

IMPACT OF FDI AND TRADE OPENNESS ON FEMALE LABOR FORCE PARTICIPATION IN SAUDI ARABIA

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Abstract

This study examines the impact of foreign direct investment (FDI) and trade openness on female labor force participation (FLFP) in Saudi Arabia from 1990 to 2024. Using the U-shaped theory of female labor supply and globalization frameworks, we apply an autoregressive distributed lag (ARDL) model to capture long- and short-run dynamics while accounting for domestic factors and structural reforms under Vision 2030. Results show that trade openness has a significant negative long-run effect on FLFP, while FDI exerts a positive and significant influence. In the short run, both FDI and trade openness significantly positively affect FLFP. However, reform-related interactions reveal important shifts: trade openness became more favorable to women's labor participation post-2016, whereas FDI effects turned negative. These findings highlight the nuanced role of globalization in shaping women's employment outcomes in Saudi Arabia and provide policy insights for sustaining progress under Vision 2030.

Keywords: *Female labor force participation; Foreign direct investment; Trade openness; Saudi Arabia; ARDL; Vision 2030.*

Introduction

Female labor force participation in Saudi Arabia has historically been among the lowest in the world due to economic structure and social norms. For decades, cultural norms – such as male guardianship rules – limited women's engagement in paid work, resulting in an extremely low Female labor force participation (FLFP) rate. For instance, in 1999, only about 16% of Saudi women participated in the labor force. Even as recently as 2017, only 19% of Saudi female nationals were working or seeking work. Such levels are far below global averages, and most countries with comparably low FLFP have similarly been in the Middle East and North Africa region (Bursztyn et al., 2018). However, Saudi Arabia has undergone transformative changes in the past decade. Under the *Vision 2030* reform agenda announced in 2016, the government implemented policies to promote women's economic empowerment, including easing restrictions on women's mobility (e.g., allowing women to drive), encouraging female employment in the private sector, and enforcing gender diversity targets. These efforts have led to a dramatic rise in participation in the women's labor force. From late 2017 to the end of 2023, the FLFP rate for Saudi women doubled from about 16% to about 34%, far surpassing the original Vision 2030 target of 30% by 2030. By 2023, female participation reached more than 35%, exceeding the Vision target eight years earlier. As of Q3 2024, the Saudi General Authority for Statistics stated that Saudi female labor force participation had climbed further to 36.2%, a remarkable increase that underscores the success of recent reforms. This rapid change suggests that Saudi Arabia's socio-economic landscape is shifting, with women playing a more active role in the economy than ever.

Therefore, understanding the drivers of female labor force participation has become urgent. A substantial body of international literature indicates that economic development and structural transformation are key determinants of women's labor supply. Classic economic

theory posits a U-shaped relationship between development and FLFP: at early stages of development, women often participate in subsistence agriculture; as incomes rise, FLFP may fall due to women withdrawing from the labor force in transitioning economies; eventually, at higher levels of income and education, FLFP rises again as the economy shifts to services and as social norms evolve (Agboola, 2021; S&P Global Ratings, 2023). Saudi Arabia's case is unique because it is a high-income country where oil wealth long obviated the economic need for dual-earner households. However, recent policy-driven changes are now pulling more women into the workforce. Beyond general development levels, globalization forces – notably foreign direct investment (FDI) and trade openness – may also influence female employment opportunities. FDI can bring new industries and multinational companies into an economy, potentially creating jobs for women and introducing gender-equal workplace practices (Irandoost, 2024; Ghazalian, 2024). By expanding export sectors and competitive pressures, trade openness can alter a country's industrial structure in ways that affect labor demand for women. For example, evidence from Brazil's trade liberalization in the 1990s showed that tariff reductions were followed by increases in female labor force participation after a few years (Gaddis & Pieters, 2017) as women shifted from domestic-oriented agriculture to export-oriented manufacturing and services.

On the other hand, some researchers caution that the gains from globalization are not automatic. If FDI flows predominantly into male-dominated industries (such as heavy oil and gas in Saudi Arabia) or trade exposure displaces female-intensive sectors, women's employment could be muted or negative (Ghazalian, 2024). Thus, the net effect of FDI and trade on female participation is an empirical question, likely mediated by the types of industries expanded and the domestic policy environment.

In the context of Saudi Arabia's Vision 2030 push for diversification, the country has actively pursued greater FDI and trade integration. Saudi Arabia joined the World Trade Organization (WTO) in 2005 and has implemented various business climate reforms to attract foreign investors. Trade openness (measured by exports plus imports as a share of GDP) has consistently been high due to oil – averaging around 70% of GDP historically, and in recent years, non-oil trade has also grown. In 2022, Saudi trade openness stood at about 63% of GDP, up from a pandemic low of 50% in 2020. FDI inflows, while volatile, have shown an uptick following the launch of Vision 2030. After peaking at about \$39 billion in 2008 (roughly 8% of GDP) during a global oil boom in 2019, FDI net inflows to Saudi Arabia had dwindled to only \$1.4 billion in 2017, according to World Investment Report 2019. This decline raised concerns, leading authorities to introduce a National Investment Strategy.

According to the data, by 2021–2022, FDI rebounded strongly – for example, FDI inflows surged to \$28.3 billion in 2022, lifting FDI to roughly 2.4% of GDP, which is achieving a government target. In addition, FDI has entered new sectors like tourism, entertainment, and technology, as well as significant infrastructure "giga-projects," potentially offering new employment avenues for Saudi women. Indeed, theory suggests that FDI can support female employment by creating formal sector jobs with higher wages and better conditions than local firms and transferring practices that encourage hiring women (Ghazalian, 2024) and (Irandoost, 2024). Greater trade openness can broaden the range of industries as the economy diversifies beyond oil into export-oriented manufacturing and services where women might find jobs (e.g., pharmaceuticals, education, finance, retail).

Beyond domestic socio-economic factors, globalization forces may also influence women's labor force participation. Two notable aspects of globalization are foreign direct

investment (FDI) and trade openness, which can reshape employment opportunities. Greater FDI can bring new industries and multinational companies into an economy, potentially creating jobs for women and introducing more gender-equal workplace practices (Irandoost, 2024; Ghazalian, 2024). Likewise, increased trade openness, by expanding export sectors and exposing the economy to global competition, can alter the industrial structure in ways that affect labor demand for women.

In light of these dynamics, this study asks: Have FDI and trade openness contributed to the rise in female labor force participation in Saudi Arabia? We specifically focus on the period from 1990 to 2024 – covering the pre-reform decades of relatively stagnant FLFP and the post-2016 surge – to capture both long-run relationships and recent changes. While prior studies have examined determinants of female labor supply in Saudi Arabia, they often emphasized socio-demographic factors (education, fertility, etc.) and domestic economic variables (Agboola, 2021). There is a paucity of research linking external openness (FDI, trade) to female labor outcomes in the Saudi context. This paper contributes to the literature by integrating international factors into analyzing female labor participation in Saudi Arabia and utilizing the latest available data (through 2023).

Research objectives

The main objective of this study was to investigate how globalization forces specifically foreign direct investments and trade openness relates to female labor force participation (FLFP) in Saudi Arabia. The research is guided by the following objectives:

- i. To analyze the short run and long-run FDI and trade openness impact on female labor force participation in Saudi Arabia from 1990-2024.
- ii. To evaluate the impact of vision 2030 on female labor participation.

