The Interplay Between Fertility and Female Labor Market Dynamics in the Arab Region: A Time Series Analysis

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Abstract

This study investigates the complex relationship between fertility and female labor force participation in the Arab region, where sociocultural norms often constrain women's economic empowerment. Utilizing panel data spanning 1991 to 2023 across 15 Arab countries, the analysis employs the Pooled Mean Group Autoregressive Distributed Lag (PMG-ARDL) model to account for potential endogeneity and dynamic heterogeneity. The results reveal that higher fertility rates reduce labor market participation among women aged 15–64, while unexpectedly increasing participation among younger women aged 15–24. However, when labor market conditions are considered, fertility is found to contribute to higher unemployment rates in both age groups. These findings underscore the need for policy interventions that support women's employment, including expanded access to reproductive health services, flexible work arrangements, childcare provision, and broader gender equity measures. The study's contribution lies in its region-wide, longitudinal perspective, offering new insights beyond prior country-specific or survey-based analyses.

JEL: J13, J16, J21, C33

Key words: PMG, Females, Arab world, Labor force participation, Fertility

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1. Introduction

Female performance in labor market outcomes in the Arab world is significantly lower than global averages and those of comparable regions (Alissa, 2007; Filali et al., 2013; El-Mallakh et al., 2018; Elhaj & Pawar, 2019; World Bank, 2025). Only 19% of females aged 15 and over actively participate in the labor force (ILO, 2025). This rate is notably lower than the global labor force participation rate, which averaged 50% from 1995 to 2025. The rate drops further to 15% for females aged 15 to 24, compared to the global average of 41% for the same age group during the same period (ILO, 2025). The low labor force participation rate of Arab females is even more evident when compared with that of their Arab male counterparts. According to statistics, Arab males had a significantly higher labor force participation rate, with 74% for men aged 15–64 and 47% for those aged 15–24 between 1991 and 2020 (ILO, 2025). This contrast highlights the disparity with the lower rates for females in the same age groups. Furthermore, the challenges faced by Arab females in entering the labor market are exacerbated by high unemployment rates. Over the past three decades, the unemployment rate among females aged 15 and over has been 18% (ILO, 2025). This rate notably surpasses the unemployment rate of Arab males, estimated at 9.5%, and exceeds the global unemployment rate for females, which stands at 6% during the same period (ILO, 2025). Similarly, the unemployment rate for young Arab females has been 23% higher than that of young Arab males over the past three decades. This rate also exceeds the global unemployment rate for young females, projected at 15.5% over the same period (ILO, 2025).

The marginalized status of Arab women in the labor market has far-reaching implications that extend beyond economic hardships, such as deteriorating household livelihoods, deepening poverty, and limited economic empowerment. It also perpetuates entrenched social inequalities (Sen, 2000; Backeberg & Tholen, 2018) and reinforces traditional gender roles that curtail women’s opportunities for both personal and professional development (Al-Asfour et al., 2017). This cycle of disadvantage not only stifles women’s individual aspirations but also impedes overall societal progress, as the potential contributions of half of the population remain untapped. According to the Gender Inequality Index, the Arab world scores approximately 0.5, indicating that 45% of the gender gap remains unaddressed (UNDP, 2025). Moreover, the region scores only 2.6 out of 6 on the Country Policy and Institutional Assessment (CPIA) for gender equality (World Bank, 2025). These suboptimal rankings challenge the arguments of numerous studies, which emphasize the transformative significance of female labor market participation as a tool for economic, political, and social empowerment (Verick, 2014).

A growing body of research has sought to identify the factors contributing to the declining labor market status of women. These studies underscore the impact of a variety of elements, such as fertility, workplace discrimination, and the adverse effects of economic downturns on women's labor market behavior. Among these, fertility remains a key factor that consistently garners research interest (Bowen & Finegan, 2015; Goldin, 1995; Brewster & Rindfuss, 2000; Tam, 2011). High fertility, defined as an increase in the number of children born, often consumes a significant portion of women’s time and energy. This burden creates considerable challenges in balancing work and family life, frequently resulting in barriers to labor force participation and career advancement (Brewster & Rindfuss, 2000; Aguero & Marks, 2008; Bloom et al., 2009).

The undesirable status of Arab females in the labor market has far-reaching consequences beyond negative economic implications, such as the deterioration of families' livelihoods, deepening poverty in societies, and the lack of economic empowerment. It also perpetuates social inequalities (Backeberg & Tholen, 2018) and reinforces traditional gender roles that restrict females' opportunities for personal and professional development (Al-Asfour et al., 2017). This cycle of disadvantage hinders not only females' individual aspirations but also the overall progress of communities, as the potential contributions of half the population remain untapped. According to the Gender Inequality Index, the Arab world's ratings hover around 0.5, indicating that 45% of the region's gender gap remains unaddressed (UNDP, 2025). Additionally, the Arab world scores 2.6 out of 6 on the CPIA for gender equality (World Bank, 2025). This poor performance contradicts numerous studies that highlight the transformative significance of females' labor market participation for economic, political, and social empowerment (Verick, 2014). Several studies have explored the factors contributing to females' declining labor market status, highlighting the impact of elements such as fertility, workplace discrimination, and economic downturns on females' labor force participation. In this context, fertility emerges as a primary determinant that continues to capture researchers' interest (Bowen & Finegan, 2015; Goldin, 1995; Brewster & Rindfuss, 2000; Narayan & Smyth, 2006; Tam, 2011). High fertility, defined as an increase in the number of children born, consumes females' time and energy. Consequently, this creates significant challenges in balancing work and family life, often resulting in barriers to labor force participation and career advancement for females (Brewster & Rindfuss, 2000; Agüero & Marks, 2008; Bloom et al., 2009).

According to available statistics, the Arab world's total fertility rate was approximately 3.85 between 1990 and 2020, exceeding the global average for the same time period (World Bank, 2025). Exploring this high fertility rate in the context of the region's labor market suggests a strong correlation between it and female underperformance in the labor market**.** In fact, only two studies have investigated the relationship between Arab female status in the labor market and fertility (Al-Qudsi, 1998 and Ucal and Gunay, 2019). However, both of these studies used microdata derived from different types of surveys, namely population surveys and labor market surveys. This limits the generalizability of their findings, as the unique socio-economic and cultural contexts of each country can significantly influence the relationship between female labor market participation and fertility rates. Therefore, adopting a more comprehensive approach that utilizes a wider dataset across multiple Arab countries is crucial for deriving more precise conclusions and effectively influencing policy decisions.

This study aims to explore how fertility rates influence the participation of Arab females in the labor force and their unemployment rates. The study will utilize demographic and economic time series data spanning from 1991 to 2023, for 15 Arab countries. To mitigate potential biases and ensure robust analysis, the study will employ the pooled mean group method, known for its ability to account for diverse factors impacting the data such as cross-country variations and time-specific effects.

The rest of the paper follows this structure. Section 2 introduces the literature review and Section 3 sketches the methodology and data. Section 4 presents results and discussion, while Section 5 concludes.

