Can Boosting Labor Force Participation Rate of Females Drive Sustainable Growth in MENA Countries?

By

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Author's declaration

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Abstract

This thesis is trying to answer whether boosting labor force participation of females can drive sustainable economic growth in Middle East and North Africa (MENA) countries. To do so, it utilizes a panel structural vector autoregression (Panel SVAR) methodology by analyzing macroeconomic data from 13 MENA countries in the period of 1994–2021. The estimated coefficients are belonging to variables include total and female labor force participation rates, real GDP growth, unemployment, investment, oil rents, inflation, and trade openness. Based on the results we can see that an exogenous shock to female labor force participation rate initially has a negative and significant effect on GDP growth, although this effect is dissolving over time. Impulse-Response Functions (IRFs) verify that labor force participation rate of females has short-term negative effect on GDP growth in MENA countries. On the other hands, Forecast Error Variance Decomposition (FEVD) shows that labor market participation rate of females shocks only explain small share of GDP growth fluctuations. These findings support labor market theories and suggesting that without sufficient job creation, increased labor supply may reduce wages and then productivity in the short-run which can lead to a negative effect on GDP growth in the whole economy. So, this thesis contributes to the labor economics literature by verifying theories via an evidence-based analysis of labor force participation rate of females' effect on GDP growth in MENA countries. Finally, the thesis also contributes to the literature by highlighting the complexities of labor market dynamics and the importance of balanced strategies for job creation in the economy.

JEL Classification Codes: E24, J16, J21, J23, O40, O53, C33

Keywords: Female Labor Force Participation, Economic Growth, MENA Countries, Panel SVAR, Labor Market, Oil Rents, Structural Shocks

Dedication

To my beloved wife: Tiam,
the love of my life and my constant companion on this journey,

To my precious daughter: Bahar,
the light of my heart and soul.

To my mother, and father,
whose love, generosity, unwavering support, and prayers made this journey possible,

To my sister: Zahra,
for her sense of kindness,

And, to all members of my wife's family: her mother, her father, and her siblings,
with deepest gratitude for each of them.

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1. Introduction

The relationship between labor force participation rate of females (LFPRF) and economic growth is an important issue for developing countries, particularly in regions facing structural labor market challenges among women such as the Middle East and North Africa (MENA). Economic theory and empirical evidence usually highlight labor force participation as a fundamental driver of a productivity in every countries' labor market which can influence long-term economic prosperity (Bloom & Freeman, 1988; Solow, 1956). However, the MENA region shows considerable low labor force participation rates, especially among women. This can lead to questions about underutilization of human capital and missed opportunities for economic growth (World Bank, 2021).

Labor force participation rates in MENA countries remain significantly lower compared to global averages, with remarkable gender disparities. The average labor force participation rate in MENA countries typically ranges between 40% and 55%, compared to a global average exceeding 60% (ILO, 2022). Labor force participation rate of females in the region is even much more less that the world's average and stands at around 20% (World Bank, 2021). Researchers have frequently referred to this phenomenon as the "MENA paradox," which can be characterized by high educational attainment among women versus considerable low workforce participation among them (Verme, 2015).

Low labor force participation of females' rates can reduce overall productivity, constrain household incomes, and intensify economic dependency ratios. For example, a report by McKinsey (2015) suggests that equalizing labor participation rates between males and females in the region could potentially add $2.7 trillion to the MENA economy by 2025, reflecting an almost 47% GDP increase. Also, the International Monetary Fund (IMF, 2018) emphasizes that even small improvements in labor participation rates of females could significantly boost economic growth in emerging economies, including those in MENA, which underscoring the high importance of labor market reforms.

So, in this context, examining of how a shock in labor force participation rate of females can influence on dynamics of real GDP growth and other macroeconomic variables—such as investment, oil revenues, inflation, and trade openness—can help better understanding of the short-term and long-term labor market policy effects. Dynamic analysis is particularly valuable for an interconnected and mutually reinforcing nature of labor market conditions and economic growth. Changes in labor force participation rate of females can directly influence economic growth, but economic conditions themselves can also alter labor participation decisions, necessitating a methodological approach capable of capturing these complex interdependencies.

This study employs a Panel Structural Vector Autoregression (Panel SVAR) methodology, which is particularly suitable for understanding dynamic structural relationships between multiple macroeconomic variables over time and across countries (Love & Zicchino, 2006). The panel SVAR model offers a robust framework that can distinguish immediate and short-term impacts from longer-term changes, which make possible for us to identify and interpret the structural shocks, such as a sudden policy-led increase in labor force participation of females.

The empirical analysis in this thesis focuses on 13 MENA countries in the period of 1994 to 2021. It captures a different aspect of economic structures within the region. The key variables included in the analysis are:

- **Labor Force Participation Rate (LFPR)**: Total labor participation as a percentage of the working-age population.
- **Labor Force Participation Rate of Females (LFPRF)**: Female-specific labor participation rate.
- **Unemployment Rate**: Annual percentage change of unemployed people who are actively seeking work.
- **GDP Growth**: Annual percentage change in ***REAL*** GDP, reflecting economic performance.
- **Investment (Gross Capital Formation as a % of GDP)**: Representing the role of capital accumulation.
- **Oil Rents (% of GDP)**: Capturing resource dependency prevalent in several MENA countries.
- **Inflation**: Annual percentage change in consumer prices, reflecting macroeconomic stability.
- **Trade Openness (% of GDP)**: The sum of exports and imports relative to GDP, measuring economic integration.

By using the Panel SVAR framework, this research aims to answer two primary research questions:

1. How does labor force participation rate of females affect economic growth in MENA countries, both in the short-term and long-term?
2. Are there significant dynamic responses of GDP growth to shocks in labor force participation rate of females?

Answering to these questions can help clarify whether increasing labor force participation rate of females is an appropriate strategy for achieving sustainable growth.

2. Literature Review

2.1 Theoretical Background on Labor Participation and Economic Growth

Economic theories widely recognize labor force participation as a key component of economic growth. Human capital theory suggests that a higher labor participation rate increases a country's productive capacity and fostering GDP growth through efficient use of available resources (Becker, 1975; Mincer, 1962). Becker and Mincer also emphasize that investment in human capital—such as education and skills development—directly improves labor productivity, which can ultimately influence positively of economic performance.

Moreover, the Solow growth model, which traditionally focusing on capital accumulation, has been extended to incorporate human capital as a fundamental growth determinant (Solow, 1956; Lucas, 1988). Lucas (1988) explicitly incorporates human capital accumulation into growth models. He argued that education and skill acquisition are integral for sustainable economic expansion. In this context, labor force participation rates reflect not only quantity, but also the quality of the labors available to economies, particularly relevant for developing regions like the MENA countries.