Research hypotheses

- i. H_1 : Foreign direct investment has no significant impact on female labour force participation in Saudi Arabia.
- ii. H_2 : Trade openness has no significant impact on female labour force participation in Saudi Arabia.
- iii. H_3 : Saudi Vision 2023 has no significant impact on female labour force participation in Saudi Arabia.

Contributions of the research

This research paper hopes to achieve the following:

1. Create a new perspective on women and work in Saudi Arabia- many studies have been done on the shortage of female labor supply in Saudi Arabia but they focus more on social and economic factors. However, this paper aims to shift on global factors like foreign direct investments and trade which play a key role in creating opportunities for women.
2. Using ARDL model is well suited for this type of research as it will use a time series data which has a small number of years and variables with different statistical properties. To account for vision 2030, the paper will include a structural break which will make the model more realistic and align with the current developments.
3. The paper will contribute heavily to the policy makers as it will give them evidence that will guide decisions on how to shape FDI and trade openness in order to continue empowering Saudi women.

Literature Review

Empirical literature review:

Female Labor Force Participation

Saudi Arabia has had one of the lowest female labor force participations historically. Women have been kept out of the workplaces due to factors like legal restrictions, cultural norms and gender-segregated workplaces. As Bursztyn et al. (2018) argues, these restrictions have kept women out of paid employment in decades with only 17% of Saudi women working in 2017 which is very low in global and regional averages. However, there was a big shift when vision 2020 was introduced in 2016 to reduce the country's dependence on oil in order to promote economic diversification. One of the main goals of vision 2030 is to increase women's economic participation and this made a series of reforms to roll out. These reforms have allowed women to drive which has made it easy for women to travel and work and hence the private sector has created more opportunities for women. Due to these reforms, FLP had more than doubled in 2023 which is a stunning transformation that has even surpassed the 2030 vision of having 30% of female workforce.

Economic research has long examined why female labor force participation rates differ across countries and over time. A foundational concept is the U-shaped hypothesis proposed by Claudia Goldin and others, which relates FLFP to stages of economic development (Agboola, 2021). In agrarian economies, women often engage in farm work (high FLFP). As countries industrialize, female participation may decline because women leave agricultural work and face barriers to entering factory or formal employment; family income might rise enough that women's labor is less economically necessary, and social norms may favor women focusing on home roles. Eventually, in mature industrial/service economies with higher education levels, FLFP rises again as women enter professional jobs, and service sector expansion creates more "female-friendly" employment opportunities. Goldin's analysis of historical data finds such a U-shaped pattern in many countries, though the timing and depth vary (Agboola, 2021). For Saudi Arabia, which until recently had an oil-driven economy with limited female employment, one could interpret the recent surge in FLFP as the upturn of the U-shape – driven by changes in education, norms, and the transition towards a service-oriented economy (S&P Global Ratings, 2023). Indeed, S&P Global Ratings (2023) attributes the impressive rise in Saudi women's workforce participation since 2016 to improved female education, declining fertility rates, and cultural liberalization. Fertility in Saudi Arabia dropped from nearly four children per woman in 2000 to about 2.4 in 2022, which tends to increase women's availability for paid work.

Meanwhile, according to S&P Global Ratings (2023), the share of adult Saudi women with at least a bachelor's degree rose to 32% by 2020 (up from 26% in 2017), exceeding educational attainment levels in some advanced economies. Higher education strongly predicts labor force participation – a relationship confirmed in Saudi Arabia by Agboola (2021), who found that increases in female tertiary enrollment and female life expectancy (a proxy for health) significantly and positively affected FLFP in Saudi data from 1991–2017. Agboola's study, which employed cointegration tests and an ARDL model, reinforces the importance of human capital investments in raising female participation, recommending policies to expand female education and health to boost women's employment.

Beyond demographics and development, institutional and policy factors are crucial. Social norms and legal barriers – such as restrictions on women's mobility or employment sectors – have historically constrained FLFP in Saudi Arabia and many MENA countries.

Research by Bursztyn et al. (2018) highlighted how “*misperceived social norms*” in Saudi Arabia made men think others disapproved of women working, discouraging them from permitting female family members to join the labor force. Such norms are not immutable: the Saudi government's recent reforms (allowing women to drive, loosening guardianship requirements, anti-discrimination labor laws, etc.) have rapidly shifted what is socially acceptable, enabling more women to seek employment. This underscores that policy can shape FLFP by altering norms and reducing institutional barriers. Factors like the economy's structure and government employment also matter in the labor economics literature. Saudi Arabia traditionally provided the majority of jobs for women in the public sector (especially in education and healthcare), while the private sector lagged. Policies under Vision 2030 aim to increase female private-sector employment through *Saudization* quotas and incentives for hiring women (S&P Global Ratings, 2023). Cross-country studies by Verme (2014) confirm that public sector dominance in Gulf countries has led to higher female employment in government. However, private sector growth and diversification are needed for sustained increases in overall FLFP.

Regarding Trade Openness, globalization can profoundly impact gender outcomes in labor markets. Trade openness – the extent of a country's integration into global goods and services markets – influences the demand for labor by sector and skill. If export-oriented industries are female-labor-intensive, greater trade can increase female employment; conversely, if trade exposes female-dominated sectors to competition and contraction, women may lose jobs. Several empirical studies provide evidence on these channels. Heath and Mobarak (2015) showed that the rapid growth of the export-oriented garment industry in Bangladesh improved women's outcomes, increasing female employment, delaying marriage and childbirth, and improving health for working women (Nica et, 2023). This is a clear example of how trade (in this case, the export demand for garments) boosted FLFP and empowered women. Similarly, Gaddis and Pieters (2017) examined Brazil's trade liberalization (1987–1994). They found that tariff reductions were associated with higher female labor force participation and employment after a lag of approximately two years (Gaddis & Pieters, 2017). their study shows that the mechanism was that trade reform accelerated structural shifts: women moved out of declining sectors like agriculture into expanding sectors, especially services, as well as some manufacturing jobs. Both “push” and “pull” factors were at play – some women entered the labor force due to male unemployment in tradable sectors (a push factor). In contrast, others were drawn by new opportunities in the growing service economy (a pull factor). These findings from Brazil echo the idea that trade openness can indirectly raise FLFP by modernizing the economy's sectoral composition.

However, the impact of trade can vary by context. Özler (2000) and Joekes (1995), among others, noted that export growth in developing countries often concentrates on labor-intensive manufacturing (textiles, electronics), which tends to employ large numbers of women – a phenomenon known as the feminization of labor in export sectors. However, if a country's comparative advantage lies in male-dominated industries (e.g., mining, heavy industry), trade expansion might not benefit women as much. In the Middle East, evidence is mixed. Çagatay and Özler (1995) found that trade openness initially increased female share of employment in many developing countries, but Seguíno (2000) pointed out potential downsides: in some cases, women are hired in export industries at lower wages, and trade can exacerbate gender wage gaps in the absence of strong labor rights. In Saudi Arabia, the main exports are oil and

petrochemicals – capital-intensive sectors with traditionally low female employment. Thus, increased trade via oil booms does not directly create many jobs for women (since extraction employs few workers). Nonetheless, trade openness in Saudi Arabia can still facilitate female employment indirectly: higher oil export revenues have funded government spending on education and healthcare (employing many women) (S&P Global Ratings, 2023), and efforts to promote non-oil exports (e.g., chemicals, pharmaceuticals, services like tourism) could generate jobs that women can fill.