2. Literature Review

Theoretically, many hypotheses have been proposed to explain the complex relationship between fertility and female labor market behavior. The incompatibility hypothesis, for instance, suggests that the constraints of modern employment, like extended absences from home and full job engagement, restrict females 'involvement in the labor market (Bowen and Finegan, 2015). Proponents of this hypothesis argue that working in industrialized communities requires physical presence and more time dedicated to daily tasks. This obviously contrasts with females' reproductive and domestic roles, which require them to spend more time at home raising and caring for children. Conversely, in communities where agriculture is dominant and there is no clear distinction between work hours allocated to farm tasks and child supervision, females could more easily manage both childcare and work responsibilities (Boserup et al., 2013).

The societal response hypothesis suggests a positive link between fertility and female labor force participation (FLFP), unlike the incompatibility hypothesis (Brewster and Rindfuss, 2000; Narayan and Smyth, 2006). Increased female workplace participation has reshaped societal norms, fostering a supportive relationship between fertility and labor market involvement. As society adapts to female labor realities, key policies like paid maternity leave and accessible childcare facilities have emerged (Brewster and Padavic, 2000; Rindfuss et al., 1996).

The U-shaped curve hypothesis posits a U-shaped relationship between economic development and FLFP (Sinha, 1965; Goldin, 1990, 1995; Tam, 2011). Initially, FLFP declines as economies shift from agrarian to industrial stages due to increased household duties and cultural norms (Goldin, 1994; Gaddis and Klasen, 2014). As economies advance, FLFP rises with improved education and evolving societal expectations, enabling women's access to higher education and professional roles, increasing labor market feminization (Gaddis and Klasen, 2013). Maturing economies, dual-income needs, and weakening traditional gender roles further support this trend (Dong and Pandey, 2012).

In general, there is no clear demarcation between these hypotheses when explaining females' labor market behavior in response to fertility. For instance, societal response theory appears to describe the labor market behavior of females in communities that have made significant economic progress. At this stage, it aligns with the U-shaped hypothesis, particularly in the upward portion of the curve, where FLFP increases as childcare options improve and alternatives to childbearing become more accessible. The incompatibility hypothesis, however, is more independent and persistent, as its negative impact on FLFP continues despite the developmental progress noted by the other two hypotheses. Nevertheless, advancements in information technology, which have reduced workplace constraints by enabling remote work, may challenge the incompatibility hypothesis and influence FLFP. In other words, technological progress both shapes and is shaped by economic growth and social changes, ultimately affecting females' labor market behaviors. These advancements are expected to positively influence FLFP by removing the incompatibility barrier, thereby integrating the three hypotheses.

Numerous studies have examined the relationship between fertility and women's labor market participation, utilizing diverse contexts, data types, and estimation methods. Generally, higher fertility rates are associated with lower labor market participation (Aguero & Marks, 2008; Bloom et al., 2009, among others). However, some studies emphasize alternative factors influencing women's workforce engagement, such as access to contraception (Aguero & Marks, 2008), effective social policies (Del Boca et al., 2009), the removal of legal abortion restrictions (Bloom et al., 2009), and shared household responsibilities (De Laat & Sevilla-Sanz, 2011). In contrast, other studies document a positive relationship between female labor force participation and fertility, particularly under supportive family policies or cultural flexibility (Azid et al., 2010; Baah-Boatenga et al., 2013; Aaronson et al., 2018; Shittu & Abdullah, 2019; Guirguis et al., 2024).

Notably, both strands of literature face potential endogeneity issues, where fertility and labor supply mutually influence each other. Without addressing this, estimates may reflect correlation rather than causation, potentially leading to biased policy implications (Bloom et al., 2009).

In the Arab world, studies on the relationship between fertility and FLFP are scarce. Despite growing interest, only two studies have explored this issue in the region. Al-Qudsi's (1998) study examined the relationship between fertility and Arab women's labor supply using microdata from just four countries. A more recent study by Ucal and Gunay (2019) analyzed data from 13 Arab countries, using the World Values Survey (2010–2014) to explore the influence of sociocultural factors on FLFP, including fertility. Although both studies concluded that higher fertility negatively affects female labor supply, their findings have several limitations. First, neither study addressed endogeneity, a crucial factor given the potential for reciprocal effects between labor supply and fertility decisions. Second, the sample coverage was limited in terms of both country diversity and longitudinal depth, restricting the generalizability of the findings across the region. Third, reliance on survey data without integrating more comprehensive demographic or policy-related information limits the robustness of their conclusions. Additionally, these studies did not disaggregate effects by age group, missing important variations in how fertility influences employment at different life stages. Given the region’s large youth population and evolving gender dynamics, such age-specific insights are critical for effective policy targeting.

3. Data and Methodology

3.1 Data

This study utilizes panel data primarily sourced from the World Bank, specifically the World Development Indicators, covering the period from 1991 to 2023 for 15 Arab countries. The time span for each variable varies depending on data availability. For example, labor market data, including the total female and young female populations and unemployment rates for both groups, is available for the period 1991–2023. This data availability defines the study's timeframe. Other variables, such as total fertility rate (births per woman), inflation rate, real GDP, real GDP per capita, gross capital formation as a percentage of GDP, domestic credit provided by banks to the private sector as a percentage of GDP, and total female population, extend beyond 1991 and 2023. The average years of schooling for the total population were sourced from the Our World in Data website. Since this dataset is updated every five years, values for the intervening years were approximated to ensure completeness and validity. Table I provides detailed definitions of the variables used in the study, along with their data sources, while Table II presents descriptive statistics, including the mean, standard deviation, and range.

Table I: Variables definition and sources

Variable	Definition	Source
Log FLFP	Log of labor force participation rate, female (% of female population ages 15+)	WDI
Log YFLFP	Log of labor force participation rate for ages 15-24, female (%)	WDI
Log FUN	Log of unemployment, female (% of female labor force)	WDI
Log YFUN	Log of unemployment, youth female (% of female labor force ages 15-24)	WDI
Log FER	Log of total fertility rate (i.e. births per woman)	WDI
Log EDU	Log of average years of education for 15-64 years male and female youth and adults	Our World in Data
Log FPOP	Total female population	WDI
Log GDPP	Log of GDP per capita (constant 2015 US$)	WDI
Log GDP	Log of GDP (constant 2015 US$)	WDI
Log KGDP	Gross fixed capital formation (% of GDP)	WDI
Log CRED	Log of domestic credit to private sector by banks (% of GDP)	WDI
INF	Inflation, GDP deflator (annual %)	WDI

Table II: Summary statistics for the variables used

Variable	Observation	Mean	Std. Dev.	Min	Max
Log FLFP	509	25.83	13.28	4.93	63.54
Log YFLFP	509	34.77	12.07	16.98	70.96
Log UNF	494	15.31	9.23	0.378	32.10
Log UNYF	494	30.58	18.49	1.48	74.62
Log FER	495	3.42	1.24	1.33	8.60
Log EDU	454	6.59	2.25	0.456	11.35
Log FPOP	510	1.00	1.09	137327	5.67
Log GDPP	509	14752.	18650.51	712.27	81608.57
Log GDP	504	1.20	1.41	9.44	7.82
Log KGDP	498	23.30	9.92	-12.88	59.34
Log CRED	458	6.59	25.78	1.26	138.41
INF	503	1.01	33.01	-28.76	396.43