2.2 Empirical Literature Review

2.2.1 Cross-Country Analyses of Labor Force Participation and Growth

There are several cross-country empirical studies which find significant relationships between labor force participation and economic growth. Empirical evidence by Bloom and Freeman (1988) shows how changes in the labor force dynamics influence growth channels across countries. Their study emphasizes demographic transitions as significant determinants of economic prosperity.

Similarly, a study by Psacharopoulos and Tzannatos (1989) shows a U-shaped relationship between females' participation rate and per capita income levels (as a proxy for economic development). It suggests that as economies expand, females' participation rate initially decreases and then rises with increasing per capita income levels.

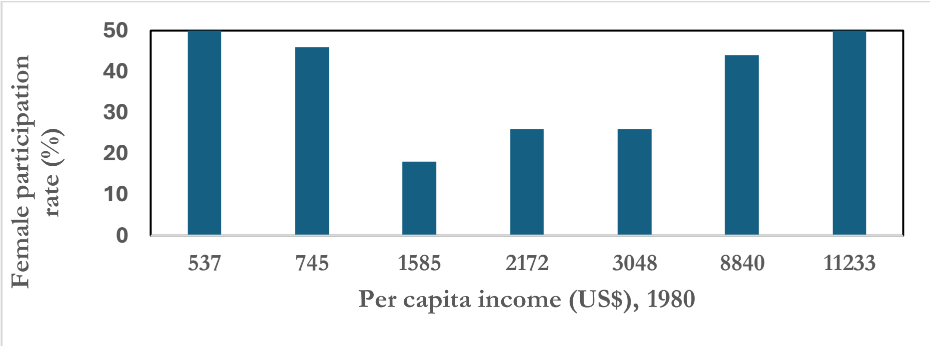

Figure 1- U-shaped relationship between females' labor participation rate and per capita income levels (Psacharopoulos and Tzannatos, 1989)

Studies related to the MENA region indicate that despite remarkable educational improvements, labor force participation rate of females remains considerably low. This has a diminishing effect on potential economic gains. Lassassi and Tansel (2020) highlight persistent low labor force participation rate of females across Algeria, Egypt, Jordan, Palestine, and Tunisia, noting significant structural and social barriers, including conservative gender norms and limited job opportunities in formal sectors, that prevent participation of females despite educational gains.

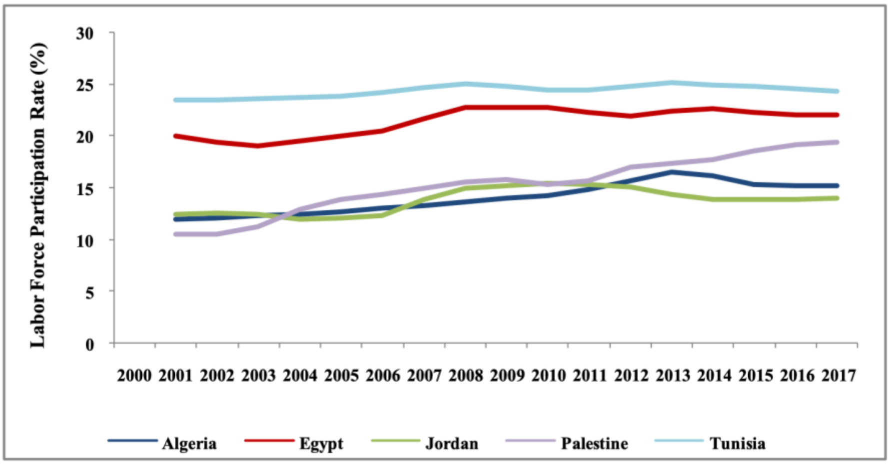

Figure 2 - Trends in Labor Force Participation Rate of Females, by Country, 2000-2017 (Computed by Lassassi and Tansel, 2020, based on data from World Bank.)

2.2.2 Gender-Specific Labor Economics in MENA and Other Developing Regions

The phenomenon of considerable low labor force participation rate of females in the MENA region, despite high educational attainment among women—termed the "MENA paradox"—is well-documented (Verme, 2015). Research emphasizes on structural and societal barriers that limiting females' economic contributions.

Hadadmoghadam (2022) specifically investigates Iran's labor market, identifying education as the strongest determinant of labor force participation rate of females, but highlights considerable barriers related to family-related responsibilities and childcare as significant limitations.

Baliamoune (2024) analyzes the differential effects of trade openness on labor force participation rate of females in the MENA region compared to Latin America and Caribbean (LAC), Sub-Saharan Africa (SSA), and South Asia (SAS). The study suggests that in MENA countries, greater trade openness paradoxically intensifies gender gaps in labor markets, primarily due to shifts away from traditionally female-intensive sectors like apparel towards more capital-intensive industries dominated by men.

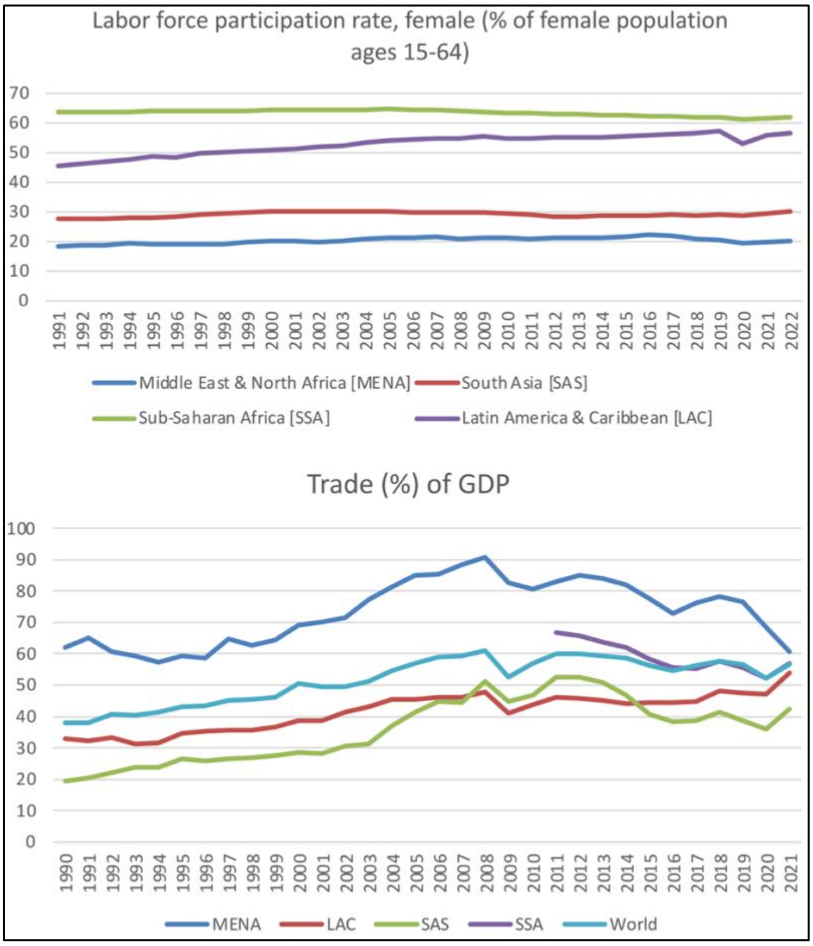

Figure 3 - Labor Force Participation Rate of Females vs. Trade Openness in MENA countries compare to LAC, SAS, SSA, and the World. (Baliamoune, 2024)

This insight aligns with the study by Roche Rodriguez et al. (2023), shows that trade liberalization in Morocco similarly reduced female participation by developing sectors that mainly employing men.

