. Additionally, women's employment involvement may suffer from inflation as a result of this circumstance. Gross fixed capital accumulation has positive effects on women's labor force participation, even though at extremely high quantiles (when the female labor force is very high), the effect is statistically insignificant. In addition to having a positive effect on economic growth, more investment in a nation opens up new career paths for women in the production, infrastructure, and service industries. In a comparable manner, it is disclosed that the internet use at all quantile levels has positive effects on women's labor force participation, and urbanization at all quantile levels has a positive effect on the number of women in parliament. By giving them easy access to additional work options, cities can boost women's labor force participation. The internet can be considered as a factor that furthers women's awareness. At the same time, women may now work from home and engage in vocational training programs with ease, increasing their labor force participation because of digitalization. Ultimately, women have an edge when it comes to awarding legal, social, and economic rights since they are represented in parliament. Representing women in parliament can help ensure that measures that directly impact women's labor force participation such equal pay, maternity leave, and childcare services, are enacted. The results obtained are similar to the studies of Savrul and Hazar (2020), Omran and Bilaan, (2022), Viollaz and Winkler (2022), Bawazir et al. (2023), Voumik et al. (2023), Kusumawardhani et al. (2023), Rahmawan and Aisyah (2024), Marjanović et al. (2024).

Dumitrescu-Hurlin (2012) causality test results indicate that there is a bidirectional causality between economic growth, inflation, internet use, urbanization, and female parliamentary representation and female labor force participation, and a unidirectional causality with gross capital investments, indicating that these variables are determinants of women's labor force participation. These findings provide important guidance for policy designs aimed at supporting women's employment. Growth strategies that encourage women's employment—such as equal pay for equal work, public incentives for the care economy, and financing and training programs that support women's entrepreneurship—strengthen economic growth, while new employment opportunities created by growth also provide a mechanism for increasing women's labor force participation. Similarly, to reinforce the positive impact of urbanization on women's employment, it is critical to make cities more attractive for women, both in terms of living and employment,

through accessible and safe public transportation, affordable housing, quality childcare services, and inclusive urban infrastructure investments. Expanding digitalization across all sectors, developing remote working and online education opportunities, and strengthening internet infrastructure are key tools that can increase women's participation in the digital economy and, consequently, their presence in the workforce. Gender quotas to strengthen women's representation in parliament, providing financial incentives to women-led political parties, and implementing comprehensive leadership programs will create additional channels to support women's participation in the workforce. Furthermore, to mitigate the negative effects of inflation on women's employment, maintaining monetary and fiscal policies aimed at price stability, setting wage increases above inflation, and implementing inflation-compensating policies in key sectors such as food and energy will both protect and encourage women's participation in the workforce, even during periods of high inflation.

When a general assessment is made, women's participation in the workforce not only contributes to increased employment rates but also has a decisive impact on key areas such as sustainable development, improving income distribution, strengthening human capital, and accelerating digital transformation. Within this framework, designing and implementing holistic policy packages that prioritize gender equality, foster macroeconomic stability, expand digital access and improve the quality of urban life is critical for both increasing women's employment and supporting overall economic prosperity in the long term.

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