3.2 Empirical Modeling

To examine the effects of the fertility rate on the participation of Arab females in the labor market, this study estimates two models. The first model examines the impact of fertility rates on females' labor force participation, whereas the second one investigates the impact of fertility rates on females' employment. To strengthen the analysis's robustness and depth, the estimation will be further disaggregated to incorporate young females. Following Goldin (1995) and Tam (2011), the first model can be expressed as follows:

$$lnFLFP_{it} = \beta_{0i} + \beta_{1i}lnFER_{it} + \beta_{2i}lnEDU_{it} + \beta_{3i}lnFPOP_{it} + \beta_{4i}lnGDPP_{it} + \beta_{5i}lnKGDP_{it} + \varepsilon_{it} \quad (1)$$

Where lnFLFP is the log of the FLFP rate; lnFERT is the log of fertility rate; lnEDU is the log of average years of education for 15-64 years population; lnFPOP is the log of total female population; lnGDPP is the log of GDP per capita; lnKGDP is the log of the gross fixed capital formation as a percentage of GDP; β_{0i} is the cross-section specific intercept; β_{ji} are the parameters of the independent variables; t is time; i = 1,2,….,15 countries, and ε is the error term.

The second model, which examines the impact of fertility on female unemployment, can be also written as follows:

$$lnFUN_{it} = \alpha_{0i} + \alpha_{1i}lnFER_{it} + \alpha_{2i}lnEDU_{it} + \alpha_{3i}INF_{it} + \alpha_{4i}lnFPOP_{it} + \alpha_{5i}lnGDP_{it} + \alpha_{6i}lnCRED_{it} + \varepsilon_{it} \quad (2)$$

Where lnFUN is the log of the unemployment rate of the female population; INF is the inflation rate; lnGDP is the log gross domestic product; lnCRED is log of domestic credit to private sector by banks as a percentage of GDP; α_{0i} is the cross-section specific intercept; α_{ji} are the parameters of the independent variables. The rest of the variables and notations remain as they defined in Equation (1).

3.3 Estimation Methodology

To estimate the models, this study employs the Pooled Mean Group (PMG) and Mean Group (MG) methods developed by Pesaran et al. (1997, 1999). These methods are well-suited for non-stationary dynamic panels with heterogeneous characteristics across groups, unlike the Dynamic Fixed Effects (DFE) approach. Pesaran et al. (1999) argue that the PMG method combines the strengths of both pooling and averaging coefficients. This approach ensures that long-run elasticities remain consistent across all panels, enhancing the accuracy and reliability of estimates, especially when the homogeneity assumption holds. Additionally, the PMG method allows for heterogeneity in short-run dynamics across individual cross-sections, enriching the analysis (Kratou & Gazdar, 2016; Musibau et al., 2019). Given that countries differ in their vulnerability to external shocks, this flexibility enables more precise short-term adjustments. Therefore, due to its superior performance compared to the MG and DFE estimators, this study adopts the PMG method as the preferred estimation approach.

By setting the maximum lag to one, as suggested by AIC, the ARDL (1,1,1,1, 1,1) and the ARDL (1,1,1,1, 1,1,1) dynamic panel representations of Equation (1) and Equation (2) can be specified as:

$$lnFLFP_{i,t} = \mu_i + \theta_{10i}lnFER_{i,t} + \theta_{11i}lnFER_{i,t-1} + \theta_{20i}lnEDU_{i,t} + \theta_{21i}lnEDU_{i,t-1} + \theta_{30i}lnFPOP_{i,t} + \theta_{31i}lnFPOP_{i,t-1} + \theta_{40i}lnGDPP_{i,t} + \theta_{41i}lnGDPP_{i,t-1} + \theta_{50i}lnKGDP_{i,t} + \theta_{51i}lnKGDP_{i,t-1} + \lambda_{1i}lnFLFP_{i,t-1} + \nu_{it} \quad (3)$$

$$lnFUN_{it} = \varphi_i + \omega_{10i}lnFER_{it} + \omega_{11i}lnFER_{i,t-1} + \omega_{20i}lnEDU_{it} + \omega_{21i}lnEDU_{i,t-1} + \omega_{30i}lnINF_{i,t} + \omega_{31i}lnINF_{i,t-1} + \omega_{40i}lnFPOP_{it} + \omega_{41i}lnFPOP_{i,t-1} + \omega_{50i}lnGDP_{it} + \omega_{51i}lnGDP_{i,t-1} + \omega_{60i}lnCRED_{it} + \omega_{61i}lnCRED_{i,t-1} + \lambda_{1i}lnFUN_{i,t-1} + \nu_{it} \quad (4)$$

Reparametrizing and rearranging equation (3) and (4) to express the error correction equations as follows:

$$\Delta lnFLFP_{it} = \delta_i\left[lnFLFP_{i,t-1} - \beta_{0i} - \beta_{1i}lnFER_{it} - \beta_{2i}lnEDU_{it} - \beta_{3i}lnFPOP_{it} - \beta_{4i}lnGDPP_{it} - \beta_{5i}lnKGDP_{it}\right] - \theta_{1i}\Delta lnFER_{i,t-1} - \theta_{2i}\Delta lnEDU_{i,t-1} - \theta_{3i}\Delta lnFPOP_{i,t-1} - \theta_{4i}\Delta lnGDPP_{i,t-1} - \theta_{5i}\Delta lnKGDP_{i,t-1} + \nu_{it} \quad (5)$$

$$\Delta lnFUN_{it} = \eta_i\left[lnFUN_{i,t-1} - \alpha_{0i} - \alpha_{1i}lnFER_{it} - \alpha_{2i}lnEDU_{it} - \alpha_{3i}lnINF_{i,t} - \alpha_{4i}lnFPOP_{it} - \alpha_{5i}lnGDP_{it} - \alpha_{6i}lnCRED_{it}\right] - \omega_{1i}\Delta lnFER_{i,t-1} - \omega_{2i}\Delta lnEDU_{i,t-1} - \omega_{3i}\Delta lnINF_{i,t-1} - \omega_{4i}\Delta lnFPOP_{i,t-1} - \omega_{5i}\Delta lnGDP_{i,t-1} - \omega_{6i}\Delta lnCRED_{i,t-1} + \nu_{it} \quad (6)$$