2.3 Use of SVAR and Panel VAR in Macroeconomic Policy Evaluation

Structural Vector Autoregression (SVAR) and Panel VAR methodologies have emerged as powerful econometric tools for analyzing macroeconomic dynamics and policy impacts across countries. A study by

Love and Zicchino (2006) analyzes the effectiveness of Panel VAR models in capturing the dynamic interdependencies between macroeconomic variables across multiple countries over time. Such models allow for accurate identification of structural shocks and their subsequent economic impacts, which makes them highly suitable for policy evaluation.

For example, studies employing SVAR frameworks have provided insights into how various macroeconomic variables—such as investment, inflation, and oil revenues—affect economic growth through dynamic channels. The application of Panel VAR by Baliamoune (2024) emphasize trade policy impacts on labor markets across regions, revealing regional differences and policy implications critical for economic reforms.

Further empirical applications include Lassassi and Tansel (2020), who employ synthetic panel analyses (Age-Period-Cohort methodology) to break down labor participation rate of women into distinct age, period, and cohort effects across several MENA countries. Their work shows the value of panel data methodologies in understanding how demographic shifts and policy interventions dynamically affect labor market outcomes.

2.4 Summary

Overall, the literature emphasizes the significant theoretical and empirical links between labor force participation, particularly among females, and economic growth. While cross-country analyses provide robust evidence of the positive impacts of higher labor participation on growth, region-specific studies, especially in MENA, highlight complex structural barriers and impacts of globalization and trade policies. Panel SVAR methodologies emerge as particularly valuable for analyzing these dynamics. They are offering policy-relevant insights into how improving labor participation—particularly among underrepresented groups—can sustainably boost economic performance.

3. Data and Method

3.1 Data Description

This study utilizes panel data for 13 countries in the MENA region from 1994 to 2021. The data structure is designed to capture macroeconomic dynamics influencing economic growth, specifically assessing the role of labor force participation rate of females. Countries including the following:

- Algeria,
- Bahrain,
- Egypt,
- Iran,
- Iraq,
- Jordan,
- Kuwait,
- Libya,
- Morocco,
- Qatar,
- Saudi Arabia,
- Tunisia,
- and, Türkiye

The dataset is sourced from famous international databases including the World Bank, and International Labor Organization (ILO).

3.2 Variables

- The primary dependent variable is GDP growth, represented as the natural logarithm of ***REAL*** GDP growth rate (lngdpgr).
- Independent variables include Total and Female Labor Force Participation Rate (lfpr and lfprf).
- Control variables are unemployment (unm), inflation (inf), investment as a percentage of GDP (inv), oil rents as a percentage of GDP (oilr), and trade openness (tro).

3.3 Data Sources

- GDP growth, unemployment, inflation, investment, oil rents, and trade openness: World Bank.
- Labor force participation rates (total and female): International Labour Organization (ILO) statistics.

3.4 Rationale for Using Panel SVAR

Panel Structural Vector Autoregression (Panel SVAR) models allow the analysis of dynamic interactions among macroeconomic variables across multiple countries and time periods. SVAR is particularly suitable for macroeconomic policy analysis due to its ability to capture contemporaneous interactions and structural shocks (Love & Zicchino, 2006). Utilizing Panel SVAR makes it easier to identify how changes in labor market participation rate of females impact economic growth, accounting for both short-run dynamics and structural shocks common across MENA countries.

3.5 Model Specification

The Panel SVAR model used in this analysis is specified as follows: where is the vector of endogenous variables (GDP growth, labor force participation rates, unemployment, inflation, investment, oil rents, trade openness), is the polynomial matrix in the lag operator, and denotes structural shocks.

3.6 Lag Selection, Stationarity Testing, and Panel Structure Validation

Optimal lag length selection for the SVAR model was determined using standard information criteria such as Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC). Stationarity of variables was tested using Im, Pesaran, and Shin (IPS) tests for panel data, ensuring robustness of the analysis. Non-stationary variables were appropriately differenced to achieve stationarity. The validity of the panel structure, including homogeneity and cross-sectional dependence, was assessed through standard diagnostic tests to ensure the reliability of the results.

3.7 Identification Strategy

The identification strategy employed in this study uses short-run structural restrictions based on the Cholesky decomposition approach. This method assumes a recursive structure among variables, where contemporaneous causality runs in one direction. Specifically, GDP growth is assumed contemporaneously affected by shocks in labor force participation and control variables, but not vice versa. Alternatively, robustness checks employing sign restrictions have been conducted to verify consistency and robustness of the structural relationships identified by the Cholesky decomposition.

3.8 Impulse-Response Functions (IRFs) and Forecast Error Variance Decomposition (FEVD)

Impulse-Response Functions (IRFs) describe the time-path of variables' reactions to shocks in labor force participation rate of females, showing how economic growth responds dynamically over a forecast horizon. Additionally, Forecast Error Variance Decomposition (FEVD) quantifies the relative importance of each structural shock in explaining the forecast error variance of GDP growth, providing deeper insights into the transmission mechanisms of labor market shocks on economic performance.

4. Empirical Results and Analysis

4.1 Stationary

Prior to VAR and SVAR estimation, stationarity of variables was assessed using the Cross-sectionally augmented IPS (CIPS) test, considering cross-sectional dependence, appropriate for panel data with potential cross-sectional correlation. Four variables, specifically LFPRF, LFPR, TRO, and UNM, exhibited non-stationarity at levels and thus required first differencing to achieve stationarity. This procedure ensures the robustness of the model and avoids spurious regression results (Pesaran, 2007). So, these variables names change to d_lfprf, d_lfpr, d_tro, and d_unm.