Sauré and Zoabi's (2014) study suggests that trade openness can *widen* the gender wage gap and *decrease* female participation in a rich country – an effect consistent with U.S. labor patterns after NAFTA. This insight underscores that the impact of trade on women's labor outcomes may depend on sector characteristics and factor endowments. Bussmann's 2009 examining multiple countries to see the effect of trade openness on female labor participation varies by a country's level of development and the structure of its economy, which analyzed 134 countries and found a striking divergence between developing and developed countries. The author found that greater trade openness is associated with *higher female labor force participation in developing countries*, as trade expansion tends to draw women into industrial and agricultural jobs. In contrast, in industrialized economies, increased trade openness was linked to a *decrease in the share of women in the workforce*. In addition, the author claimed that trade in rich countries may lead to labor shifts that disadvantage female workers. This cross-country evidence aligns with the idea that globalization benefits women's employment in lower-income countries but may marginally reduce women's workforce share in high-income countries. Focusing on Asian countries, Li et al. (2019) study used a panel threshold regression to test for non-linear effects of trade openness on FLFP. They found an optimal level of trade openness for female participation. At trade openness levels below the threshold, further openness enhances female labor force participation rates, presumably by opening new labor opportunities and reducing costs for female-intensive firms. However, once trade openness exceeds the threshold value, the relationship reverses – *beyond this point, additional trade integration is associated with lower FLFP*. Li et al. attribute this switch to a trade-off between a cost-reduction effect (benefitting female employment at first) and a technology effect: extremely high openness may introduce labor-saving technologies or tougher foreign competition that displace female workers. This evidence suggests that the impact of trade is not linear – moderate openness can help women enter the labor force, but very high openness without supporting policies might hurt female employment prospects.

Empirical research on trade liberalization in Indonesia also sheds light on gender-specific labor outcomes. For instance, Kis-Katos et al. (2018) studied Indonesia's tariff reductions in the 1990s and 2000s. They found that *regions more exposed to input tariff cuts experienced higher growth in female work participation* than males. Their findings reinforce that reducing trade barriers (especially intermediate inputs) in emerging economies can boost female labor participation by expanding demand in female-intensive industries and possibly shifting societal norms. It should be noted that the Indonesian case also depended on women being able to take up new jobs – factors like education levels and cultural norms moderated the extent of the trade benefits for women.

The Middle East presents a unique context for examining trade and female labor force participation, given the region's historically low FLFP rates and distinct socio-economic conditions. A recent policy-oriented study by Mina Balamoune (2024) compares the Middle East

and North Africa with other developing regions. Using panel data and a GMM estimation, this study finds that trade openness in MENA has not had the same positive impact on female employment as seen elsewhere. The results suggest that in the MENA region, trade expansion may have *contributed to a widening gender gap in labor force participation and a reduction in paid employment for women*. These adverse effects of trade openness on female labor-force participation are a cause for concern, as they imply that globalization could further marginalize MENA women in the workforce without complementary reforms.

The literature suggests that trade openness can benefit female labor participation, but outcomes depend on sectoral dynamics, complementary policies, and economic context. In Saudi Arabia, as tariffs are already low and trade is dominated by hydrocarbons, a key aspect is how trade policies tie into the broader diversification strategy. Establishing special economic zones and encouraging industries like textiles, tourism, and finance as part of Vision 2030 could make trade liberalization more gender-inclusive by fostering sectors where women have a comparative advantage or interest.

Foreign direct investment – multinational companies investing and establishing operations in a host country – can be a conduit for transferring technology, capital, and new workplace norms. Theoretically, FDI might support female labor force participation in several ways. First, multinational enterprises (MNEs) often create formal-sector jobs and may have non-discriminatory hiring practices, potentially increasing demand for female employees (Ghazalian, 2024). Ghazalian study shows that some firm-level evidence shows foreign firms employ a higher share of women than domestic firms in developing and developed countries. This could be because foreign investors may leverage underutilized female labor or because they bring a "modern" corporate culture less bound by local gender biases. In addition, FDI inflows can spur growth in service sectors (such as finance, telecommunications, and retail) where women are often well-represented. Alternatively, because of the increasing labor demand, FDI could raise female labor force participation if women are drawn into the workforce to fill new positions ("pull" effect). On the other hand, not all FDI is equal from a gender perspective. If FDI is concentrated in capital-intensive industries like oil/gas or construction, it might generate relatively few jobs, primarily for men.

Additionally, some scholars have cautioned that while FDI can increase female employment, it does not automatically guarantee good working conditions – *Standing (1989)* famously argued that globalization led to a rise in female employment but often in low-wage, insecure jobs. Thus, the net impact of FDI on women's employment and empowerment can be context-dependent.

Empirical studies on FDI and female labor provide nuanced insights. *Irandoost (2024)* conducted a panel analysis of 14 Arab countries (including Saudi Arabia) from 1991 to 2021, examining the linkage between FDI inflows and women's labor force participation. The study found that FDI inflows significantly boost women's participation in the labor force in about half of the sample countries. The author suggests that FDI has the potential to help governments promote gender equality in employment *"through either higher female labor demand or sustainable labor practices and gender-equal norms"*. However, the effect was not uniform across all countries, implying that country-specific factors (such as labor laws, the sectors attracting FDI, and the initial gender gap) mediate the FDI-FLFP relationship. There is limited published research for Saudi Arabia isolating FDI's impact on female employment. One related study by *Ghazalian (2024)* looked at a global sample and found that while FDI had no significant

effect on the overall female employment rate, it *did* lead to sectoral shifts: FDI tended to increase the share of female employment in services and decrease it in agriculture, with an insignificant effect in industry. This is insightful for Saudi Arabia, given that agriculture is tiny and services are growing – it suggests FDI flowing into service industries (e.g., foreign investment in education, healthcare, or business services) could particularly benefit women.

Overall, the literature implies that any thorough analysis of female labor participation – especially in a rapidly changing economy like Saudi Arabia – should account for FDI and trade openness alongside traditional domestic factors. Prior studies on Saudi Arabia (e.g., Agboola, 2021) have confirmed the importance of variables such as GDP per capita (capturing the U-shape developmental effects), female education (a key supply-side factor), inflation (macroeconomic stability influencing job creation), and urbanization (structural changes and lifestyle factors). Building on that foundation, our study adds the international dimensions of FDI and trade. By doing so, we address a gap in the literature. No published study has yet specifically quantified the impact of FDI and trade openness on Saudi Arabia's female labor force participation in a unified econometric framework. Given the significant policy emphasis on globalization (through investment attraction and trade agreements) in Saudi Arabia's Vision 2030, it is important to empirically assess whether these external factors have played a measurable role in shaping women's employment outcomes. In the next section, we outline the theoretical framework that links these variables to FLFP and form the basis for our hypotheses.

