

# FEMALE LABOUR FORCE PARTICIPATION IN TÜRKİYE: NEW EVIDENCE FROM WAVELET APPROACH

## TÜRKİYE'DE KADINLARIN İŞGÜCÜNE KATILIMI VE BELİRLEYİCİLERİ ARASINDAKİ BAĞLANTI: WAVELET YAKLAŞIMINDAN KANITLAR

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### Abstract

This study is conducted to deliver a fresh vision of the dynamic connectedness between Türkiye's female labour force participation, per capita GDP, education attainment, fertility, and economic risk through utilizing the wavelet methodology. The empirical investigation of the connectedness between FLFP and other variables is carried through precisely applying multiple and partial wavelet coherence techniques employing quarterly data covering the years from 1990 to 2019. The use of multiple and partial wavelet coherence presents the role of the control variable in the relationship between two variables. To the author's best knowledge, there has been no prior study on this topic, exploring the impact of economic growth and educational attainment on FLFP through wavelet tools. Consequently, the uniqueness of this study will fill this gap in the related literature, which highlights the study's key contribution to the academic literature and policy arena. Empirical outcomes confirm significant connectedness between indicators over different spans and frequencies. Overall, the results put forth a strong link between GDP per capita and FLFP in Türkiye, followed by education attainment over different time spans. Thus, the policy design should promote GDP per capita and education attainment to encourage female attainment in Türkiye's labour market.

**Keywords:** FLFP; Türkiye; per capita income; education attainment; multiple wavelet coherence; partial wavelet coherence

**JEL Classification:** J01, E01, H52, C01

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**How to cite this article/Atf için:** Beton Kalmaz D, Giritli N. (2025). Female Labour Force Participation in Türkiye: New Evidence from Wavelet Approach. *Marmara Üniversitesi İktisadi ve İdari Bilimler Dergisi*, 47(3), 292-306. DOI: 10.14780/muiibd.1625615

Makale Gönderim Tarihi: 23.01.2025

Yayına Kabul Tarihi: :01.09.2025

Benzerlik Oranı: %20



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**Öz**

Bu çalışma, dalgacık metodolojisinin uygulanması yoluyla Türkiye’de kadınların işgücüne katılımı, kişi başına düşen GSYİH, eğitime erişim, doğurganlık ve ekonomik risk arasındaki dinamik bağlantıya dair yeni bir vizyon sunmak amacıyla yürütülmektedir. Kadınların işgücüne katılımı ile diğer değişkenler arasındaki bağlantının ampirik araştırması, 1990’dan 2019’a kadar olan yılları kapsayan üç aylık veriler kullanılarak çoklu ve kısmi dalgacık tutarlılığı tekniklerinin hassas bir şekilde uygulanması yoluyla gerçekleştirilir. Çoklu ve kısmi dalgacık tutarlılığının kullanılması, kontrol değişkeninin kontrol değişkenindeki rolünü sunar. İki değişken arasındaki ilişki. Yazarın bildiği kadarıyla, daha önce yapılan hiçbir çalışma ekonomik büyümenin ve eğitime erişimin FLFP üzerindeki etkisini dalgacık araçları aracılığıyla incelememektedir. Sonuç olarak, bu çalışmanın benzersizliği, ilgili literatürdeki bu boşluğu dolduracaktır; bu da, bu çalışmanın akademik literatüre ve politika alanına ana katkısını vurgulamaktadır. Ampirik sonuçlar, farklı kapsam ve frekanslardaki göstergeler arasındaki önemli bağlantıyı doğrulamaktadır. Genel sonuçlar, Türkiye örneğinde kişi başına GSYİH ile FLFP arasındaki güçlü bağlantıyı ve bunu farklı zaman aralıklarında eğitim başarısının takip ettiğini ortaya koymaktadır. Bu nedenle politika tasarımı, Türkiye’nin işgücü piyasasında kadınların katılımını teşvik etmek için kişi başına düşen GSYİH’yi ve eğitim kazanımını teşvik etmelidir.

**Anahtar Kelimeler:** Kadınların İşgücüne Katılım Oranı; Türkiye; Kişibaşına Gelir; Eğitim Kazanımı; Çoklu Wavelet Yaklaşımı; Kısmi Wavelet Yaklaşımı

**JEL Sınıflandırması:** J01, E01, H52, C01

**1. Introduction**

There exists a consistent worldwide gap between females and males, increasing the attention of policymakers and academics to the issue. The Global Gender Gap Report classifies gender inequalities under four key dimensions: i) economic participation and opportunity, ii) educational attainment, iii) health and survival, and iv) political empowerment (World Economic Forum, 2024). According to the Report, there has been considerable improvement in health and survival, and educational attainment, but the progress experienced in the other two categories is disappointing.