4.2 Theoretical Rationale for Cholesky Ordering in SVAR

The recursive identification of structural shocks in a Structural Vector Autoregression (SVAR) using the Cholesky decomposition requires a theoretically and empirically grounded ordering of variables. This ordering reflects contemporaneous causal assumptions about the transmission mechanisms among macroeconomic variables. The following provides the rationale for the sequence:

d_lfprf, lngdpgr, d_lfpr, d_unm, oilr, inf, inv, d_tro.

4.2.1 Labor Force Participation Rate of Females (d_lfprf)

Positioning **d_lfprf** first assumes that innovations in labor force participation rate of females may contemporaneously influence all other variables but are not themselves affected instantaneously by shocks to macroeconomic indicators within the same period. This reflects the view that changes in labor participation rate of females are often driven by deep structural, demographic, or policy factors (e.g., legal reforms, cultural shifts), which respond only gradually to short-run macroeconomic shocks (El-Khazindar & Omran, 2021; Psacharopoulos & Tzannatos, 1989).

4.2.2 GDP Growth (lngdpgr)

Placing **lngdpgr** next suggests that output growth may respond immediately to changes in labor force participation rate of females (e.g., through supply-side effects), but its impact on participation rate is lagged, as labor supply typically adjusts more slowly to short-term economic conditions (Blanchard & Johnson, 2013; Becker, 1964).

4.2.3 Total Labor Force Participation Rate (d_lfpr)

d_lfpr follows real GDP growth, indicating that the aggregate labor supply (including both genders) can be contemporaneously influenced by female labor force shocks and output growth, but its feedback effect is not immediate. This reflects the typically slower adjustment of aggregate participation to macroeconomic shocks compared to output (Bloom & Freeman, 1988).

4.2.4 Unemployment Rate (d_unm)

d_unm is ordered after participation variables and GDP, and emphasizes that based on the primary assumption of labor market tightness, unemployment rate responds contemporaneously to both output fluctuations and labor supply shocks, but impacts labor force participation and output only with a lag (Pissarides, 2000).

4.2.5 Oil Rents (oilr)

oilr is placed in the middle of the equation, since resource rents are a major exogenous driver in MENA economies. While they can quickly influence macroeconomic aggregates (output, and labor market indicators), they are primarily determined by global oil markets and are assumed exogenous to domestic short-run shocks in the other variables (World Bank, 2023).

4.2.6 Inflation (inf)

inf follows oil rents, as resource windfalls (or shortfalls) often transmit rapidly to domestic prices, particularly in resource-dependent economies. Inflation responds to shocks in GDP, unemployment, and resource rents, but generally impacts real variables like investment and trade openness only with a delay (Blanchard & Johnson, 2013).

4.2.7 Investment (inv)

inv is ordered before trade openness, under the assumption that investment decisions react contemporaneously to domestic macroeconomic conditions, including output, prices, and external resource shocks. However, investment is slower to respond to changes in trade flows, which usually reflect more persistent shifts in openness or competitiveness (Lucas, 1988).

4.2.8 Trade Openness (d_tro)

Finally, **d_tro** is last, reflecting the view that trade integration is the most sluggish variable, adjusting to the accumulated effects of internal macroeconomic shocks and policy settings over time. Short-term shocks in trade openness are unlikely to contemporaneously affect core macroeconomic conditions within the same period (Baliamoune, 2024; Love & Zicchino, 2006).

4.2.9 Final Ordering of Variables

Order	Variable	Contemporaneous Causal Rationale
1	d_lfprf	Structural/demographic; exogenous to other variables
2	lngdpgr	Responds to labor shocks; does not instantly affect labor
3	d_lfpr	Aggregate supply adjusts after female participation
4	d_unm	Follows output and labor supply; tightness is responsive
5	oilr	Exogenous to domestic macro, affects prices and output
6	inf	Prices affected by oil and output shocks, lag in real response
7	inv	Investment reacts to macro, slow to trade shocks
8	d_tro	Trade slowest to adjust, least contemporaneous feedback

Table 1 - Ordering of Variables in SVAR Estimation Model

4.3 Theoretical Foundation: Economic Structure and Identification

The **SVAR model** aims to identify both dynamic (lagged) and contemporaneous (instantaneous) relationships among macroeconomic variables in MENA economies. In particular, it explores how shocks to **female labor force participation (d_lfprf)** propagate to other variables, including **GDP growth (lngdpgr)**, **aggregate labor force participation (d_lfpr)**, **unemployment (d_unm)**, **oil rents (oilr)**, **inflation (inf)**, **investment (inv)**, and **trade openness (d_tro)**.

- **Female labor force participation (d_lfprf):** Considered contemporaneously exogenous, reflecting that shifts in female labor supply arise from long-term, structural forces such as demographics, cultural change, or policy reforms—not from short-term fluctuations in the macroeconomy (El-Khazindar & Omran, 2021; Psacharopoulos & Tzannatos, 1989).
- **GDP growth (lngdpgr):** Responds instantly to labor supply shocks (especially from females entering the labor market), consistent with supply-side macroeconomic models (Becker, 1964; Blanchard & Johnson, 2013) but does not instantaneously feedback to participation.
- **Remaining variables:** Ordered by their likely speed of adjustment and macroeconomic logic, based on empirical literature and labor market theory (Pissarides, 2000; World Bank, 2023).

This ordering is encoded through Cholesky decomposition, translating theoretical causal claims into empirical identification.

4.3.1 SVAR Model Specification

The **reduced-form VAR** (with $k = 8$ variables and $p = 1$ lag) is:

$$Y_t = A_1 Y_{t-1} + u_t$$

Where:

- Y_t is the 8×1 vector of endogenous variables at time t:

$$Y_t = \begin{bmatrix} d\_lfprf_t \\ lngdpgr_t \\ d\_lfpr_t \\ d\_unm_t \\ oilr_t \\ inf_t \\ inv_t \\ d\_tro_t \end{bmatrix}$$

- A_1 is an 8×8 matrix of lagged coefficients,
- u_t is the vector of reduced-form residuals, assumed to have covariance matrix Σ_u.

4.3.2 From VAR to Structural VAR (SVAR): The Structural Equation

The **SVAR model** explicitly connects reduced-form errors u_t to economically meaningful, orthogonalized shocks ϵ_t:

$$BY_t = C_1 Y_{t-1} + \epsilon_t$$

Or equivalently (after pre-multiplying by B^{-1}:

$$Y_t = B^{-1}C_1Y_{t-1} + B^{-1}\epsilon_t$$

$$u_t = B^{-1}\epsilon_t$$

Here:

- B is the **contemporaneous impact matrix**, capturing instantaneous relations and identification restrictions,
- ϵ_t are the **structural shocks** (white noise, uncorrelated: $E[\epsilon_t\epsilon_t'] = I$.