Theoretical literature review

The U-shaped theory in development and female labor participation.

The U-shaped theory was developed by Claudia Goldin which argues that female labor force participation follows a non-linear path as the country develops economically. According to the theory, in the traditional agrarian economies, women's labor is crucial for household survival such as agriculture. Most women participate in subsistence farming, informal markets or production that is family based. Thus, women at this stage are economically active due to necessity (Sajid et al., 2024). As countries enter the industrialization stage and income levels rises, female labor force participation declines. Due to the high household incomes, the need for women to work reduces. At this stage, the social norms in the developing societies view female employment as unnecessary. At the industrialization stage, the industrial jobs are physically demanding which does not favor a lot of women. During the high development stages, female labor force participation rises due to the expansion of service sector which is more friendly, improved family planning and reproductive health and access to education for women. At this stage, there is a gradual shift in societal attitudes and this accommodates more women in the labor force. According to this theory, Saudi Arabia has long sat at the bottom of the U-curve due to high incomes from oil. Besides, the FLFP has been low for long due to the social norms and the low need for a dual income household. The 2030 vision has moved this shift to the rising phase as FLFP increases due to structural and social reforms.

Structural Transformation Theory

This theory argues that economies evolve with time by reallocating labor to different sectors from agriculture, manufacturing to services. Through this reallocation, more job opportunities change and are created for men and women. In agriculture, production heavily relies in family labor where women play a key role in the agricultural economies. However, their work is mainly unpaid and informal and is not recorded. In the early and middle stages of

development, manufacturing starts dominating (HO, 2024). At this stage, different industries such as steel, machinery and construction are male dominated and women are not favored as they are physically demanding. At this stage some countries start light manufacturing such as electronics and textiles which gives more opportunities for women. When the countries enter the final development stages, the service sector emerges such as finance, education, retail, hospitality, and health care which favor women. The service sector creates opportunities that are formal, safer and more compatible with social expectations. However, in Saudi Arabia, the structural transformation has been unusual. The country bypassed the large manufacturing stage and remained oil-dependent for long due to the huge wealth from oil. However, Vision 2030 transformed the service sector and an increase in FLFP has been witnessed.

Human Capital Theory

The human capital theory was developed by Gary Becker in 1964. The theory suggests that in order for people to increase their earning potential and productivity, they invest in skills development, education, and training. Thus, education is a form of capital that enhances an individual's value in the labor market (Rafid, 2023). Education has been linked to high labor force participation especially to women. Educated women are likely to work in high-paying jobs and more stable jobs, are likely to enter and remain in formal employment and likely to have low fertility rates with delayed marriages and childbearing which makes them have longer careers. There has been a tremendous progress in women education in Saudi Arabia. More than half of the students in universities are women, and have outperformed men in different academic fields. However, despite this progress, women lagged behind in the labor force. According to human capital theory, demand for women labor must exist for them to enter the workforce. The labor market have to offer jobs that match women skills. However, if barriers such as discrimination, transportation, and limited childcare, then education alone cannot increase the rates of FLFP. Thus, globalization like trade and FDI may create high demands for educated female labor thus improving the rates of FLFP.

Comparative Advantage Theory and Trade Openness

Comparative advantage theory asserts that countries specialize in production of goods that use their most abundant resources. Women in labor rich countries benefit from trade liberalization if female labor is abundant and underutilized (Akhtar et al., 2023). Trade openness leads to expansion of export-oriented industries such as textile and electronics which are female intensive. Due to lower consumer prices, there is increased household purchasing power and this may shift women to paid labor from household work. Competition and innovation encourages firms to adopt modern practices which involves diverse workforce.

Data and Methodology

The research will employ an annual time-series data for Saudi Arabia covering the period 1990 through 2024. This period provides 34 observations, a reasonable span to capture long-run relationships while including the most recent developments. All data are sourced from reputable, publicly available sources such as the World Bank and Saudi government statistics, ensuring consistency and comparability. The analysis will involve an autoregressive distributed lag (ARDL) model with an error correction mechanism (ECM) to address the research question. The ARDL approach is well-suited for our analysis, given the limited sample size (34 years) and the likelihood of mixed stationarity in the variables. It allows us to test for a long-run equilibrium relationship (cointegration) between FLFP and its determinants, even if the regressors combine

stationary and non-stationary series. We explicitly incorporate a dummy variable for the *reform period* after 2016 to account for the structural break associated with the Vision 2030 reforms that specifically targeted increased female employment. Our model controls for GDP per capita (as a proxy for development level), female education (which enhances women's employability), inflation (to capture macroeconomic stability), and urbanization (since urban economic development may offer more job opportunities for women). By including these controls, we aim to isolate the marginal impact of FDI and trade openness on FLFP. We also conduct standard unit root tests and cointegration tests to ensure robust inference, and we perform various robustness checks (such as using alternative education metrics and checking for model stability) to validate our findings.

Below, we describe the key variables in our analysis and their definitions and sources:

Female Labor Force Participation Rate (FLFP): This is the dependent variable, measured as the labor force participation rate of females ages 15 and above, expressed as a percentage of the female working-age population. We obtained this series from the World Bank's World Development Indicators and cross-validated recent values with Saudi Arabia's General Authority for Statistics labor market reports.

Foreign Direct Investment (FDI) Inflows (% of GDP): The key independent variable of interest. This measures net FDI inflows as a percentage of Saudi GDP. Net inflows comprise equity capital, reinvested earnings, and other capital from foreign investors in Saudi enterprises, minus reverse investments. Data are sourced from the World Bank.

Trade Openness: The second primary independent variable. This is the sum of exports and imports of goods and services as a share of GDP. It captures the degree of Saudi Arabia's integration into global trade. Data are from World Bank national accounts.

GDP per capita (constant 2015 US\$): We use GDP per capita (in constant terms) to control economic development and income. Source: World Bank WDI.]

Female Education: Education is a crucial factor enabling women to work. We consider the gross enrollment ratio in female secondary or tertiary education as a direct measure of female human capital. From the World Bank's Education Statistics. This indicator measures the extent of female participation in higher education.

Inflation: We include annual inflation (percent change in consumer prices) from the World Bank/IMF data as a macroeconomic control.

Urbanization: Urbanization rate is included to represent structural change and social transformation. It is measured as the percentage of the population living in urban areas from World Bank data.

Reform Dummy (Post-2016) to capture the impact of the significant social and economic reforms that began around 2016; we include a dummy variable, Reform, which takes the value 1 for years 2017– 2024 and 0 for 1990–2016. 2017 marked the aftermath of Vision 2030's launch (mid-2016) when many women-oriented reforms started materializing (e.g., easing restrictions, labor law changes, and Vision 2030 initiatives). One could also test 2018 as a start (since women were allowed to drive in 2018 and guardianship rules eased), but we chose 2017 to capture the cumulative reform period. This dummy effectively allows a one-time shift in the FLFP level attributable to structural/ policy change.