Where δ_i represents the coefficient of the error correction term which determines the speed of adjustment resulting from changes in the explanatory variables. The β_{ij} and α_{ij} are the long run parameters that emerge with variables under estimation in the two equations. The signs of the error correction terms δ_i and η_i are supposed to be negative and statistically significant in the case that these variables maintain long run equilibriums. Specifically, if $\delta_i < 0$ and $\eta_i < 0$ this will imply that the female labor force participation and female unemployment and the right hand side variables are co-integrated and if $\delta_i = 0$ and $\eta_i = 0$ then the cointegration is no longer holds. The parameter of the error term in Equation (5) can be defined as $\delta_i = -(1-\lambda_{1i})$ and $\beta_{0i} = \frac{\mu_i}{1-\lambda_{1i}}$, $\beta_{1i} = \frac{\theta_{10i}+\theta_{11i}}{1-\lambda_{1i}}$, $\beta_{2i} = \frac{\theta_{20i}+\theta_{21i}}{1-\lambda_{1i}}$, $\beta_{3i} = \frac{\theta_{30i}+\theta_{31i}}{1-\lambda_{1i}}$, $\beta_{4i} = \frac{\theta_{40i}+\theta_{41i}}{1-\lambda_{1i}}$, and $\beta_{5i} = \frac{\theta_{50i}+\theta_{51i}}{1-\lambda_{1i}}$. In the same way, the parameter of the error term in Equation (6) can be defined as $\eta_i = -(1-$

λ_{2i}) and $\alpha_{0i} = \frac{\varphi_i}{1-\lambda_{2i}}$, $\alpha_{1i} = \frac{\omega_{10i}+\omega_{11i}}{1-\lambda_{2i}}$, $\alpha_{2i} = \frac{\omega_{20i}+\omega_{21i}}{1-\lambda_{2i}}$, $\alpha_{3i} = \frac{\omega_{30i}+\omega_{31i}}{1-\lambda_{2i}}$, $\alpha_{4i} = \frac{\omega_{40i}+\omega_{41i}}{1-\lambda_{2i}}$, $\alpha_{5i} = \frac{\omega_{50i}+\omega_{51i}}{1-\lambda_{2i}}$, and $\alpha_{6i} = \frac{\omega_{60i}+\omega_{61i}}{1-\lambda_{2i}}$.

Equation 5 will be used to estimate the impact of fertility on the labor force participation rate of the total female population and young females. Equation 6 will be used to estimate the impact of fertility on the unemployment rate of all females and young females. To ensure the reliability and robustness of the findings, it is crucial to estimate the three PMG, MG, and DFE parameters as suggested by Pesaran et al. (1999). This allows for a comprehensive evaluation of the model's performance and facilitates a deeper understanding of the underlying dynamics.

3.3.1 Unit Root Test

To investigate the long-term relationship between variables, the order of integration for each series must first be verified using suitable unit root tests. The Im-Pesaran-Shin (IPS) and Fisher Augmented Dickey-Fuller (ADF) tests are employed for this purpose. Unlike more restrictive tests, such as Levin and Lin (1993), Levin et al. (2002), and Breitung (2000), which assume a fixed autoregressive coefficient, the IPS and Fisher ADF tests allow this coefficient to vary across units. The IPS test evaluates the null hypothesis of a unit root against the alternative of no unit root, yielding a single statistic. On the other hand, the Fisher ADF test produces four statistics: inverse chi-square (P), inverse normal (Z), inverse logit transform (L*), and modified inverse chi-square (Pm).

3.3.2 Co-integration Test

After verifying the order of integration of the variables, the next step is to examine the existence of long-run equilibrium relationships between the dependent and independent variables within the model. To achieve this, the study employs the Johansen-Fisher panel cointegration test, as proposed by Maddala (1999). The Johansen-Fisher test constructs a panel-level test statistic by combining the p-values derived from the trace and maximum eigenvalue statistics of the individual cross-sections. For example, if Π_i represents the probability value from the individual cointegration test for cross-section i, then the null hypothesis for the panel is:

$$-2 \sum_{i=1}^{n} \log(\Pi_i) \sim \chi^2_{2n}$$

Where χ^2_{2n} represents the distribution of chi-square with 2N degrees of freedom. The value of chi-square is based on probabilities values for Johansen cointegration trace test and maximum eigenvalue test. The Johansen's Maximum likelihood procedure is expressed as follows:

$$\Delta Y_{i,t} = \Pi_i Y_{i,t-1} + \sum_{k=1}^{p} \Gamma_k \Delta Y_{i,t-k} + \varepsilon_{i,t}$$

Where $Y_{i,t}$ is a vector of variables, Π_i is the cointegration matrix, Γ_k are short-run adjustment matrices, $\varepsilon_{i,t}$ is the error term each cross-section and time period. The hypotheses are: H_0 : rank $(\Pi_i) = r_i \leq r$ for all i=1, ... ,n, while H_a : rank $(\Pi_i) = p$ for all i =1, ... ,n, where r is the hypothesized cointegration rank, and p is the number of variables in $Y_{i,t}$.

4. Results and Discussions

Prior to estimating the models, it is essential to confirm that the variables are stationary and cointegrated. We adopted two panel unit root tests, namely the IPS and the Fisher-type Augmented Dickey-Fuller (ADF) tests. These tests are well-suited for panel data, as they account for heterogeneity by allowing parameters, such as the autoregressive coefficient, to vary independently across the 15 Arab countries in the dataset, accommodating cross-sectional differences in economic and demographic dynamics.

Table III: Panel unit root tests results

Method	Test	Log FERT	Log EDU	Log FPOP	Log RGDPP	Log RGDP	Log CRED	Log KGDP
At level of variable								
Im-Pesaran-Shin	W-t-bar	-1.426	2.962	2.706	-0.829	-1.637	0.0253	-2.3664
		(0.077)	(0.998)	(0.997)	(0.204)	(0.051)	(0.510)	(0.009)
Fisher A. Dickey-Fuller	P	54.98	21.35	18.28	52.25	61.84	28.29	71.95
		(0.004)	(0.877)	(0.954)	(0.007)	(0.001)	(0.555)	(0.000)
	Z	1.517	2.791	2.802	-0.882	-1.725	0.135	-2.730
		(0.064)	(0.997)	(0.998)	(0.189)	(0.042)	(0.554)	(0.003)
	L*	-1.878	3.074	2.798	-1.385	-2.486	0.089	-3.147
		(0.032)	(0.998)	(0.997)	(0.085)	(0.008)	(0.536)	(0.001)
	P_m	3.225	-1.117	-1.514	2.872	4.110	-0.221	5.416
		(0.001)	(0.868)	(0.935)	(0.002)	(0.000)	(0.587)	(0.000)
At difference of variable								
Im-Pesaran-Shin	W-t-bar	-3.717	-0.381	-6.769	-9.300	-9.155	-10.25	-2.037
		(0.000)	(0.352)	(0.000)	(0.000)	(0.000)	(0.000)	(0.021)
Fisher A. Dickey-Fuller	P	69.71	84.38	122.2	182.4	185.8	219.1	68.55
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	Z	-4.034	-5.799	-7.445	-10.06	-9.827	-10.98	-2.350
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.009)
	L*	-4.286	-5.833	-8.368	-12.97	-13.19	-15.61	-2.796
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)
	P_m	5.126	7.020	11.90	19.68	20.11	24.41	4.976
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

p-values are in parentheses

The IPS test generates a single test statistic (W-t-bar) by averaging individual unit root test statistics, providing a straightforward assessment of stationarity across the panel. In contrast, the Fisher-type ADF test, based on Fisher's (1932) method of combining p-values, produces four distinct statistics, inverse chi-square (P), inverse normal (Z), inverse logit transform (L*), and modified inverse chi-square (Pm), offering a more comprehensive evaluation of stationarity by capturing different aspects of the data's behavior. Both tests operate under the null hypothesis that all series in the panel contain a unit root, implying non-stationarity, against the alternative hypothesis that at least some series are stationary. To ensure the tests accurately reflect the dynamic properties of the data, the lag length for each variable was carefully selected using the Akaike Information Criterion (AIC), which balances model fit and parsimony by minimizing information loss.