The World Economic Forum Report of June 2024 states that Türkiye, located in Central Asia, is ranked at the bottom with the lowest percentage score (63.9 per cent) of the distance covered to close the gender gap in general over the last two years. Furthermore, in the specific dimension of Economic Participation and Opportunity, Türkiye again scored at the bottom in Central Asia with 49.3 per cent progress to close the gender gap over the same period, ranking 134<sup>th</sup> among 146 countries. The economic participation and opportunity dimension includes professional and technical workers, wage equality for similar work, labour force participation rate, estimated earned income, and legislators, senior officials, and managers sub-categories. While there has been a considerable slight improvement in the first two sub-categories with 69 per cent and 61 per cent, respectively, the progress in the last three is dissatisfying.

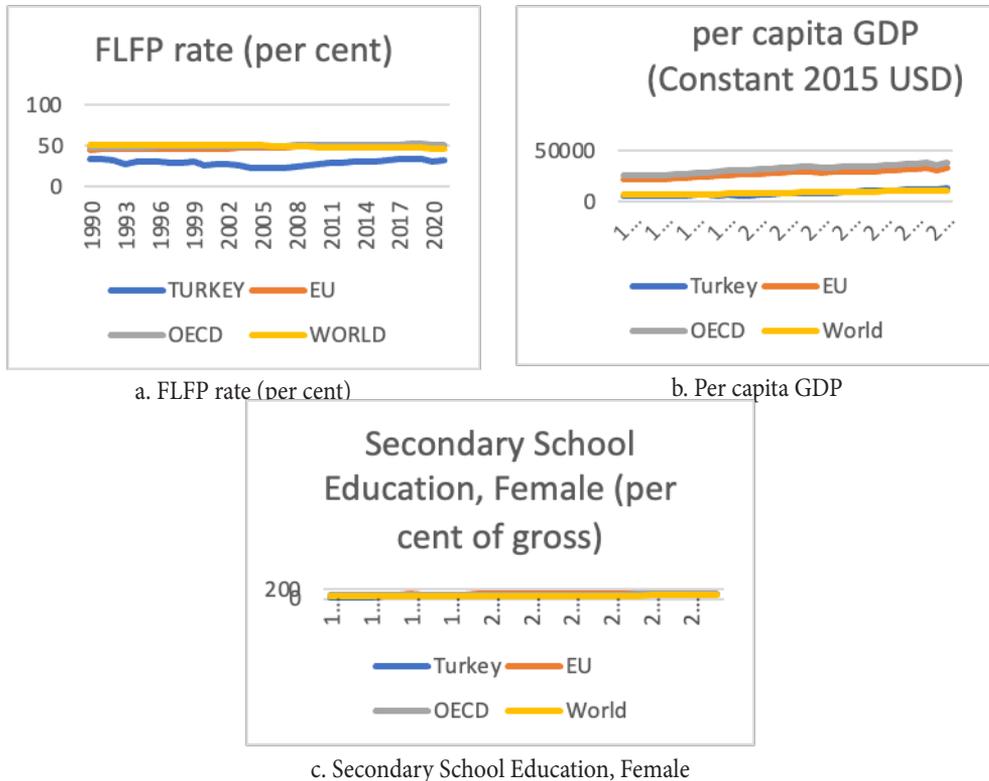
One of the most significant attempts to decrease gender inequalities is the 2030 Agenda for Sustainable Development, adopted by the United Nations member states in 2015, focusing on 17 Sustainable Development Goals (SDGs). This agenda portrays gender-specific goals to decrease gender gaps, giving particular attention to low female labour market attainment (OECD, 2023; The World Bank, 2023). Even though increased female labour force participation (FLFP) is recognised to play a vital role in closing gender inequalities, there is still a significant gap existing between males and females

in the labour market, mostly in developing countries and emerging economies. Estimates of the Global Gender Gap Index demonstrate a decline in labour force parity, which has been declining since 2009 (World Economic Forum, 2024).

The current FLFP rate at the global level accounts for 46.29 per cent, while the male labour market participation rate is estimated to be 72 per cent. The situation is even more difficult in Türkiye, which is an emerging economy. The FLFP rate falls far below the global level of 32 per cent in Türkiye, where the female-to-male labour force participation rate is only 46 per cent (World Bank, 2023). FLFP is a critical indicator that deserves exceptional attention to close the gender gap in the economic participation and opportunity dimension. Moreover, the increased involvement of females in the labour market is one of the vital indicators of the reputation and status of females in society. Furthermore, increasing female access to the labour market is a critical factor that brings equity and efficiency since equity entails improved female social status and, in turn, brings economic efficiency through raised female attainment in production. Additionally, improved FLFP augments economic growth and per capita GDP, thus the living standards in a country, through the increased total output in the country. Therefore, a country-specific investigation of the leading forces behind FLFP is crucial for efficient policy identification to promote FLFP according to country-specific characteristics, accelerating the attention of policymakers and academics on the issue in recent years.