Given the mix of potential integration orders and the relatively short sample, we adopt the Autoregressive Distributed Lag (ARDL) approach developed by Pesaran and Shin (1999) and Pesaran et al. (2001) for cointegration analysis.

$$\begin{aligned} \text{FLFP}_t = & \alpha + \sum_{i=1}^p \phi_i \text{FLFP}_{t-i} + \sum_{j=0}^{q_1} \beta_j \text{FDI}_{t-j} + \sum_{k=0}^{q_2} \gamma_k \text{Trade}_{t-k} + \sum_{\ell=0}^{q_3} \delta_{\ell} \text{GDPpc}_{t-\ell} \\ & + \sum_{m=0}^{q_4} \theta_m \text{Educ}_{t-m} + \sum_{n=0}^{q_5} \kappa_n \text{Inflation}_{t-n} + \sum_{o=0}^{q_6} \mu_o \text{Urban}_{t-o} + \sum_{p=0}^{q_7} \pi_p \text{Reform}_{t-p} + \varepsilon_t, \end{aligned}$$

$$\Delta \text{FLFP}_t = \tau + \lambda(\text{FLFP}_{t-1} - \chi_1 \text{FDI}_{t-1} - \chi_2 \text{Trade}_{t-1} - \chi_3 \text{GDPpc}_{t-1} - \dots - \chi_7 \text{Reform}_{t-1}) + \sum \omega \Delta X_{t-i} + u_t,$$

Lag Selection: We will determine the appropriate lag length for the ARDL using information criteria (Akaike, Schwarz/BIC) and ensuring satisfactory residual diagnostics (no serial correlation in errors, etc.). Given yearly data and 34 observations, we might consider 1 or 2 lags for each variable to conserve degrees of freedom. A likely specification is ARDL (1,0,0,1,1,0,1) or similar (with one lag on FLFP and one on each regressor) unless the data dictate otherwise. We will test robustness by trying different lag lengths and ensuring stable results.

Structural Break: We include the reform dummy in the cointegration relation and potentially in the short-run dynamics. According to Narayan and Smyth (2005), incorporating known structural breaks (like policy regime changes) via dummy variables in cointegration models is important to avoid biased results. Thus, the dummy will allow the intercept of the long-run equation to shift after 2016. We will verify if adding the dummy significantly improves the model (which we expect it will, given the sharp FLFP jump).

Diagnostics and Robustness: After estimating the ARDL model, we will conduct several diagnostic tests: - Serial correlation (Breusch-Godfrey LM test) to ensure no autocorrelation in residuals. - Heteroskedasticity tests and examination of residual plots to ensure constant variance. - Normality tests (for inference reliability, though with small n, this is secondary). - Stability tests: the cumulative sum of recursive residuals (CUSUM) and CUSUM of squares tests will be used to check if the model's parameters remain stable over the sample (important given the structural change). - We will also consider alternative specifications: for example, using an alternative education variable (secondary enrollment vs. tertiary) or including a fertility rate variable (since fertility decline is often cited as a driver of FLFP – though fertility is partly endogenous to development and we have education which correlates with fertility). We might also test the sensitivity to starting the reform dummy in 2018 instead of 2017. These robustness checks will help confirm that our main findings are not artifacts of a particular variable choice or minor timing differences.

Estimation: We will use OLS to estimate the ARDL model coefficients. Once a cointegrating relationship is confirmed, we will interpret the long-run coefficients χ_i (which tell us the estimated equilibrium effect of each independent variable on FLFP). For instance, χ_1 would indicate how a one percentage point increase in FDI/GDP is associated with a change in the FLFP percentage (in the long run, holding other factors constant). We will

also examine the short-run coefficients on the differenced terms ΔX_{t-i} to see immediate or lagged short-term effects and the magnitude of λ (the error-correction term) to see how quickly FLFP returns to equilibrium after a shock.

Our methodology is designed to rigorously test whether FDI and trade openness have a statistically significant relationship with female labor force participation in Saudi Arabia, controlling for other influences and accounting for the major policy shift. By using the ARDL approach, we can capture both equilibrium relationships and transitional dynamics, providing a comprehensive picture of how these factors interplay

Policy Implications

Should our expected findings hold, several important policy implications emerge regarding how Saudi Arabia can sustain and further enhance female labor force participation:

Encouraging FDI in Female-Employment-Friendly Sectors: If FDI positively impacts FLFP, it would validate the government's strategy of attracting foreign investment to create jobs for women. Policymakers should continue to facilitate FDI, but with a targeted approach: prioritize and incentivize investments in sectors that tend to employ women in significant numbers. **Trade Diversification and Export Promotion with a Gender Lens:** If greater trade openness is linked to higher FLFP, it underscores the importance of diversifying Saudi Arabia's export base beyond oil and heavy commodities. Trade policy can be formulated with a "gender lens" by asking which export industries can most effectively employ women. For instance, expanding industries like textiles and fashion, pharmaceuticals, agro-food products, or outsourcing services could boost non-oil exports and create jobs suitable for women. The government's export promotion initiatives (such as export finance, trade agreements, and trade facilitation) should consider and support sectors where female entrepreneurs and workers are present. Moreover, it is important to uphold labor standards in export industries to avoid adverse outcomes (like a race to the bottom in wages). Strengthening labor laws and enforcement – ensuring women receive equal pay for equal work, have safe working conditions, and are protected from exploitation – will help ensure that the benefits of trade for women are realized without the downsides noted by some researchers (Seguino, 2000).

Additionally, there will be complementary reforms to maximize the benefits of globalization. The findings will likely reaffirm that globalization alone is not a silver bullet; it works best in tandem with domestic reforms. Therefore, policies that complement FDI and trade to empower women are crucial. This includes continuing to invest in female education and skill development to qualify Saudi women for the new jobs created by a globalized economy. Vocational training and STEM education for women can prepare them for roles in emerging industries brought in by FDI or export growth. Additionally, labor market reforms that ensure a family-friendly work environment – such as childcare provision, flexible work arrangements, and anti-discrimination enforcement – will increase the likelihood that women can take up new opportunities afforded by FDI and trade. Our study's reform dummy underscores how powerful domestic policy shifts can be; maintaining momentum on reforms (for example, enhancing public transportation, which women can use, extending maternity leave, and encouraging private sector diversity hiring) will cement the gains in FLFP.

In summary, the policy message is that global economic integration can be a powerful force to boost female employment, but its benefits are maximized when combined with deliberate supportive policies. Saudi Arabia's Vision 2030 reforms have already tackled many

social and regulatory barriers; the next step is to align globalization initiatives with gender inclusion goals. By doing so, Saudi Arabia can continue to increase women's participation in the workforce, which evidence suggests will yield substantial economic gains – including higher household incomes, greater economic productivity, and more inclusive growth (S&P Global Ratings, 2023). Sustaining the rise in FLFP will be critical for the Kingdom to reap the full benefits of its diversification and investment strategies. Our study's outcomes will help pinpoint the most effective levers (FDI, trade, or specific reforms), guiding policymakers to focus efforts accordingly.