The identification of the system relies on imposing a **recursive (Cholesky) structure** on B^{-1}: each variable can only be contemporaneously affected by shocks to itself and to those ordered before it.

4.3.3 Cholesky Ordering and Economic Restrictions

The **ordering** (from most exogenous to most endogenous) is:

1. d_lfprf (labor force participation rate of females)
2. $lngdpgr$ (GDP growth)
3. d_lfpr (total labor force participation)
4. d_unm (unemployment)
5. $oilr$ (oil rents)
6. inf (inflation)
7. inv (investment)
8. d_tro (trade openness)

This means, for example:

- d_lfprf is **not affected contemporaneously** by any other variable,
- $lngdpgr$ is affected contemporaneously only by d_lfprf,
- d_lfpr can be contemporaneously affected by both d_lfprf and $lngdpgr$, and so forth.

This ordering translates economic reasoning—regarding the speed and exogeneity of different macro variables—into formal identification (Blanchard & Johnson, 2013).

4.3.4 SVAR Structural Matrix Representation

The structural form for the contemporaneous relationships can be expressed as:

$$Bu_t = \epsilon_t$$

where B is:

$$B = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{21} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{31} & b_{32} & 1 & 0 & 0 & 0 & 0 & 0 \\ b_{41} & b_{42} & b_{43} & 1 & 0 & 0 & 0 & 0 \\ b_{51} & b_{52} & b_{53} & b_{54} & 1 & 0 & 0 & 0 \\ b_{61} & b_{62} & b_{63} & b_{64} & b_{65} & 1 & 0 & 0 \\ b_{71} & b_{72} & b_{73} & b_{74} & b_{75} & b_{76} & 1 & 0 \\ b_{81} & b_{82} & b_{83} & b_{84} & b_{85} & b_{86} & b_{87} & 1 \end{bmatrix}$$

This structure means each variable is contemporaneously affected only by shocks to variables **above it** and itself.

4.3.5 Example: Main Equation for GDP Growth

For the **second variable** ($lngdpgr_t$):

$$lngdpgr_t = a_{21} d\_lfprf_t + \sum_{j=1}^{8} \alpha_{2j} Y_{j,t-1} + u_{2t}$$

- a_{21} is the contemporaneous impact of female labor force participation on GDP growth,
- The sum $\sum_{j=1}^{8} \alpha_{2j} Y_{j,t-1}$ captures the lagged (dynamic) effects from all variables,
- u_{2t} is the reduced-form residual.

The structural form for u_{2t}:

$$u_{2t} = b_{21}\epsilon_{1t} + \epsilon_{2t}$$

where:

- ϵ_{1t} is the structural shock to labor force participation rate of females,
- ϵ_{2t} is the shock to GDP growth not explained by d_lfprf.

4.3.6 General System for All Variables

The full SVAR system for all 8 variables is:

$d\_lfprf_t = \text{lags} + u_{1t}$

$lngdpgr_t = a_{21}d\_lfprf_t + \text{lags} + u_{2t}$

$d\_lfpr_t = a_{31}d\_lfprf_t + a_{32}lngdpgr_t + \text{lags} + u_{3t}$

$d\_unm_t = a_{41}d\_lfprf_t + a_{42}lngdpgr_t + a_{43}d\_lfpr_t + \text{lags} + u_{4t}$

$oilr_t = a_{51}d\_lfprf_t + a_{52}lngdpgr_t + a_{53}d\_lfpr_t + a_{54}d\_unm_t + \text{lags} + u_{5t}$

$inf_t = a_{61}d\_lfprf_t + a_{62}lngdpgr_t + a_{63}d\_lfpr_t + a_{64}d\_unm_t + a_{65}oilr_t + \text{lags} + u_{6t}$

$inv_t = a_{71}d\_lfprf_t + a_{72}lngdpgr_t + a_{73}d\_lfpr_t + a_{74}d\_unm_t + a_{75}oilr_t + a_{76}inf_t + \text{lags} + u_{7t}$

$d\_tro_t = a_{81}d\_lfprf_t + a_{82}lngdpgr_t + a_{83}d\_lfpr_t + a_{84}d\_unm_t + a_{85}oilr_t + a_{86}inf_t + a_{87}inv_t + \text{lags} + u_{8t}$

Where each equation's contemporaneous terms respect the recursive Cholesky restrictions, and each "lags" term includes the lagged values of all variables.

4.3.7 Interpretation and Theoretical Implications

This system allows tracing **structural shocks** (such as a sudden increase in female labor participation) through the macroeconomic system, isolating both contemporaneous and dynamic effects on GDP growth and other variables. The **recursive structure** ensures that these effects respect the economic theory about causal ordering and speed of adjustment (Blanchard & Johnson, 2013; Pissarides, 2000).

4.4 Lag Selection Criteria and Stationarity Testing

The selection of the optimal number of lags in VAR and SVAR models is critical for accurate modeling of dynamic relationships among macroeconomic variables. The optimal lag order in this study was determined using standard information criteria, specifically the Akaike Information Criterion (AIC) and the Final Prediction Error (FPE). As indicated by VAR Lag Order Selection Criteria (Figure 4), a lag of one was selected as optimal, ensuring model parsimony and preventing overfitting. We can see that all of the main criteria including FPE, AIC, SC, and HQ suggest a lag of one.

VAR Lag Order Selection Criteria
Endogenous variables: D_LFPRF LNGDPGR D_LFPR D_UNM OILR INF INV D_T
Exogenous variables: C
Date: 06/01/25 Time: 19:50
Sample: 1994 2021
Included observations: 286

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-5138.658	NA	589833.8	35.99061	36.09288	36.03160
1	-4280.404	1662.492	2283.671*	30.43639*	31.35678*	30.80531*
2	-4234.774	85.83529	2599.197	30.56485	32.30337	31.26170
3	-4155.368	144.9292	2339.475	30.45712	33.01376	31.48190
4	-4107.677	84.37615	2634.404	30.57117	33.94593	31.92388
5	-4044.527	108.1947*	2670.455	30.57711	34.77000	32.25775

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 2 - Lag selection results in Eviews. Most of the criteria suggest 1 lag.

4.5 Model Specification and Estimation

The SVAR model employed in this study examines the impact of labor force participation rate of females (d_lfprf) on economic growth (lngdpgr), controlling for other macroeconomic variables such as total labor force participation rate (d_lfpr), unemployment (d_unm), oil rents (oilr), inflation (inf), investment (inv), and trade openness (d_tro). The SVAR identification strategy used a recursive Cholesky decomposition, placing d_lfprf first, if shocks in female labor force participation contemporaneously affect GDP growth but not vice versa.