Türkiye is a motivating country to investigate the key factors affecting the female labour market attainment since she is a candidate for the European Union (EU) and the Organisation for Economic Cooperation and Development (OECD) member. Both OECD and EU members put effort into increasing FLFP rates over the last couple of decades and experienced positive returns on average, while Türkiye remained far behind the average levels of OECD and EU accounts. Not only is the FLFP rate of Türkiye far below the averages of OECD and EU but also the per capita GDP. The main drivers behind FLFP are confirmed in related literature to be per capita GDP and education attainment; however, even though Türkiye has significantly progressed in female education attainment, the FLFP rate remains low. Thus, investigating the key factors affecting FLFP in Türkiye is vital to be able to effectively implement the most suitable policies aimed at improving FLFP both for economic and social reasons.

To illustrate the progress in the leading indicators under consideration in this study and to be able to compare the EU, OECD, world, and Türkiye progress of the indicators over the years, Figure 1 is provided below, showing FLFP rates, per capita GDP, and secondary school education of female over 1990 to 2020.



**Figure 1:** Trends of main indicators of the study over 1990 and 2020

The information presented in Figure 1 illustrates clearly that Türkiye falls far below the averages of the EU, OECD, and world for FLFP, while Türkiye has a per capita GDP distantly below the OECD and EU averages, being close to the world average. When we look at the education trend over the years, it can easily be seen that Türkiye is significantly improving the education attainment category. It is out of the ordinary that even though there is a remarkable investment in human capital, which is gestured from the increase in female education attainment, the level of FLFP remains dissatisfying. The main reason behind FLFP's significantly low level in Türkiye might be the result of inefficient policies.

This study aims to explore the key determinants affecting FLFP to be able to design effective and efficient policies to achieve higher FLFP and improved economic and social status of women in Türkiye. This study provides deep insight into the issue since the empirical analysis is applied through the utilization of multiple and partial wavelet analysis that have not been previously employed in related literature. Using the MWC and PWC will aid policymakers in Türkiye in formulating policies in time and frequency, which is neglected by prior studies.

## 2. Literature Review

The interest in exploring the drivers of encouraged FLFP has been increasing both in developed and developing countries in the last couple of decades, accelerating the studies investigating the determinants of FLFP in related literature since gender equity is recognized to be one of the fundamental issues that have to be solved (Goldin, 1995; Banerjee, 2019).

Certain studies in the existing literature either applied a panel technique concentrating on a group of countries or solely on one country adopting time series analysis. In both cases, the studies in related literature confirm a strong link between FLFP and economic growth. However, the direction of the relationship is inconclusive since some studies verify economic growth to be a driving factor behind FLFP (Goldin, 1995), while some validate that FLFP is the determinant of economic growth (Verick, 2014; Bloom et al., 2009). Thus, some studies apply causality tests to identify of the relationship's direction between FLFP and economic growth (Dursun & Damadoglu, 2020; Budun, 2021). Nevertheless, the strong link between FLFP and economic growth is undeniable. Conversely, there still exists a complex effect of economic growth on FLFP in the literature.

Beginning mainly with the founding studies of Mincer (1962) and Cain (1966), there have been several studies in the literature exploring the validity of the U-shaped relationship between FLFP and economic growth. The U-shaped relationship between the indicators hypothesizes that, as economic growth accelerates, FLFP declines at the economic development's early stages till development's threshold level is attained, and improved economic growth brings higher FLFP after a development's certain threshold level is achieved (Goldin, 1995; Fatima & Sultana, 2009).

Certain research results in related literature validate that economic growth positively affects FLFP, where improved per capita GDP is considered to be a proxy for economic growth. Modernization Theory explains the positive effect of economic growth as being the result of industrialization leading to structural social changes transforming families from traditional extended families to elementary families, where females' social acceptance in the workplace is improved (Bergh, 2007). Improved females' social acceptance raises demand for female workers; additionally, shrunk family size decreases socially assigned responsibilities of women at home, increasing the supply of women, expanding the FLFP, boosting production, and thus economic growth.

On the contrary, various research outcomes suggest a positive effect of economic growth on FLFP only for the groups with low-income, that may perhaps not lead to the country-level effect of economic growth on FLFP, which is named as World System Theory (Nam, 1991). According to the theory, female labour demand increases in labour-intensive industries to benefit from female employment from lower income groups that accept to work at a lower wage. In contrast, the supply of female labour will crowd only for a certain industry to meet the demand, not being able to have an impact on FLFP at the country level.

Besides economic growth being confirmed to be an important indicator for improved FLFP, education is considered to be another essential factor that generates progress in FLFP (Verme, 2015;

Osundina, 2020). Investment in human capital through education improves skills and productivity, thus facilitating access to better-conditioned and higher-paid jobs for females. Education not only has economic benefits for women but also generates social benefits due to women obtaining the necessary proficiencies for female empowerment, awarding them with social and economic power to manage their own lives independently. However, certain studies confirmed that education negatively affects FLFP, arising from the positive impact of education on home production, leading women to produce at home and attain less in the labour market in the case of developing countries (Klasen et al., 2021; Gupta, 2023).