Table III presents the IPS and Fisher ADF unit root test results for each series at both levels and first differences, along with the corresponding p-values. Overall, the results are mixed, indicating that while some series exhibit stationarity at levels, others require differencing to achieve stationary behavior. Therefore, taking the first difference fully ensures the stationarity of all series used. This is evident in the lower part of the table, which shows the variables after differencing, revealing a more consistent pattern of stationarity across the analyzed series.

Upon verifying that none of the series exhibit stationarity of order higher than one, the subsequent phase of the analysis involves investigating the cointegration relationships among the variables. The Johansen-Fisher panel cointegration test (Maddala and Wu, 1999) is employed for this purpose. In this test, the null hypothesis assumes no cointegrating relationship between the variables, whereas the alternative hypothesis assumes the existence of at least one. The appropriate lag length for the test is selected based on the Schwarz Information Criterion (SIC).

The results from the four model tests, using both the trace and maximum eigenvalue statistics, are presented in Table IV. For the Total FLFP model, the Fisher statistics from the trace test (653.0, 396.3, 235.9, 140.0, 79.0, 50.3) and maximum eigenvalue test (340.4, 310.3, 124.9, 91.43, 70.73, 50.3) for hypothesized cointegrating vectors ($r = 0$ to $r \leq 5$) yield p-values of 0.000 for $r = 0$ to $r \leq 4$ and 0.012 for $r \leq 5$, rejecting the null hypothesis of no cointegration at the 5% significance level and indicating up to six cointegrating vectors, as the p-value for $r \leq 5$ remains significant. Similarly, for the YFLFP model, the trace test statistics (647.1, 386.1, 227.8, 146.0, 83.24, 61.66) and maximum eigenvalue statistics (330.4, 197.5, 107.3, 95.31, 68.79, 61.66) show p-values of 0.000 across all levels ($r = 0$ to $r \leq 5$), also confirming up to six cointegrating vectors. These results, computed using MacKinnon et al. (1999) p-values and the asymptotic Chi-Square distribution, demonstrate robust long-run relationships among the variables, suggesting that fertility and economic factors are cointegrated and move together over time in both models.

The lower part of Table IV presents the results of the Johansen-Fisher panel cointegration tests for the Total Female Unemployment (UNF) and Youth Female Unemployment (YUNF) models, which examine the long-run equilibrium relationships among variables such as fertility, education, inflation, female population, GDP, and domestic credit in 15 Arab countries from 1991 to 2023. For the UNF model, the Fisher statistics from the trace test (735.7, 623.7, 466.5, 335.9, 224.2, 135.0, 81.05) and the maximum eigenvalue test (594.3, 305.8, 241.7, 192.7, 144.0, 110.2, 81.05) for hypothesized cointegrating vectors ($r = 0$ to $r \leq 6$) yield p-values of 0.000, rejecting the null hypothesis of no cointegration at the 5% significance level and indicating the presence of at least six cointegrating vectors. Similarly, for the YUNF model, the trace test statistics (656.7, 595.3, 457.3, 330.2, 255.5, 141.8, 88.92) and maximum eigenvalue statistics (446.3, 282.6, 238.7, 186.2, 150.3, 113.0, 88.92) also show p-values of 0.000 across all levels ($r = 0$ to $r \leq 6$), confirming up to seven cointegrating vectors.

Summing up, these findings, based on MacKinnon et al. (1999) p-values and the asymptotic Chi-Square distribution, demonstrate that fertility, education, economic indicators, and labor market outcomes are strongly cointegrated, supporting the applicability of the Pooled Mean Group Autoregressive Distributed Lag (PMG-ARDL) model for analyzing their dynamic relationships.

Table IV: Johansen Fisher Panel Cointegration Tests

FLFP model				
Hypothesized No. of CE(s)	Fisher Stat (from trace test)	p-value	Fisher stat (from max-eigen test)	p-value
r = 0	653.0	0.000	340.4	0.000
r ≤ 1	396.3	0.000	310.3	0.000
r ≤ 2	235.9	0.000	124.9	0.000
r ≤ 3	140.0	0.000	91.43	0.000
r ≤ 4	79.0	0.000	70.73	0.000
r ≤ 5	050.3	0.012	50.3	0.012
YFLFP model				
Hypothesized No. of CE(s)	Fisher Stat (from trace test)	p-value	Fisher Sta (from max-eigen test)	p-value
r = 0	647.1	0.000	330.4	0.000
r ≤ 1	386.1	0.000	197.5	0.000
r ≤ 2	227.8	0.000	107.3	0.000
r ≤ 3	146.0	0.000	95.31	0.000
r ≤ 4	83.24	0.000	68.79	0.000
r ≤ 5	61.66	0.000	61.66	0.000
UNF model				
Hypothesized No. of CE(s)	Fisher Stat(from trace test)	p-value	Fisher Sat(from max-eigen test)	p-value
r = 0	735.7	0.000	594.3	0.000
r ≤ 1	623.7	0.000	305.8	0.000
r ≤ 2	466.5	0.000	241.7	0.000
r ≤ 3	335.9	0.000	192.7	0.000
r ≤ 4	224.2	0.000	144.0	0.000
r ≤ 5	135.0	0.000	110.2	0.000
r ≤ 6	81.05	0.000	81.05	0.000
UNYF model				
Hypothesized No. of CE(s)	Fisher Stat (from trace test)	p-value	Fisher Sat (from max-eigen test)	p-value
r = 0	656.7	0.000	446.3	0.000
r ≤ 1	595.3	0.000	282.6	0.000
r ≤ 2	457.3	0.000	238.7	0.000
r ≤ 3	330.2	0.000	186.2	0.000
r ≤ 4	255.5	0.000	150.3	0.000
r ≤ 5	141.8	0.000	113.0	0.000
r ≤ 6	88.92	0.000	88.92	0.000

Chi-square statistics are based on the MacKinnon et al. (1999) p-values for Johansen's cointegration trace and maximum eigen-value tests. Probabilities are computed using asymptotic Chi-square distribution

As shown above, the results of the unit root and cointegration tests confirm that the series included in the above models are I(1) and cointegrated. This allows us to proceed with the estimation of the parameters of the dynamic error correction models using PMG and the other two comparable methods, DFE and MG. Table V presents the results of these three estimators for the determinants of Arab FLFP, divided into two models: one for total Arab females (aged 15–64) and the other for youth females (aged 15–24). The PMG results for these two models are shown in the second and fifth columns, respectively.