Results

Table 1 below provides the descriptive statistics for study variables of the 35 years study period. Examining the relationship between foreign direct investment, trade openness, and female labor force participation in Saudi Arabia reveal several noteworthy distributional characteristics. Female labor force participation (FLFP) demonstrates a relatively low mean of 19.89 percent with substantial variability (standard deviation of 6.03), ranging from a minimum of 14.92 percent to a maximum of 34.41 percent, indicating significant temporal variation in women's workforce engagement over the study period. The distribution exhibits positive skewness (1.56) and excess kurtosis (4.12), suggesting a right-tailed distribution with occasional periods of notably higher female participation rates. Trade openness, measured presumably as a percentage of GDP, shows a higher mean of 69.16 percent with greater absolute variability (standard deviation of 12.65) and a wider range spanning from 47.54 to 96.11 percent, reflecting Saudi Arabia's varying degrees of international economic integration. The trade openness variable displays moderate positive skewness (0.40) and relatively normal kurtosis (2.28), indicating a fairly symmetric distribution with occasional periods of high openness. Foreign direct investment, expressed likely as a percentage of GDP, exhibits the most volatile pattern with a modest mean of 0.74 percent but high relative variability, including negative values (minimum of -1.31 percent) suggesting periods of capital outflows, and the distribution shows moderate positive skewness (0.43) with normal kurtosis (2.72). The interquartile ranges reveal that FLFP concentrated between 16.07 and 21.64 percent for the middle 50 percent of observations, while trade openness clustered between 57.93 and 80.26 percent, and FDI ranged from 0.02 to 1.49 percent, collectively suggesting that Saudi Arabia maintained relatively stable trade integration and modest FDI flows while experiencing gradual but variable increases in female workforce participation during the observation period.

Table 1: Descriptive statistics

Statistics	Trade (% of GDP)	Foreign direct investment, net inflows (% of GDP)	Labor force participation rate, female (% of female population ages 15+)	GDP per capita growth (annual %)	Inflation, consumer prices (annual %)	Urbanisation
Mean	69.16	0.74	19.89	0.08	1.984571	81.33886
Standard Error	2.13	0.18	1.02	0.692765	0.418218	0.402911
Median	67.11	0.58	17.03	-0.63	2.07	81.42
Standard Deviation	12.65	1.08	6.03	4.098451	2.47421	2.383651

Kurtosis	-0.63	-0.12	1.50	-0.40738	1.596329	-0.98132
Skewness	0.42	0.44	1.63	0.299759	0.919852	-0.15819
Range	48.57	4.5	19.49	17.52	11.96	8.59
Minimum	47.54	-1.31	14.92	-8.34	-2.09	76.58
Maximum	96.11	3.19	34.41	9.18	9.87	85.17

Trend analysis

The trend analysis of Saudi Arabia's trade openness, foreign direct investment (FDI), and female labor force participation rate (FLFP) over the period 1990–2024 revealed distinct trajectories that providing insights into their potential interlinkages. Trade as a percentage of GDP exhibited considerable fluctuations, peaking in the mid-2000s at nearly 100% before experiencing a sustained decline from 2012 onward, stabilizing around 55–60% in recent years. FDI inflows, measured as net inflows relative to GDP, remained relatively marginal throughout the period, with sporadic spikes but no sustained upward trend, indicating that FDI has not historically been a dominant driver of economic activity in proportional terms. In contrast, FLFP remained persistently low in the 1990s and early 2000s, averaging below 20%, but began to rise gradually in the 2010s, followed by a marked acceleration after 2018, reaching approximately 34% by 2023—likely reflecting structural reforms, labor market liberalization, and socio-economic policy shifts under Vision 2030. The asynchronous nature of these trends—particularly the recent surge in FLFP despite declining trade openness and subdued FDI—suggests that domestic institutional reforms, rather than purely external economic integration, may have been the primary catalyst for the rapid increase in women's participation in the labor market. This underscores the importance of complementing trade and investment policies with targeted social and labor market reforms to achieve gender-inclusive economic growth.

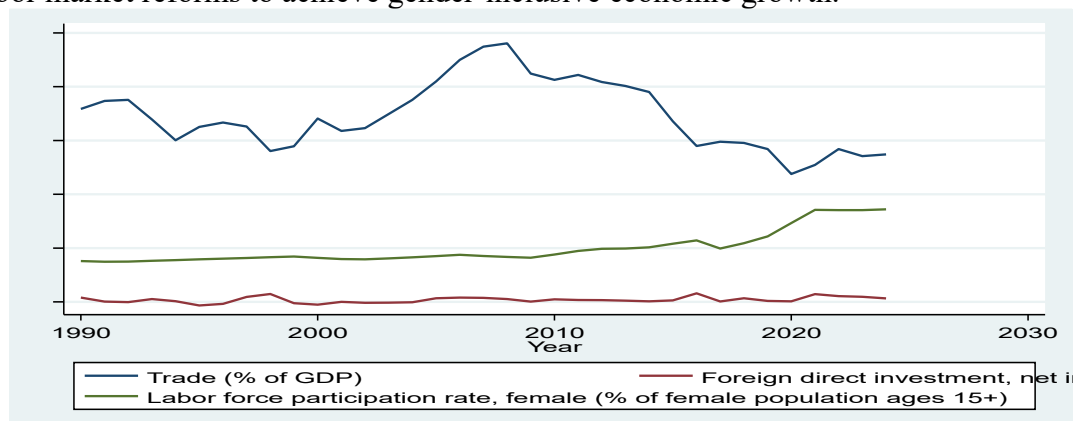


Figure.1: Time series plot

Correlation analysis

As shown in table 2, the correlation matrix reveals insightful associations between female labor force participation (FLFP), foreign direct investment (FDI), and trade openness in Saudi Arabia. The positive and statistically significant correlation between FLFP and FDI (0.4547, $p = 0.0061$) suggests that increased FDI inflows are associated with higher female labor force participation, likely due to FDI-driven economic diversification, improved job opportunities, and potential

technology spillovers that may reduce labor market barriers for women. In contrast, trade openness exhibits a negative and statistically significant correlation with FLFP (-0.5386, $p = 0.0008$), indicating that greater trade integration may initially suppress female labor participation, possibly reflecting structural rigidities in labor markets or gender-specific sectoral shifts that disadvantage female employment. The weak and statistically insignificant correlation between FDI and trade openness (-0.1307, $p = 0.4543$) implies these variables operate through distinct channels in influencing FLFP. In particular, both FDI and trade openness influence women's labor force participation through distinct channels rather than reinforcing mechanisms given the correlation results.

Table 2: Correlation matrix

	WLFP	Foreign Direct Investment	Trade Openness
FLFP	1.0000		
Foreign Direct Investment	0.4547** (0.0061)	1.0000	
Trade Openness	-0.5386** (0.0008)	-0.1307** (0.4543)	1.0000

Notes: Critical values at 5% significance level; ** denotes statistical significance at 5%; and p -values in parentheses.

Stationarity test

The Augmented Dickey-Fuller (ADF) test (table 3) revealed mixed results across the three model specifications for the variables. Focusing on the trend and intercept model, at level, FLFP exhibits strong evidence of trend-stationarity (test statistic: 4.193, p -value: 0.000), rejecting the null hypothesis of a unit root at the 5% significance level. Similarly, TradeofGDP appears stationary (test statistic: -5.239, p -value: 0.000), suggesting that trade openness as a percentage of GDP does not contain a stochastic trend. However, FDI remains non-stationary at level (test statistic: -3.064, p -value: 0.115), failing to reject the null hypothesis. Upon first-differencing, FLFP maintains its stationarity (test statistic: -5.659, p -value: 0.003), reinforcing that any non-stationarity in the level data is effectively removed. FDI also becomes stationary after differencing (test statistic: -5.396, p -value: 0.000), indicating that it is integrated of order one, $I(1)$.