There are several other micro and macro determinants of FLFP confirmed through recent studies in the literature, such as, the role of globalization, housework, fertility, and the impact of social, cultural, and religious norms, etc. (Klasen, 2021). Instead of aiming to explore the key factors of FLFP in Türkiye, this study intends to capture the heterogeneous impacts of economic growth and education attainment on FLFP utilising the multiple and partial wavelet tools, taking into consideration economic risk and fertility additionally that yields the advantage of exploring the policy designs at various frequencies. Unlike several conventional techniques such as, FMOLS, ARDL, OLS, DOLS, and many others, the wavelet methods show the co-movement between two series at different frequencies and periods, which is neglected by the mentioned techniques. While the bivariate wavelet method, provides information about the connectedness between two indicators at various time and frequency scales, the PWC and MWC are expanded versions of the bivariate wavelet method providing the opportunity to include the third variable in the analysis. Since the main aim of this paper is to explore the connectedness between the FLFP and its main determinants considering the third variable as a risk indicator of the country, the MWC and PWC are utilized. There are studies in the literature applying the bivariate version of wavelet coherence; however, the number of studies employing MWC and PWC in economic literature is still rare. To the best of the author's knowledge, no previous study explores the impact of economic growth and education attainment on FLFP through wavelet tools. Consequently, the uniqueness of this study will fill this gap in the related literature, which highlights the key contribution of this research paper to the academic literature and policy arena.

### **3. Data and Methodology**

This section of the study gives information about the data employed and explains the methods utilized to explore the impact of independent variables, namely economic growth and education attainment, on the dependent variable FLFP as a case study of Türkiye. For the purpose of the study, data is collected from the World Bank database for all the variables under consideration covering the time period from 1990 to 2019 (World Bank, 2024), except for the economic risk index, which is gathered from the PRS Group (PRS Group, 2022). The frequency of the annual data is transformed into the quarterly match-sum form, which provides the advantage of adjusting the data for seasonal deviations. Furthermore, the data transformation method is confirmed to capture the necessary frequency length for empirical analysis significantly. The labour force participation rate of female as a per centage of female in the working age population is applied to represent FLFP, economic growth

is measured as a proxy of the per capita GDP, and the share of female in gross for secondary school enrolment is employed as an education attainment indicator. All indicators are transformed into their natural logarithmic forms for the smoothness of the data, warranting the time series' stationarity to obtain more accurate and reliable empirical results. Table 1, provided below, summarizes information related to the indicators employed for the key purpose of this study.

**Table 1:** Variable Information

Variable Name	Indicator	Definition of Measurement
FLFP	Female Labour Force Participation Rate	Labour Force Participation Rate, Female (per cent of female population ages 15+ (modelled ILO estimate))
EG	Economic well being	GDP Per Capita Constant 2010 US\$
EDU	Education	School enrollment, secondary, female (per cent gross)
FR	Fertility Rate	Fertility rate, total (births per woman)
ER	Economic Risk	Economic Risk Index

Equation 1, given below, provides the economic function of the empirical analysis applied for the main purpose of this study as follows:

$$FLFP = f(EG, EDU, FR, ER) \quad (1)$$

As mentioned before, the wavelet approach provides the opportunity to analyze the association among the indicators at different time spans in several time series with time-frequency scales. One of the other advantages of the wavelet approach is that since the wavelet approach regards non-stationarity as the fundamental feature of the data, there is no pre-processing data required to solve the non-stationarity of the series. However, there are a limited number of studies conducting wavelet techniques in economic literature (Rua, 2010). Nevertheless, the number of research utilizing the wavelet technique has been increasing in the last decade since it is realized that the wavelet technique provides precious information about the link between economic indicators (Ramsey, 2002). Though, the application of partial and multiple wavelet techniques in economics still remains very rare. Moreover, there is no study known by the author shedding light on the impact of economic growth and education attainment on FLFP.

The main advantage of wavelet coherence is to provide an empirical investigation of the relationship between economic indicators at two or three dimensions, which reflects the frequency and time components instantaneously, as well as delivers insight into the strength of the link between time series (Loh, 2013). This study employs two novel techniques of wavelet coherence partial (PWC) and multiple wavelet coherence (MWC) developed by Mihanović et al. (2009), providing the advantage of adjusting the third series utilized for the main purpose of the study. PWC gives delegated information about the interrelationship among variables by influencing the wavelet coherence for two series while controlling the impact of the third series, whereas MWC yields the advantage of providing information about the relationship of independent variables with a dependent variable when no restriction is imposed.