The negative coefficient of fertility variable in the second column suggests that higher fertility rates decrease overall FLFP in the long run, consistent with previous studies (Aguero & Marks, 2008; Bloom et al., 2009; Mishra & Smyth, 2010; De Laat & Sevilla-Sanz, 2011; Ukil, 2015; Ucal & Günay, 2019; Bawazir et al., 2022; Sunday et al., 2024). However, the positive coefficient for fertility in the fifth column indicates that higher fertility increases youth female labor force participation. Several factors may explain this surprising result: changing cultural norms in Arab countries that increasingly support women balancing paid work with household responsibilities, the societal response hypothesis suggesting improved childcare and workplace policies, greater educational and job opportunities for young females, and the potential impact of digitization, which enables women to work while managing childcare. This could also signal progress in gender equality and economic empowerment for young Arab women.

The coefficients of the remaining variables did not depart from the expected signs and magnitudes. In both models, the coefficients of GDP per capita and bank credit variables are positive and significant. A number of studies have shown that GDP per capita, which is comparable to wages, encourages females to enter the labor market in order to earn high salaries (Tam, 2011; Gaddis& Klasen, 2014; Dhar, 2021). The accessibility and availability of bank loans also represent the advancement of financial development and economic activity, which leads to increased job prospects (Elouaourti & Ibourk, 2024). Interestingly, the coefficient of the education variable is insignificant in the FLFP model, whereas it is positive and statistically significant in the youth's female model. This suggests that while education may not be a major determining factor for the FLFP, it plays a crucial role in youth female employability. This is expected as young females enter the labor market, the skills and qualifications they have acquired from education can significantly enhance their employability, paving the way for a more active role in the labor force.

The coefficients associated with the capital variable in both models are positive and statistically significant. This outcome suggests that the relationship between female labor and capital accumulation is complementary rather than substitutive.

The coefficients of the error correction term (ECT) for both models are negative and statistically significant. This confirms the presence and robustness of cointegration relationship between the variables. Specifically, the ECT coefficient of 0.11 in the FLFP model indicates that for every 1% deviation from the long-term equilibrium, the FLFP rate adjusts by 0.11% in the subsequent period. On the other hand, the ECT coefficient of -0.08 in the YFLFP model indicates that a similar adjustment occurs, albeit at a slightly lower rate. This suggests that while FLFP among youth is responsive to deviations from equilibrium, it does so sluggishly when compared to the total female labor force.

The analysis of the Hausman test results firmly establishes the suitability of the PMG model for our examination, revealing its superior performance compared to the MG model. The test statistical values of 0.981 for the FLFP model and 0.823 for the YFLFP model show that the PMG approach is strong and reliable at getting to the details of the data.

Table V: FLFP results: ARDL (1,1,1,1,1)

	DV: Log FLFP			DV: Log YFLFP		
	PMG	MG	DFE	PMG	MG	DFE
Long run coefficients						
Log FERT	-0.368***	0.0908	-2.300	0.274***	1.208	-0.0272
	(0.0796)	(0.796)	(2.104)	(0.0775)	(0.818)	(0.440)
Log EDU	-0.0551	0.217	-6.600	0.346***	0.792	-0.912**
	(0.110)	(0.646)	(5.618)	(0.104)	(0.893)	(0.457)
Log FPOP	-0.00657	-1.897*	1.230	-0.000129	-0.459	0.171
	(0.0225)	(1.143)	(1.079)	(0.0542)	(0.749)	(0.304)
Log RGDPP	0.0783***	0.561	0.315	0.140***	-0.293	-0.562
	(0.00976)	(0.397)	(0.696)	(0.0424)	(0.380)	(0.374)
Log KGDP	0.0268***	-0.0971	0.277	0.0426**	-0.0771	0.161
	(0.00952)	(0.162)	(0.414)	(0.0179)	(0.109)	(0.178)
ECT	-0.108**	-0.369***	-0.0187	-0.0817**	-0.319***	-0.0332**
	(0.0466)	(0.0929)	(0.0173)	0.274***	1.208	-0.0272
Short run coefficients						
ΔLog FERT	0.210	-0.167	0.210**	0.0288	-0.110	0.0414
	(0.143)	(0.220)	(0.0951)	(0.0784)	(0.141)	(0.0734)
ΔLog EDU	0.0478	-1.068	-0.221	1.070**	-0.279	0.251
	(0.286)	(1.251)	(0.193)	(0.543)	(0.490)	(0.153)
ΔLog FPOP	1.847	2.293	0.0605	0.379	0.00866	0.0454
	(1.343)	(1.962)	(0.0847)	(0.472)	(0.640)	(0.0658)
ΔLog RGDPP	0.120	0.118	0.0189	0.110	0.0887	0.0283
	(0.0807)	(0.120)	(0.0223)	(0.0679)	(0.0692)	(0.0175)
ΔLog KGDP	0.00646	0.00494	0.00541	-0.0187*	-0.0313*	-0.00105
	(0.00927)	(0.0205)	(0.00775)	(0.0108)	(0.0186)	(0.00606)
Constant	0.279*	0.109	-0.0830	0.0746	1.190	0.212
	(0.152)	(4.833)	(0.177)	(0.0541)	(2.627)	(0.166)
Countries	15	15	15	15	15	15
Obs.	424	424	424	424	424	424
Hausman test,pmg/mg		0.823			0.981	

*The numbers in parentheses represent the standard errors, *** p<0.01, ** p<0.05, * p<0.1*

Table VI displays the results of the second model estimate, which examines the impact of fertility on females' unemployment. For robustness, the model is estimated for both the total female population and youth females using PMG, MG, and DFE. A glance at the table shows that findings are largely agree with prior expectations. For instance, the coefficients of the fertility variable emerge with PMG estimates are positive and statistically significant, indicating that higher fertility are associated with an increase in unemployment for both total and youth females. This suggests that as females take on greater reproductive responsibilities, they may face challenges in securing or maintaining employment. This outcome lends further support to the previous findings pertaining to the Arab region, which indicate that cultural and societal norms significantly influence females' employability (Spierings et al., 2010, and Sidani, 2016). Unexpectedly, the coefficient of the educational attainment variable is positive and statistically significant in both models. This indicates that higher levels of education are correlated with increased unemployment rates among Arab females, contrary to what might typically be expected (Ali, 2015). One possible explanation for this counterintuitive finding could be that educated females are more likely to seek employment that matches their qualifications, leading to a prolonged job search in a competitive market. Moreover, in the context of the Arab region, cultural and societal factors may further exacerbate this phenomenon, as females with higher educational qualifications often face additional barriers to get employed.