Vector Autoregression Estimates
Date: 06/01/25 Time: 19:44
Sample (adjusted): 1996 2021
Included observations: 338 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D_LFPRF	LNGDPGR	D_LFPR	D_UNM	OILR	INF	INV	D_TRO
D_LFPRF(-1)	0.360018	0.000327	-0.076726	-0.205485	0.978077	-0.361514	0.407156	1.806621
	(0.09127)	(0.00823)	(0.07889)	(0.09386)	(0.58422)	(1.09960)	(0.48955)	(1.22538)
	[3.94443]	[0.03972]	[-0.97252]	[-2.18917]	[1.67416]	[-0.32877]	[0.83169]	[1.47433]
LNGDPGR(-1)	0.061007	-0.199119	-0.013685	0.316223	-14.58890	2.752195	3.042433	-7.458156
	(0.63442)	(0.05718)	(0.54837)	(0.65243)	(4.06078)	(7.64308)	(3.40276)	(8.51736)
	[0.09616]	[-3.48228]	[-0.02496]	[0.48468]	[-3.59263]	[0.36009]	[0.89411]	[-0.87564]
D_LFPR(-1)	-0.134018	0.003197	0.246068	0.330539	-0.937169	-1.279873	0.107273	-2.752986
	(0.10607)	(0.00956)	(0.09169)	(0.10908)	(0.67895)	(1.27789)	(0.56893)	(1.42407)
	[-1.26346]	[0.33441]	[2.68382]	[3.03014]	[-1.38033]	[-1.00155]	[0.18855]	[-1.93318]
D_UNM(-1)	0.004490	-0.003275	-0.005225	0.141191	0.099068	-0.115660	-0.248586	0.345045
	(0.05187)	(0.00468)	(0.04484)	(0.05334)	(0.33201)	(0.62491)	(0.27821)	(0.69639)
	[0.08656]	[-0.70061]	[-0.11654]	[2.64682]	[0.29839]	[-0.18508]	[-0.89351]	[0.49548]
OILR(-1)	0.003967	-0.000239	0.004947	-0.000607	0.952192	-0.029790	-0.013233	-0.025106
	(0.00296)	(0.00027)	(0.00256)	(0.00304)	(0.01893)	(0.03562)	(0.01586)	(0.03970)
	[1.34172]	[-0.89635]	[1.93540]	[-0.19950]	[50.3102]	[-0.83627]	[-0.83439]	[-0.63242]
INF(-1)	-0.002922	0.000214	-0.002093	-6.22E-05	0.024625	0.172199	0.027048	-0.031572
	(0.00211)	(0.00019)	(0.00182)	(0.00217)	(0.01351)	(0.02542)	(0.01132)	(0.02833)
	[-1.38493]	[1.12391]	[-1.14759]	[-0.02865]	[1.82335]	[6.77422]	[2.38998]	[-1.11452]
INV(-1)	0.003779	-9.03E-05	0.001403	-0.002742	-0.060670	0.002044	0.817931	-0.024426
	(0.00573)	(0.00052)	(0.00495)	(0.00589)	(0.03667)	(0.06901)	(0.03072)	(0.07690)
	[0.65976]	[-0.17490]	[0.28328]	[-0.46546]	[-1.65469]	[0.02962]	[26.6218]	[-0.31761]
D_TRO(-1)	0.001286	0.000855	0.000354	-0.006069	-0.013292	0.008279	0.033032	0.023601
	(0.00489)	(0.00044)	(0.00423)	(0.00503)	(0.03129)	(0.05889)	(0.02622)	(0.06563)
	[0.26302]	[1.94079]	[0.08376]	[-1.20737]	[-0.42483]	[0.14058]	[1.25988]	[0.35962]
C	-0.038218	0.050611	-0.072966	0.078284	2.759797	6.067721	4.582544	1.946675
	(0.17645)	(0.01590)	(0.15252)	(0.18146)	(1.12940)	(2.12572)	(0.94639)	(2.36888)
	[-0.21660]	[3.18239]	[-0.47842]	[0.43142]	[2.44359]	[2.85443]	[4.84213]	[0.82177]
R-squared	0.086567	0.046713	0.056942	0.053045	0.894245	0.146412	0.713286	0.022729
Adj. R-squared	0.064356	0.023532	0.034010	0.030019	0.891673	0.125656	0.706314	-0.001035
Sum sq. resids	284.4726	2.310952	212.5403	300.8580	11654.99	41288.52	8183.813	51274.60
S.E. equation	0.929870	0.083810	0.803753	0.956275	5.951932	11.20254	4.987465	12.48398
F-statistic	3.897472	2.015195	2.483127	2.303689	347.7449	7.053987	102.3105	0.956456
Log likelihood	-450.4641	362.9291	-401.1997	-459.9283	-1077.936	-1291.696	-1018.182	-1328.303
Akaike AIC	2.718723	-2.094255	2.427217	2.774724	6.431575	7.696425	6.077999	7.913036
Schwarz SC	2.820520	-1.992458	2.529014	2.876521	6.533372	7.798222	6.179796	8.014834
Mean dependent	0.162737	0.038207	0.034154	-0.017447	19.47216	7.044522	25.98609	0.491088
S.D. dependent	0.961318	0.084814	0.817780	0.970960	18.08382	11.98052	9.203186	12.47753

Determinant resid covariance (dof adj.)	11536.14
Determinant resid covariance	9295.955
Log likelihood	-5381.019
Akaike information criterion	32.26639
Schwarz criterion	33.08076
Number of coefficients	72

Table 3 - Standard VAR estimation results.

The relatively low R-squared in VAR/SVAR models is a common outcome and should not be interpreted as a weakness of the model. These models are primarily designed to analyze the dynamic and structural relationships among macroeconomic variables, rather than maximizing explanatory power. In line with previous studies, it is normal to observe low R-squared values in macroeconomic panel or time series settings due to the high volatility and complexity of aggregate data. Thus, the focus should be on the significance and interpretation of structural parameters and impulse responses, rather than on the proportion of variance explained.

4.6 Structural VAR Estimation Results

Results from the SVAR model indicate significant contemporaneous interactions among variables. Specifically, the structural coefficient of d_lfprf (Labor Force Participation Rate of Females) impact on lngdpgr (Real GDP Growth) (C(2)) was negative and statistically significant (-0.086555, z = -3.51497, p = 0.0004). This suggests an immediate negative response in economic growth to a positive shock in labor force participation rate of females. This finding aligns with established labor market theories, suggesting increased labor supply, without proportionate job creation, could depress wages and productivity temporarily, thereby affecting economic growth negatively (Becker, 1964; Blanchard & Johnson, 2013; Pissarides, 2000).