Equation 2 provided below illustrates the partial correlation square used to estimate the impact of independent variables on the dependent variable, removing the influence of the second independent

variable for the estimation purposes. In the given Equation 2,  $y$  represents the dependent variable, while  $x_1$  and  $x_2$  stand for the independent variables.

$$RP^2 = \frac{|R(y,x_1) - R(y,x_2) \cdot R(y,x_1)^* I^2|}{[1 - R(y,x_2)]^2 [1 - R(x_2,x_1)]^2} \quad (2)$$

Multiple wavelet coherence application provides the advantage of investigating the impacts of both independent variables on the dependent variable without imposing any restrictions.

$$RM^2 = \frac{R^2(y,x_1) + R^2(y,x_2) - 2Re[R(y,x_2) \cdot R(y,x_1)^*]}{1 - R^2(x_2,x_1)} \quad (3)$$

The statistical significance level of PWC and MWC is approximated through the application of the Monte Carlo technique.

#### 4. Empirical Findings

This section of the study illustrates and explains the empirical results obtained through the application of the wavelet approach to investigate the multiple and partial impacts of selected indicators on FLFP in Türkiye.

The outcomes of MWC and PWC explaining the coherence plots between education, economic risk, and FLFP are shown in Figure 2, given below. The result of MWC is given in Figure 2a, where the association of both education and economic risk with FLFP is considered simultaneously. According to the MWC, a strong co-movement exists among the variables in 0-4 months and 4-8 months cycles over 1988-1992, 1997-2002, and 2007-2018. In addition, there is a significant long-run association among the variables observed over the time period of 1995-2001. According to the findings of PWC among FLFP and education attainment after cancelling out economic risk, illustrated by Figures 2b, the co-movement among the indicators appears in the short run and medium run in 0-4 months and 4-8 months cycles over different time horizons. However, there is only a short-run significant association observed between FLFP and economic risk after cancelling out education attainment in 0-2 months cycle in 1997 and 1999, which is illustrated by Figure 2c.

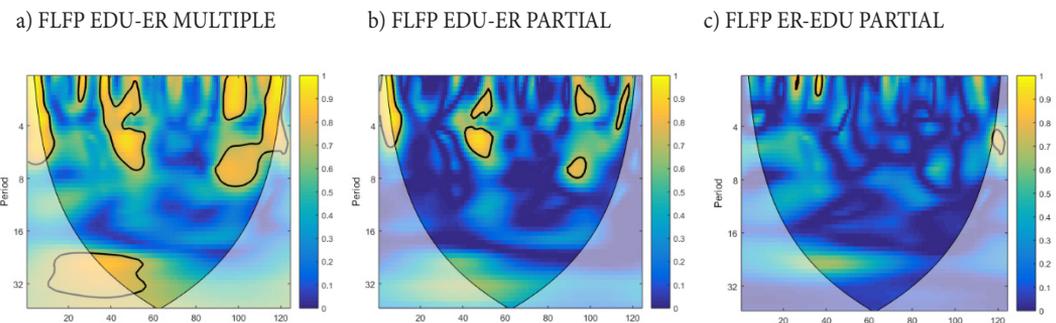
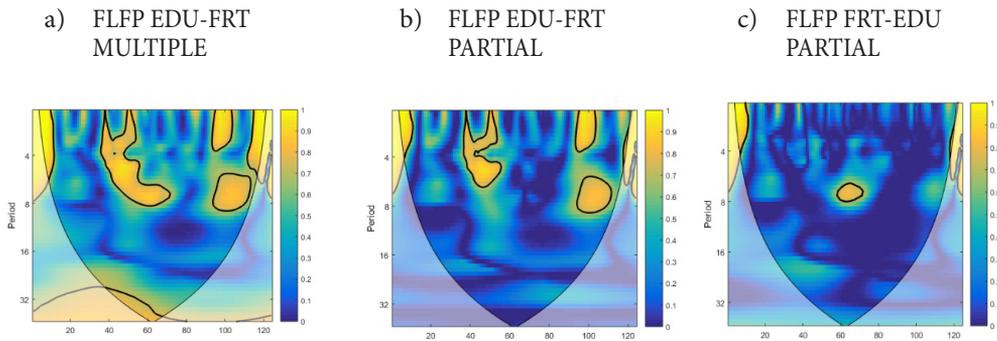


Figure 2: MWC and PWC results of the Education and Economic Risk on FLFP

Comparing Figures 2b and 2c above, it is verified that the connectedness among FLFP and the variables is weaker when education is controlled.