Table VI: Total females and youth females' unemployment results: ARDL (1,1,1,1,1,1)

	DV: Log UNF			DV: Log YUNF		
	PMG	MG	DFE	PMG	MG	DFE
Long run coefficients						
Log FERT	0.560***	-2.437	0.615	0.540***	0.0840	0.977
	(0.216)	(4.052)	(1.116)	(0.166)	(2.932)	(1.611)
Log EDU	0.826***	-1.627	0.798	1.228***	-0.538	0.846
	(0.300)	(1.485)	(0.784)	(0.0874)	(1.227)	(1.083)
INFL	0.00144	0.00538*	-0.0155*	0.00467***	0.0060*	-0.0261
	(0.00093)	(0.00312)	(0.00842)	(0.00143)	(0.0034)	(0.0168)
Log FPOP	-0.466*	3.472	0.483	-0.690***	4.183	0.305
	(0.275)	(3.110)	(0.713)	(0.207)	(3.181)	(0.964)
Log RGDP	-0.0897	-0.517	-0.630	0.000403	-0.421	-0.339
	(0.182)	(0.469)	(0.610)	(0.115)	(0.405)	(0.831)
Log CRED	0.0640	-0.193	0.0978	0.00697	-0.273*	0.0123
	(0.0411)	(0.123)	(0.288)	(0.0401)	(0.145)	(0.403)
ECT	-0.222**	-0.692***	-0.0604***	-0.259***	-0.813***	-0.0459*
	(0.0926)	(0.0813)	(0.0221)	(0.0878)	(0.0970)	(0.0260)
Short run coefficients						
ΔLog FERT	-1.935***	-1.096	-0.278	-1.696***	-0.693	-0.0602
	(0.577)	(0.849)	(0.287)	(0.649)	(0.657)	(0.291)
ΔLog EDU	0.248	-0.740	-0.270	0.598	-3.377	0.00904
	(2.201)	(4.178)	(0.607)	(2.537)	(3.996)	(0.627)
ΔINFL	-0.00061*	-0.00152	0.000732*	-0.00112**	-0.00183*	0.000616
	(0.00035)	(0.00106)	(0.000378)	(0.000567)	(0.0010)	(0.00039)
ΔLog FPOP	-5.823	-5.137	-0.612**	-7.848	-1.045	-0.269
	(5.218)	(7.498)	(0.311)	(5.187)	(8.122)	(0.321)
ΔLog RGDP	-0.344*	-0.196	-0.102	-0.261	0.0718	-0.129
	(0.176)	(0.252)	(0.0824)	(0.188)	(0.330)	(0.0852)
ΔLog CRED	-0.0958	-0.0499	-0.101***	-0.0799	0.0225	-0.0919**
	(0.0883)	(0.0753)	(0.0357)	(0.0825)	(0.0765)	(0.0368)
Constant	2.278**	-13.76	0.547	3.045***	-16.70	0.236
	(0.993)	(11.54)	(0.783)	(1.075)	(13.03)	(0.775)
Countries	15	15	15	15	15	15
Obs.	397	397	397	397	397	397
Hausman test,pmg/mg		0.74			0.59	

*The numbers in parentheses represent the standard errors, *** p<0.01, ** p<0.05, * p<0.1*

The coefficient of the female population is negative and statistically significant. This indicates that an increase in the female population correlates with a decrease in females' unemployment rates. One possible interpretation for this outcome may be that as the female population grows, more females may be entering workforce, leading to greater employment opportunities and improved support networks. Moreover, this trend may reflect societal shifts towards greater gender equality and the removal of barriers that have historically hindered Arab females' participation in the labor market.

Turning to the short-run results, the fertility seems to have a negative impact on Arab females' unemployment. The coefficients of the variable in both models are negative and statistically significant, indicating that as fertility rates increase, the chances of Arab females being unemployed decrease in the short run. This suggests that females with higher fertility may be more likely to engage in the workforce, potentially due to the need for financial stability to support their families. In both models, the short-run coefficients of the inflation rate variable are negative and statistically significant, which supports the Phillips curve's argument. Interestingly, the coefficient of the GDP variable in the total female model is positive and maintains significance. This indicates that as the economy grows, the likelihood of Arab females securing employment increases, reinforcing the Okun 's law (1963), which argues that increased economic activity correlates with lower unemployment rates.

The coefficients of the error correction terms are negative and statistically significant. This supports the existence of the long-run or cointegration relationships among the variables included in these models.

Finally, the Hausman test results show that the autoregressive lagging model in the PMG estimator works better than the MG method when it comes to model fit and accuracy of prediction. Therefore, employing the PMG estimator not only improves model performance but also enhances our understanding of the dynamics at play in the labor market for Arab females.

5. Conclusion

The modest performance of Arab women in the labor market, coupled with persistent empowerment deficits and gender inequality, necessitates further empirical analysis of the factors hindering their progress. However, existing studies investigating these factors are limited, not comprehensive, and fail to fully explain the observed underperformance. This study examines the impact of fertility on Arab women's labor market behavior. To achieve this, it employs panel time series data from 15 Arab nations, spanning 1991–2023. The study adopts the PMG approach, which offers advantages over methods such as MG and DFE, including addressing endogeneity and avoiding spurious results in short- and long-run relationships. To our knowledge, this is the first study based on panel data covering 15 countries in the Arab region. The two prior studies (Al-Qudsi, 1998; Ucal and Günay, 2019) relied on cross-sectional survey data or included only a few countries, limiting their ability to explore the relationship between fertility and women's labor market behavior across diverse contexts and time periods. Additionally, this study disaggregates the analysis to examine labor market participation and unemployment for both total women and young women. The primary finding is that higher fertility reduces overall women's labor market participation. Conversely, evidence suggests that rising fertility rates increase young women's labor force participation. Furthermore, increased fertility is associated with higher unemployment among both overall and young women, indicating that fertility's adverse effects intensify when unemployment is considered. The reliability of the PMG approach was confirmed by comparing it to the MG method and applying the Hausman test, with results consistently favoring PMG in terms of fit and reliability.

Several measures can be implemented to mitigate the negative impact of fertility on Arab women's labor force participation. First, providing accessible and affordable childcare services can enable working mothers to balance professional and family responsibilities. Second, policies such as flexible work hours and childcare subsidies can encourage more women to enter the labor market. Third, challenging cultural norms and stereotypes, such as expectations that women prioritize caregiving over career advancement, can significantly enhance their participation. Fourth, offering education and training opportunities to develop skills and support career advancement can increase women's presence in the workforce. Finally, fostering inclusive work environments that promote diversity can remove barriers and encourage Arab women to actively participate in the labor force.

This study has two primary limitations. First, it may not fully account for all cultural and societal factors influencing Arab women's labor market behavior. Second, the panel time series data may not capture individual-level variations in factors affecting labor market outcomes. Nevertheless, the study offers valuable insights into the complex relationship between fertility and women's labor market participation in the Arab region. Future research should incorporate a broader set of variables to address potential omitted variable bias. Additionally, employing qualitative methods, such as interviews, could provide deeper insights into the cultural and societal influences on Arab women's labor market behavior.

References

Abraham, A. Y., Ohemeng, F. N. A., & Ohemeng, W. (2017). Female labour force participation: Evidence from Ghana. *International Journal of Social Economics*, *44*(11), 1489-1505.