Structural VAR Estimates
Date: 06/01/25 Time: 19:44
Sample (adjusted): 1996 2021
Included observations: 338 after adjustments
Estimation method: Maximum likelihood via Newton-Raphson (analytic derivatives)
Convergence achieved after 21 iterations
Structural VAR is just-identified

Model: Ae = Bu where E[uu']=I

A =

1	0	0	0	0	0	0	0
C(1)	1	0	0	0	0	0	0
C(2)	C(8)	1	0	0	0	0	0
C(3)	C(9)	C(14)	1	0	0	0	0
C(4)	C(10)	C(15)	C(19)	1	0	0	0
C(5)	C(11)	C(16)	C(20)	C(23)	1	0	0
C(6)	C(12)	C(17)	C(21)	C(24)	C(26)	1	0
C(7)	C(13)	C(18)	C(22)	C(25)	C(27)	C(28)	1

B =

C(29)	0	0	0	0	0	0	0
0	C(30)	0	0	0	0	0	0
0	0	C(31)	0	0	0	0	0
0	0	0	C(32)	0	0	0	0
0	0	0	0	C(33)	0	0	0
0	0	0	0	0	C(34)	0	0
0	0	0	0	0	0	C(35)	0
0	0	0	0	0	0	0	C(36)

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-0.005225	0.004894	-1.067673	0.2857
C(2)	-0.687329	0.028042	-24.51027	0.0000
C(3)	-0.185995	0.091580	-2.030952	0.0423
C(4)	0.725408	0.536595	1.351871	0.1764
C(5)	1.031730	1.096945	0.940548	0.3469
C(6)	0.661631	0.476702	1.387936	0.1652
C(7)	1.090429	1.035025	1.053529	0.2921
C(8)	-0.742577	0.311130	-2.386711	0.0170
C(9)	1.758982	0.614807	2.861030	0.0042
C(10)	-26.89672	3.623644	-7.422562	0.0000
C(11)	2.288587	7.967157	0.287253	0.7739
C(12)	-11.31583	3.458199	-3.272173	0.0011
C(13)	-17.50827	7.604880	-2.302241	0.0213
C(14)	0.118229	0.106588	1.109215	0.2673
C(15)	-1.085017	0.621884	-1.744725	0.0810
C(16)	0.095988	1.273573	0.075369	0.9399
C(17)	-0.786298	0.552741	-1.422544	0.1549
C(18)	-0.903490	1.200295	-0.752723	0.4516
C(19)	-0.112685	0.316776	-0.355725	0.7220
C(20)	0.431023	0.645953	0.667266	0.5046
C(21)	0.392786	0.280531	1.400152	0.1615
C(22)	0.251991	0.609126	0.413694	0.6791
C(23)	0.055784	0.110894	0.503035	0.6149
C(24)	0.127840	0.048147	2.655224	0.0079
C(25)	-0.957065	0.105322	-9.087050	0.0000
C(26)	0.040179	0.023607	1.702034	0.0887
C(27)	-0.017001	0.051329	-0.331211	0.7405
C(28)	0.385370	0.117764	3.272399	0.0011
C(29)	0.929870	0.035764	26.00000	0.0000
C(30)	0.083669	0.003218	26.00000	0.0000
C(31)	0.478593	0.018407	26.00000	0.0000
C(32)	0.937852	0.036071	26.00000	0.0000
C(33)	5.461917	0.210074	26.00000	0.0000
C(34)	11.13558	0.428292	26.00000	0.0000
C(35)	4.832884	0.185880	26.00000	0.0000
C(36)	10.46349	0.402442	26.00000	0.0000

Log likelihood -5417.507

Estimated A matrix:

1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
-0.005225	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
-0.687329	-0.742577	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000
-0.185995	1.758982	0.118229	1.000000	0.000000	0.000000	0.000000	0.000000
0.725408	-26.89672	-1.085017	-0.112685	1.000000	0.000000	0.000000	0.000000
1.031730	2.288587	0.095988	0.431023	0.055784	1.000000	0.000000	0.000000
0.661631	-11.31583	-0.786298	0.392786	0.127840	0.040179	1.000000	0.000000
1.090429	-17.50827	-0.903490	0.251991	-0.957065	-0.017001	0.385370	1.000000

Estimated B matrix:

0.929870	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.083669	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.478593	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.937852	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	5.461917	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	11.13558	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	4.832884	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	10.46349

Estimated S matrix:

0.929870	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.004859	0.083669	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.642735	0.062131	0.478593	0.000000	0.000000	0.000000	0.000000	0.000000
0.088414	-0.154519	-0.056584	0.937852	0.000000	0.000000	0.000000	0.000000
0.163497	2.300433	0.512905	0.105682	5.461917	0.000000	0.000000	0.000000
-1.079419	-0.259174	-0.050162	-0.410131	-0.304686	11.13558	0.000000	0.000000
-0.067125	0.772660	0.334988	-0.365407	-0.686009	-0.447421	4.832884	0.000000
-0.206465	3.459475	0.807599	-0.001342	5.486598	0.361734	-1.862450	10.46349

Estimated F matrix:

1.382287	0.112956	-0.156121	0.042086	0.600260	-0.024091	-0.013556	-0.007627
0.003301	0.068051	0.001403	-0.004704	-0.022797	0.000749	0.003716	0.009499
0.797439	0.202477	0.609568	0.053182	0.788918	0.011950	-0.171835	-0.047315
0.067850	-0.146712	0.212518	1.105635	0.086886	0.010210	-0.120433	-0.092873
11.12994	18.11874	-6.783226	10.64769	130.2028	7.378850	-33.99399	-8.776312
-3.536356	-1.048209	-0.720997	-1.157888	-6.635628	13.17378	1.581717	0.552775
1.798736	4.853578	1.794355	-4.374537	-12.56619	-1.138825	29.08665	2.931745
-0.120293	2.056149	-0.963220	0.226290	1.891408	-0.297119	-1.423712	10.86477

Table 4 - Structural VAR estimation results.

4.7 Impulse-Response Functions (IRFs)

The impulse response analysis (Figure 2) shows GDP growth's reaction to a one-standard-deviation shock in d_lfprf (Labor Force Participation Rate of Females). Initially, lngdpgr (Real GDP growth) declines slightly, stabilizing quickly towards zero. This indicates the dissolving nature of d_lfprf (Labor Force Participation Rate of Females) shocks on lngdpgr (Real GDP Growth), consistent with theoretical expectations of temporary market adjustment frictions (El-Khazindar & Omran, 2021; Mousa & Abdelaziz, 2020).