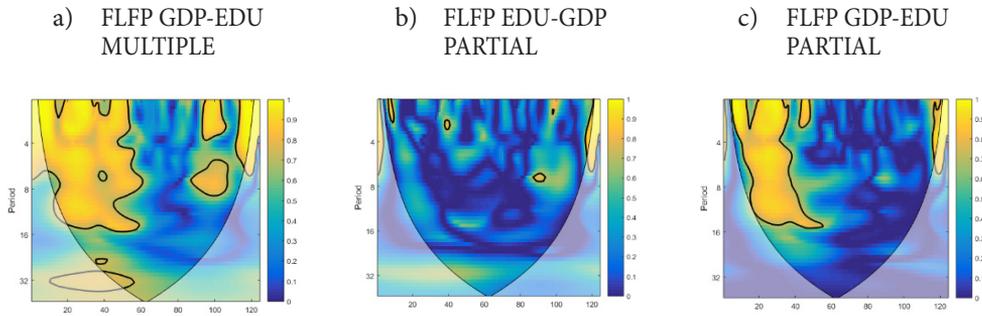
Figure 3, provided below, represents the outcomes of MWC and PWC, explaining the coherence plots between education, fertility, and FLFP. Figure 3a illustrates the outcome of MWC, where the association of both education and fertility with FLFP is considered concurrently. It is confirmed that there is a strong co-movement among the variables in 0-4 months and 4-8 months cycles over 1988-1992, 1997-2007, and 2010-2018. Moreover, a long-run significant association among the variables is confirmed over the time period from 1997 to 2007. Figure 3b shows PWC among FLFP and education attainment after removing fertility, where the same co-movement among the indicators is observed as in the case of MWC results, which confirms a strong interrelationship between education and FLFP in the short run and medium run in 0-4 months and 4-8 months cycles over different time horizons. However, a very short-run significant association was observed between FLFP and fertility after cancelling education attainment in a 0-2 months cycle in 1988 and a medium-run association over 2002-2005, which Figure 3c illustrates. The outcomes of both Figure 2 and Figure 3 verify a strong link between educational attainment and FLFP in Türkiye.



**Figure 3:** MWC and PWC results of the Education and Fertility Rate on FLFP

Comparing Figures 3b and 3c above, it can be concluded that the strength of the connectedness among FLFP and the variables becomes weaker when education is controlled.

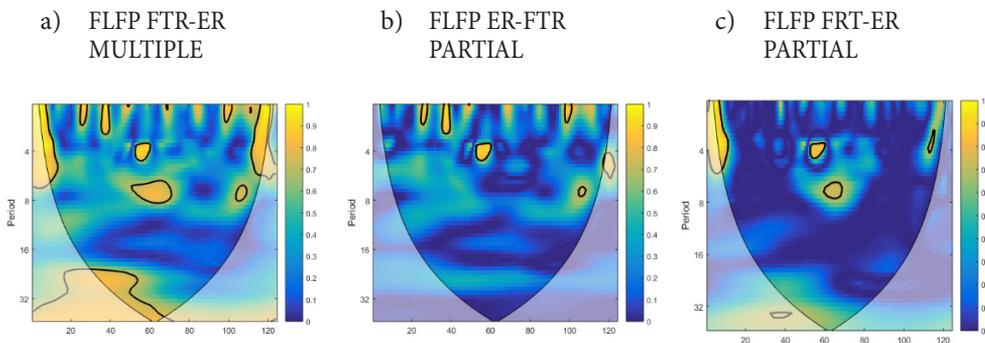
Figure 4 shows the MWC and PWC results of the coherence plots between economic growth, education attainment, and FLFP. There is a strong link observed among the indicators according to the results of MWC illustrated by Figure 4a all over short-run, medium-run, and long-run over the time period from 1988 to 2002, and 0-8 months cycles over 2007 and 2018. However, when economic growth is cancelled out, only a few small plots are observed showing the link between FLFP and educational attainment in the short run, as seen in Figure 4b. On the contrary, Figure 4c verifies a highly strong link between GDP and FLFP when education attainment is cancelled out in the short and medium run covering the years between 1988 and 2002, and 0-8 months cycles in 2018.



**Figure 4:** MWC and PWC results of the Education and Economic Growth on FLFP

Comparing Figures 4b and 4c above, it is clear that the connectedness among FLFP and the variables becomes weaker when GDP is controlled.

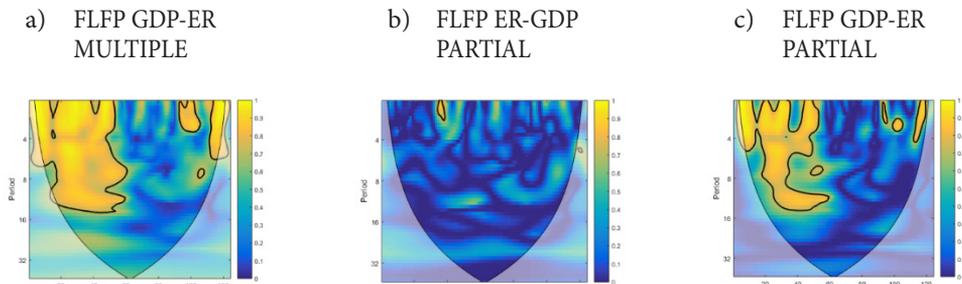
Figure 5 illustrates the MWC and PWC results of the coherence plots between fertility, economic risk, and FLFP. According to the empirical findings of MWC, there is a statistically significant link among the indicators when both fertility and economic risk are considered simultaneously. The link among the variables is illustrated in Figure 5a, given below, summarizing the results of MWC. According to the findings, 1988 there is a link between 0-8 months cycles in 1988 and after 2017 to the present, 0-4 months cycles over 1993 and 1997, 0-2 months cycles in 2002 and 2007, and a long-run link over the time period 1995-2005. Figure 5b illustrates the connection between FLFP and economic risk after cancelling fertility, where strong but few plots are observed over different time horizons at varying scales. Moreover, as it is clear from Figure 5c, cancelling out economic risk also considerably decreases the interconnection between fertility and FLFP observed by few statistically significant plots in the short and medium run.