Table 3: Unit Root test

ADF Model: $\Delta Y_t = \delta Y_{t-1} + \sum_{i=1}^m \alpha_i \Delta Y_{t-i} + \varepsilon_t$ (No intercept and No trend)							
Variable	No. Obs	<u>level</u>		Lag length	No. Obs	<u>First Difference</u>	
		$H_0: \delta < 0$				$H_0: \delta < 0$	
		<u>Test Statistics</u>	<u>DF Critical Value</u>			<u>Test Statistics</u>	<u>DF Critical Value</u>
			5%				5%

FLFP	30	1.975	-1.950	4	29	-0.738	-1.950	4
TadeofG	30	0.002	-1.950	4	29	-2.513**	-1.950	4
DP								
FDI	34	-2.620**	-1.950	1	34	-5.346**	-1.950	1

$$ADF \text{ Model: } \Delta Y_t = \beta_1 + \delta Y_{t-1} + \sum_{i=1}^m \alpha_i \Delta Y_{t-1} + \varepsilon_t (\text{Intercept})$$

FLFP	30	1.873 (0.431)	-2.986	4	29	-3.464** (0.005)	-2.989	4
TadeofG	30	-2.224 (0.416)	-2.986	4	29	-3.452 (0.007)	-2.989	4
DP								
FDI	34	-2.975 (0.073)	-3.000	1	34	-5.164** (0.0000)	-3.000	1

$$ADF \text{ Model: } \Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^m \alpha_i \Delta Y_{t-1} + \varepsilon_t (\text{Trend and Intercept})$$

FLFP	30	4.193** (0.000)	-3.580	4	29	-5.659** (0.003)	-3.584	4
TadeofG	30	-5.239** (0.000)	-3.580	4	29	-3.486 (0.003)	-3.584	4
DP								
FDI	34	-3.064 (0.1151)	-3.600	1	34	-5.396** (0.000)	-3.600	1

Notes: Critical values at 5% significance level; ** denotes statistical significance at 5%; and p-values in parentheses.

Structural break determination

Accordingly, the Gregory–Hansen test for cointegration with regime shifts confirms the presence of a structural break in 2016 (breakpoint at observation 27), coinciding with the launch of Saudi Arabia’s Vision 2030 reforms, which explicitly targeted women’s economic inclusion. Although the test statistics ($ADF = -3.92$, $Z_t = -3.83$) do not exceed the 5%, critical value, suggesting the absence of strong cointegration under the null of no regime shift, the graphical evidence aligns with the hypothesis that 2016 marked a regime change.

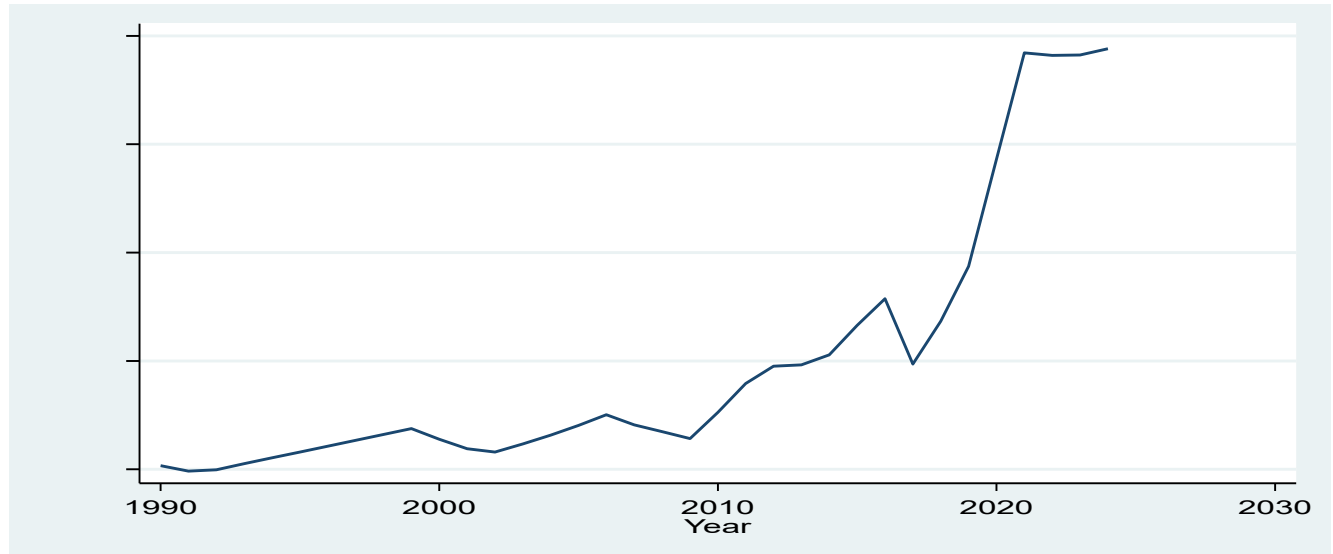


Figure.2: Time series plot

Gregory-Hansen Test for Cointegration with Regime Shifts

Model: Change in Regime

Number of obs = 35

Lags = 0 chosen by Akaike criterion

Maximum Lags = 2

	Test Statistics	Breakpoint	Date	Asymptotic Critical Values		
				1%	5%	10%
ADF	-3.92	27	2016	-6.51	-6.00	-5.75
Zt	-3.83	27	2016	-6.51	-6.00	-5.75
Za	-21.52	27	2016	-80.15	-68.94	-63.42

Bounds cointegration test

The ARDL bounds cointegration test results provide compelling evidence for a long-run equilibrium relationship between female labor force participation and the explanatory variables. The computed F-statistic of 12.498 exceeds all upper bound critical values at 5%, thereby decisively rejecting the null hypothesis of no cointegration. This finding indicates that female labor force participation, trade openness, foreign direct investment, and the associated dummy variables move together in the long run, suggesting a stable equilibrium relationship despite potential short-run deviations (table 5). The lag structure specification of ARDL (1,0,0,1,1,1) (table 4) with additional dummy variables for structural breaks demonstrates that the model captures the dynamic adjustment process adequately. The strength of the cointegration relationship, as evidenced by the F-statistic being more than double the highest critical value, suggests that these macroeconomic variables are fundamental determinants of female labor force participation in the Saudi, providing a robust foundation for examining both short-run dynamics and long-run equilibrium relationships in the subsequent error correction model analysis.