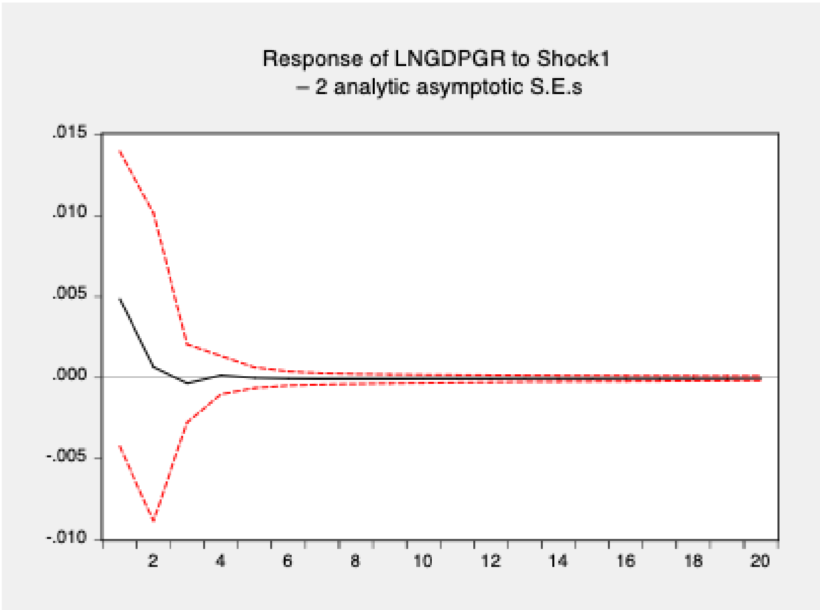

Figure 4 - Response of GDP growth to a Labor Force Participation Rate of Females' shock results in a 20 years horizon.

4.8 Forecast Error Variance Decomposition (FEVD)

The FEVD results (Figure 3) demonstrate that shocks to d_lfprf (Labor Force Participation Rate of Females) account for a poor share of lngdpgr (Real GDP Growth) fluctuations over the forecast horizon. Most of the variation in GDP growth is explained by its own shocks. This finding suggests the limited role labor force participation rate of females plays in short-run economic volatility, highlighting the dominance of internal growth dynamics or structural economic factors over labor market participation shifts (Asongu & Odhiambo, 2019).

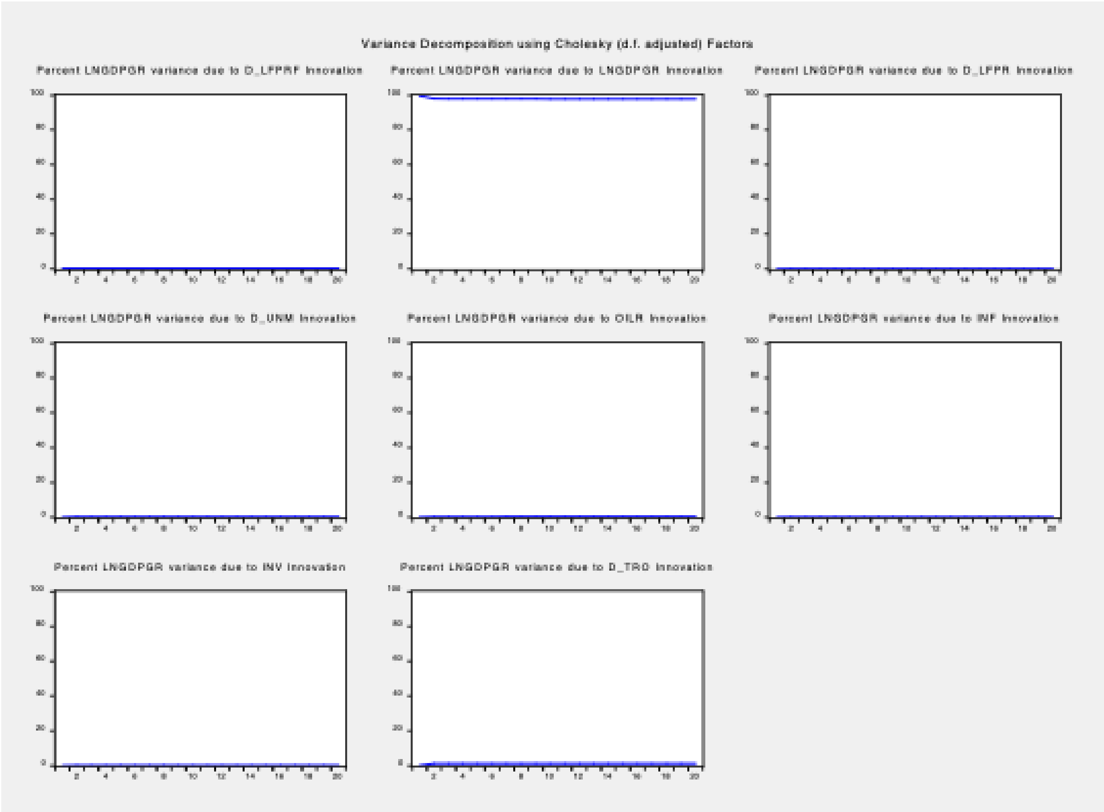

Figure 5 - The FEVD charts.

4.9 Theoretical Interpretation

The negative and transient impact of increased labor participation rate of females on real GDP growth can theoretically be explained by labor market rigidities and mismatches in labor supply and demand. Increased labor force participation rate of females without sufficient job creation leads to excess labor supply, wage cut, decreased productivity, and ultimately reduced growth rates. According to Becker (1964), Blanchard and Johnson (2013), and Pissarides (2000), when labor demand does not rise proportionally with increased labor supply, excess labor emerges, causing wage reduction and reduced productivity, ultimately preventing growth. This mechanism is supported empirically by recent studies highlighting market rigidities and mismatches between labor supply and demand (Sinha & Sinha, 2019; World Bank, 2023).

Empirical support for this hypothesis is robust in recent literature (World Bank, 2023; Sinha & Sinha, 2019).

5. Conclusion and Policy Implications

5.1 Summary of Main Findings

This research empirically investigated the relationship between labor force participation rate of females and real GDP growth in MENA countries using panel SVAR methodology. Key findings indicate an immediate negative impact of increased labor force participation rate of females on real GDP growth, attributed to temporary market disequilibria. The impulse-response analysis confirmed the dissolving nature of this impact, while variance decomposition highlighted minimal explanatory power of labor force participation rate of females shocks on real GDP growth fluctuations.

5.2 Policy Implications for Inclusive Growth

For labor force participation rate of females to significantly enhance inclusive real GDP growth, supportive measures must accompany increased labor supply. Policymakers need to focus on creating robust job markets that can absorb increased female participation.

5.3 Limitations and Future Research

This study faced limitations such as data constraints, potential omitted variables, and limitations related to panel SVAR methodology. Future research directions could include more detailed sectoral analyses, long-term institutional impacts, and incorporating micro-level wage and productivity data to deepen understanding of the relationship between labor force participation rate of females and economic growth.

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