**Figure 5:** MWC and PWC results of the Economic Risk and Fertility on FLFP

Comparing Figures 5b and 5c above, the connectedness among FLFP and the variables does not show much difference under the condition of either the control of ER or FRT. However, considering the FTR and ER together increases the strength of the connectedness among the indicators.

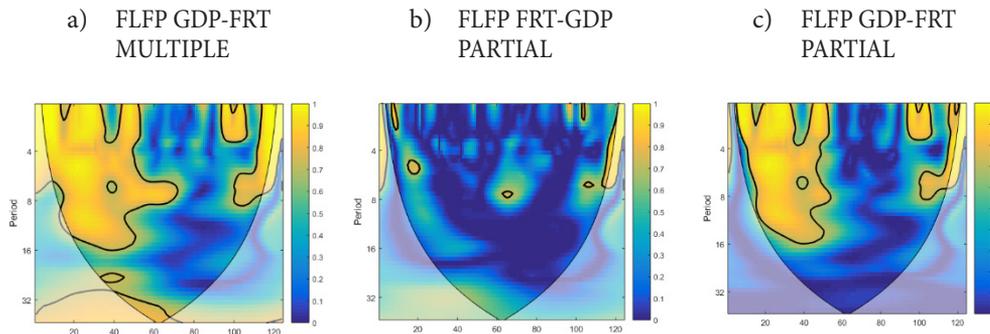
Outcomes of the MWC and PWC of the coherence among economic growth, economic risk, and FLFP are illustrated in Figure 6 below. There is a strong link observed among the indicators all over the years except from the period over the years 2002 and 2007 in the long run, as it is evidenced by Figure 6a. The strong link between economic growth and FLFP still persists when economic risk is removed, as can be seen from Figure 6c, which illustrates the results of PWC in the absence of economic risk. However, the connection between economic risk and FLFP gets weaker and appears to exist only in the short run, as can be seen from Figure 6b, where economic growth is removed.



**Figure 6:** MWC and PWC results of the Economic Risk and Economic Growth on FLFP

Comparing Figures 6b and 6c above, it is clear that the connectedness among FLFP and the variables becomes significantly weaker when GDP is controlled.

Lastly, Figure 7, given below, illustrates the link among economic growth, fertility, and FLFP, reflecting the results obtained from the MWC and PWC analysis. It is clear from Figure 7a that there is a strong link among the variables over the investigation time span at different scales. As evidenced in Figure 7b and Figure 7c, the outcomes of PWC where economic growth and fertility are cancelled, respectively, show that the strong link between economic growth and FLFP continues to occur. However, the link between fertility and FLFP exists only in very short cycles.



**Figure 7:** MWC and PWC results of the Economic Growth and Fertility on FLFP

Comparing Figures 7b and 7c above, it is confirmed that the connectedness among FLFP and the variables becomes weaker when GDP is controlled.

## 5. Discussion of the Findings

Regarding the main aim of this study, multiple and partial wavelet methods are applied to investigate the strength of the connectedness of the main determinants of FLFP, namely GDP per capita and education attainment in Türkiye, by employing quarterly data over the years from 1990 to 2019. The wavelet approach provides the advantage of exploring the connectedness among the variables at different times and frequencies. The main purpose of using the wavelet approach is to compare the outcomes obtained to design appropriate policies to promote Türkiye's FLFP.

The outcomes of the MWC, illustrated through Figure 2a to Figure 7a, verify the strong connection between per capita GDP and FLFP in Türkiye. This conclusion is driven by the wide range of plots of the outcomes shown in Figure 4a, Figure 6a, and Figure 7a, where GDP is considered the main indicator of Türkiye's FLFP. According to the findings, when GDP per capita is included in the estimation together with educational attainment, economic risk, and fertility rate, the strength of the connectedness of the indicators can be ranked from the strongest to the weakest from GDP per capita and education attainment, GDP per capita and fertility, and lastly GDP per capita and economic risk. This conclusion verifies the importance of policies to be designed to improve GDP per capita and education attainment together. Comparing Figure 4a (where the connectedness of GDP and education attainment together with FLFP is illustrated) and Figure 7a (where the connectedness of GDP and fertility together with FLFP is shown), it is clear that the link between FLFP and GDP per capita together with education attainment is stronger than the link between FLFP and GDP per capita together with fertility, verified from the shades observed over the more extended time period, and with higher frequencies appearing at larger scales.