Aguero, J. M., & Marks, M. S. (2008). Motherhood and female labor force participation: evidence from infertility shocks. *American Economic Review*, *98*(2), 500-504.

Al-Asfour, A., Tlaiss, H. A., Khan, S. A., & Rajasekar, J. (2017). Saudi females's work challenges and barriers to career advancement. Career Development International, 22(2), 184-199.

Ali, M. E. M. (2015). The Determinants of Urban Youth Unemployment in Sudan: A Co-Integration and VECM Analysis. Urban Youth Unemployment in Eastern and Southern Africa, 206.

Alissa, S. (2007). The school-to-work transition of young people in Syria. ILO.

Al-Qudsi, S. S. (1998). Labour participation of Arab females: estimates of the fertility to labour supply link. *Applied Economics*, *30*(7), 931-941.

Azid, T., Ejaz Ali Khan, R., & Alamasi, A. M. (2010). Labor force participation of married females in Punjab (Pakistan). *International Journal of Social Economics*, *37*(8), 592-612.

Baah-Boatenga, W., Nketiah-Amponsah, E., & Frempong, R. (2013). The effect of fertility and education on female labour force participation in Ghana. *Ghanaian Journal of Economics*, *1*(1), 119-137.

Backeberg, L., & Tholen, J. (2018). The frustrated generation youth exclusion in Arab Mediterranean societies. Journal of Youth Studies, 21(4), 513-532.

Bawazir, A. A., Osman, A. F., & Aslam, M. (2022). Factors affecting female labor force participation in the Middle East: An empirical evidence from panel data approach. *The Journal of Developing Areas*, *56*(1), 59-72.

Bloom, D. E., Canning, D., Fink, G., & Finlay, J. E. (2009). Fertility, female labor force participation, and the demographic dividend. *Journal of Economic growth*, *14*, 79-101.

Boserup, E., Kanji, N., Tan, S. F., & Toulmin, C. (2013). Woman's role in economic development. Routledge.
Bowen, W. G., & Finegan, T. A. (2015). The economics of labor force participation. Princeton University Press.
Brewster, K. L., & Padavic, I. (2000). Change in gender-ideology, 1977–1996: The contributions of intracohort change and population turnover. *Journal of Marriage and Family*, *62*(2), 477-487.
De Laat, J., & Sevilla-Sanz, A. (2011). The fertility and females's labor force participation puzzle in OECD countries: the role of men's home production. *Feminist Economics*, *17*(2), 87-119.
Del Boca, D., Pasqua, S., & Pronzato, C. (2008). Motherhood and market work decisions in institutional context: a European perspective. Oxford Economic Papers, 61(suppl_1), i147-i171.
Dhar, S. (2020). Economic development and female labor force participation in Bangladesh: A test of the U-shaped hypothesis. Journal of South Asian Studies, 8(3), 99-111.
Dong, X. Y., & Pandey, M. (2012). Gender and labor retrenchment in Chinese state owned enterprises: Investigation using firm-level panel data. *China Economic Review*, *23*(2), 385-395.
Elhaj, M., & Pawar, P. (2019). Socio-economic and environmental factors affecting female labor force participation in Saudi Arabia: ARDL bounds testing approach. Int. J. Adv. Study Res. Work, 5, 2581-5997.
El-Mallakh, N., Maurel, M., & Speciale, B. (2018). Arab spring protests and females's labor market outcomes: Evidence from the Egyptian revolution. Journal of Comparative Economics, 46(2), 656-682.
Elouaourti, Z., & Ibourk, A. (2024). Financial Technologies for All MENA citizens: Tackling barriers and promoting inclusion. *Regional Science Policy & Practice*, *16*(6), 100019.
Filali Adib, F. Z., Driouchi, A., & Achehboune, A. (2013). Education attainment, further female participation & feminization of labor markets in Arab countries.
Gaddis, I., & Klasen, S. (2014). Economic development, structural change, and females's labor force participation: A reexamination of the feminization U hypothesis. *Journal of population economics*, 27, 639-681.
Goldin, C. (1990). Understanding the gender gap: An economic history of American females (No. gold90-1). National Bureau of Economic Research.
Goldin, C. (1994). The U-shaped female labor force function in economic development and economic history.
Guirguis, H., Donlon, T., McCarthy, M., Mehovic, A., & Mehta, R. (2024). The future of the labour force: a quantitative examination of the drivers of female labor force participation and total fertility rate in developed economies. *Applied Economics*, *56*(44), 5238-5248.
International Labor Office (ILO). (2025). Statistics on the population and labor force. Retrieved January 11, 2025, from https://ilostat.ilo.org/data/#
Kratou, H., & Gazdar, K. (2016). Addressing the effect of workers' remittance on economic growth: evidence from MENA countries. *International Journal of Social Economics*, 43(1), 51-70.
Musibau, H. O., Yusuf, A. H., & Gold, K. L. (2019). Endogenous specification of foreign capital inflows, human capital development and economic growth: A study of pool mean group. International Journal of Social Economics, 46(3), 454-472.

Narayan, P. K., & Smyth, R. (2006). Female labour force participation, fertility and infant mortality in Australia: some empirical evidence from Granger causality tests. Applied Economics, 38(5), 563-572.

Okun, A. M. (1963). *Potential GNP: its measurement and significance*. Cowles Foundation for Research in Economics at Yale University.

Pesaran, M. Hashem, Yongcheol Shin, and Ron P. Smith. "Pooled mean group estimation of dynamic heterogeneous panels." Journal of the American statistical Association 94, no. 446 (1999): 621-634.

Rindfuss, R. R., & Brewster, K. L. (1996). Childrearing and fertility. *Population and development review*, *22*, 258-289.

Shittu, W. O., & Abdullah, N. (2019). Fertility, education, and female labour participation: Dynamic panel analysis of ASEAN-7 countries. *International Journal of Social Economics*, *46*(1), 66-82.

Sidani, Y. M. (2016). *Working females in Arab countries: a case for cautious optimism* (pp. 689-701). Springer Netherlands.

Sinha, J. N. (1965). Dynamics of female participation in economic activity in a developing economy.

Spierings, N., Smits, J., & Verloo, M. (2010). Micro-and macrolevel determinants of females's employment in six Arab countries. *Journal of Marriage and Family*, *72*(5), 1391-1407.

Sunday, A. L., Lihawa, R. M., & Mkuna, E. (2024). The effect of fertility on female labour force participation in Tanzania. *Plos one*, *19*(1), e0292122.

Tam, H. (2011). U-shaped female labor participation with economic development: Some panel data evidence. Economics Letters, 110(2), 140–142.

Ucal, M., & Günay, S. (2019). Female employment status: A survey analysis of selected member states of the Arab League. *Eurasian Economic Review*, *9*, 373-394.

Ukil, P. (2015). Effect of fertility on female labour force participation in the United Kingdom. Margin: The Journal of Applied Economic Research, 9(2), 109-132.

Verick, S. (2014). female labor force participation in developing countries. IZA World of Labor.