The application of PWC provides the advantage of obtaining information about individual connectedness among variables, removing the third variable's effect. The outcomes of the PWC results are presented by the 'b' and 'c' charts of each Figure from Figure 2 to Figure 7. The maps of partial coherence among the variables unveil the fact that the strongest significant connectedness exists between GDP per capita and FLFP in Türkiye. In other words, GDP per capita reveals the strongest link to FLFP among the other factors determining FLFP for the case of Türkiye. The strength of the link among variables decreases when one of the variables is removed, evidenced by the PWC outcomes compared to the outcomes of MWC. However, the strong link between educational attainment and FLFP is still persistent when economic risk and fertility are removed, as represented by Figures 2b and 3b, respectively. Nevertheless, when GDP has been removed, the link between FLFP and educational attainment gets considerably weaker, as illustrated by Figure 4b.

The overall results obtained put forth the strong link between GDP per capita and FLFP in the case of Türkiye, followed by education attainment. Thus, the policy design should be in the direction of promoting GDP per capita and educational attainment to encourage female attainment in the labour market of Türkiye.

## 6. Conclusion

In this research paper, the partial and multiple wavelet coherence techniques are applied to investigate the connectedness between female attainment to the labour market and its main determinants in Türkiye through time and frequency. The main determinants of FLFP are considered to be GDP per capita and education attainment. Furthermore, fertility and economic risk are used as control variables. As underlined earlier in the paper, wavelet methodology mainly allows for the investigation of the connectedness between the determinants of FLFP at different frequency bands and over different time periods. The main contribution of this study to the related literature is the use of PWC, and MWC presents the role of the control variable in the relationship between two variables, which no previous study exploring the main determinants of FLFP and female attainment to the labour market through the application of wavelet tools. Consequently, the main contribution of the paper is to highlight the advantage of the wavelet methodology application to analyze the connectedness between per capita GDP, education attainment, fertility, economic risk, and FLFP in Türkiye over time and at different frequencies.

The outcomes of the empirical analysis deliver fresh evidence of the connectedness of per capita GDP, educational attainment, fertility, economic risk, and female labour market attainment in Türkiye. It is clear from the findings that the connectedness of the variables has changed through time and frequency. According to the empirical outcomes, there is a significantly strong link that exists between per capita GDP and FLFP in the short run and medium run, while educational attainment is linked to female market attainment more in the long run. It is evidenced that when GDP per capita is considered with control variables under different scenarios, the link between GDP per capita and FLFP also exists in the long term. In other words, MWC results confirm the increased link between FLFP and GDP per capita when fertility is also included in the consideration. Furthermore, including control variables fertility and economic risk accompanied both with per capita GDP and educational attainment generate a long-term strong link between GDP and FLFP, and education attainment and FLFP.

Based on the empirical findings, it can be concluded that while designing policies to encourage female labour market attainment, short-term policies are applicable for the per capita GDP improvement and education attainment, while long-term policies should be applied considering fertility and economic risk. The gender wage gap decrease is one of the options that promote per capita GDP, thus FLFP in Türkiye. There have been considerable improvements in the educational attainment of females. However, it remained mostly in urban regions that appear in western parts of Türkiye, which is considerably more industrialized compared to the eastern regions, and at the primary level for rural areas. To improve the education level of female, higher education for female should be encouraged, particularly for female coming from lower-income groups and from rural regions. The gap between regions for both gender educational attainment and female-male pay is obvious. Thus, policymakers should take the regional differences under consideration for policy design to decrease the gender pay gap and increase the educational attainment of female.

As fertility expands the linkage between FLFP and GDP per capita, and FLFP and education attainment in the long run, policies should be designed to provide a balance between work and family life. One of the solutions in the case of Türkiye can be regarding parental leave, which is only given to the spouses of public workers on a voluntary basis, which can find a broader base. Widened childcare and elderly care services, which are rare even in urban areas, might reduce the female responsibilities at home to increase female labour market attainment. There should also be some legal and institutional reforms that might be applied to promote the labour force participation of females. The laws protecting women's rights can be improved, such as laws to avoid discrimination in the workplace. Furthermore, the financial literacy of females can be improved to provide access to financial services supporting economic empowerment. Moreover, improved safety of transportation might encourage female labour force participation, allowing for secure travel to and from places of employment. A revised social security system, which enables better inclusion of females, can be applied as short and medium-run policies to increase female labour force attainment, while long-run policies should take into account the regional differences in addition to the strength of the connectedness between indicators over different time spans. Thus, further studies can be conducted comparing the female labour market attainment in rural and urban regions of Türkiye separately to be able to uncover the differences for appropriate policy design to improve FLFP. Furthermore, it should also be mentioned that even though the wavelet approach is a strong technique providing information about the relationship between time series at different frequencies, it does not imply causality. Therefore, it can be suggested for further research to apply other econometric techniques to establish causal links.

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