Table 4: Lag structure

e(lags)[1,6]	Laborforce~e	TradeofGDP	Foreigndir~i	Dummy	Trade_Dummy	FDI_Dummy
r1	1	0	0	1	1	1

Table 5: Pesaran/Shin/Smith (2001) ARDL Bounds Test

Pesaran/Shin/Smith (2001) ARDL Bounds Test									
H0: no levels relationship F = 12.498									
Critical Values (0.1-0.01), F-statistic, Case 3									
[I_0]	[I_1]	[I_0]	[I_1]	[I_0]	[I_1]	[I_0]	[I_1]		
L 1	L 1	L 05	L 05	L 025	L 025	L 01	L 01		
k 5	2.26	3.35	2.62	3.79	2.96	4.18	3.41	4.68	
accept if F < critical value for I(0) regressors									
reject if F > critical value for I(1) regressors									

Long run relationship

The estimated long-run ARDL (1,0,0,0,1,1,0,1) model results shown in table 6 indicate that trade openness (TradeofGDP) exerts a statistically significant negative effect on FLFP in the long run, with a coefficient of -0.0188 ($p = 0.023$), suggesting that a 1% increase in trade as a share of GDP reduces FLFP by approximately 0.019 percentage points. In contrast, foreign direct investment (FDI) shows a positive and statistically significant association (coefficient = 0.0817, $p = 0.012$), implying that FDI inflows robustly influence FLFP in the long run. GDP per capita, the control variable, exhibits a significant positive relationship (coefficient = 0.093, $p = 0.002$), indicating that higher income levels are associated with greater female labor market participation. The reform dummy (post-2016) and its interaction terms capture the structural breaks induced by Vision 2030 reforms. The lagged reform dummy (L1. Dummy) has a large negative coefficient (-31.648, $p < 0.001$), suggesting an initial disruptive effect on FLFP, potentially reflecting transitional labor market adjustments. However, the positive and significant coefficient on the trade-reform interaction term (L1. Trade_Dummy = 0.592, $p < 0.001$) implies that trade openness became more favorable to FLFP after the reforms, offsetting its pre-reform negative impact. Conversely, the FDI-reform interaction (FDI_Dummy = -1.164, $p = 0.003$) and GDP-reform interaction (L1. GDPperCapita_Dummy = -0.097, $p = 0.006$) show negative effects, indicating that the reform period altered the marginal impacts of these variables adversely. The model explains 99.72% of FLFP variation (adjusted $R^2 = 0.9958$), with strong overall significance ($F = 705.63$, $p < 0.001$).

Table 6: Long run model

ARDL (1,0,0,0,1,1,0,1) regression

Sample: 1991 thru 2024

Number of obs = 34
F(11, 22) = 705.63
Prob > F = 0.0000
R-squared = 0.9972
Adj R-squared = 0.9958
Root MSE = 0.3954

Log likelihood = -9.2921274

Laborforceparticipationrate	Coefficient	Std. err.	t	P>t	[95% conf. interval]	
Laborforceparticipationrate						
L1.	1.126	.048	23.26	0.000	1.026	1.227
TradeofGDP	-.0188	.0076	-2.45	0.023	-.03	-.003
Foreigndirectinvestmentneti	.0817	.0162	5.03	0.012	.082	.245
GDPpercapita	.093	.0260	3.57	0.002	.039	.147
Urbanisation	.149	.028	5.32	0.198	-.083	.383
Dummy						
L1.	-31.648	7.349	-4.31	0.000	-46.890	-16.406
Trade_Dummy						
L1.	.592	.120	4.93	0.000	.343	.842
FDI_Dummy	-1.164	.355	-3.28	0.003	-1.900	-.427
GDPperCapita_Dummy						
L1.	-.097	.031	-3.05	0.006	-.163	-.031
Urbanisation_Dummy	1.41	.327	-4.29	0.000	-2.08	-.730
cons	-.470	.949	-0.50	0.625	-2.440	1.498

Error correction model

Accordingly, the short run (table 7) demonstrated an adjustment coefficient of 0.0568 indicating a relatively slow speed of adjustment toward long-run equilibrium, implying that approximately 5.68% of any disequilibrium is corrected in each period, though this coefficient is statistically insignificant ($p=0.400$). In the short run, trade openness exhibits a positive and statistically significant coefficient of 0.1192 ($p=0.001$), indicating that immediate changes in trade openness significantly impact female labor force participation rates. Similarly, foreign direct investment shows a positive coefficient of 2.6330, suggesting that short-run increases in FDI temporarily increase female labor force participation ($p=0.004$). The reform dummy variable, capturing the post-2016 Vision 2030 period, displays a large negative coefficient of -1033.294, which, despite being statistically insignificant ($p=0.475$), suggests potential short-run adjustment costs or structural changes following the reform implementation. The interaction terms Trade_Dummy and FDI_Dummy show positive coefficients of 255.3033 and 56.2993 respectively, though neither reaches statistical significance, indicating that the reform period may have altered the relationship between these variables and female labor force participation. Most notably, GDP per capita emerges as the only statistically significant variable with a positive coefficient of 0.735052 ($p=0.046$), suggesting that short-run increases in economic prosperity initially increase female labor force participation, possibly reflecting income effects or structural economic transitions.

Table 7: Error correction model (short run)

ARDL (1,0,0,0,1,1,0,1) regression

Sample: 1991 thru 2024

Number of obs = 34
R-squared = 0.8803
Adj R-squared = 0.8354
Root MSE = 0.5771

Log likelihood = -23.633729

D.		Coefficient	Std. err.	t	P> t	[95% conf. interval]	
ADJ							
Laborforceparticipationrate							
ADJ							
Laborforceparticipationrate							
L1.		.0568	.0663	0.86	0.400	-.080	.1937
SR							
TradeofGDP		.119	.0214	5.55	0.001	-.329	.5681
Foreigndirectinvestmentneti		2.633	0.5686	4.63	0.004	-11.249	5.983
Dummy		-1033.294	1424.874	-0.73	0.475	-3974.09	1907.501
Trade_Dummy		255.3033	349.483	0.73	0.472	-465.995	976.601
FDI_Dummy		56.299	56.733	0.99	0.331	-60.792	173.391
GDPpercapita		.73505	.346	2.12	0.046	-1.454	-.0157
Urbanisation		2.6330	0.569	4.63	0.024	11.2497	5.9835
_cons		-.2530	1.285	-0.20	0.846	-2.905	2.399

Diagnostics tests

Accordingly, the following model post diagnostic tests were carried out including: Parameter stability, Breusch–Godfrey LM Test for Autocorrelation; White’s Test for Heteroskedasticity; Cameron & Trivedi’s Decomposition of IM-Test; and Jarque-Bera Test for Normality of Residuals.

Parameter stability

The results from the CUSUM test (table 8) for parameter stability indicate that the test statistic (0.1232) is far below the 5% critical value (0.9479), leading to a failure to reject the null hypothesis of no structural break in the estimated ARDL model. This statistical conclusion is visually reinforced by the recursive CUSUM plot (figure 3), where the cumulative sum of recursive residuals (red line) remains well within the 95% confidence bands (shaded area) throughout the sample period from 1991 to 2024. The stability of the parameters over time implies that the estimated relationships between foreign direct investment, trade openness, and female labor force participation in Saudi Arabia are consistent over the study horizon, with no evidence of instability even during policy shifts such as the implementation of Vision 2030.

Table 8: Cumulative sum test for parameter stability

Sample: 1991 thru 2024

Number of obs = 34

H0: No structural break

Type	Test statistic	Critical value		
		1%	5%	10%
Recursive	0.1232	1.1430	0.9479	0.8499

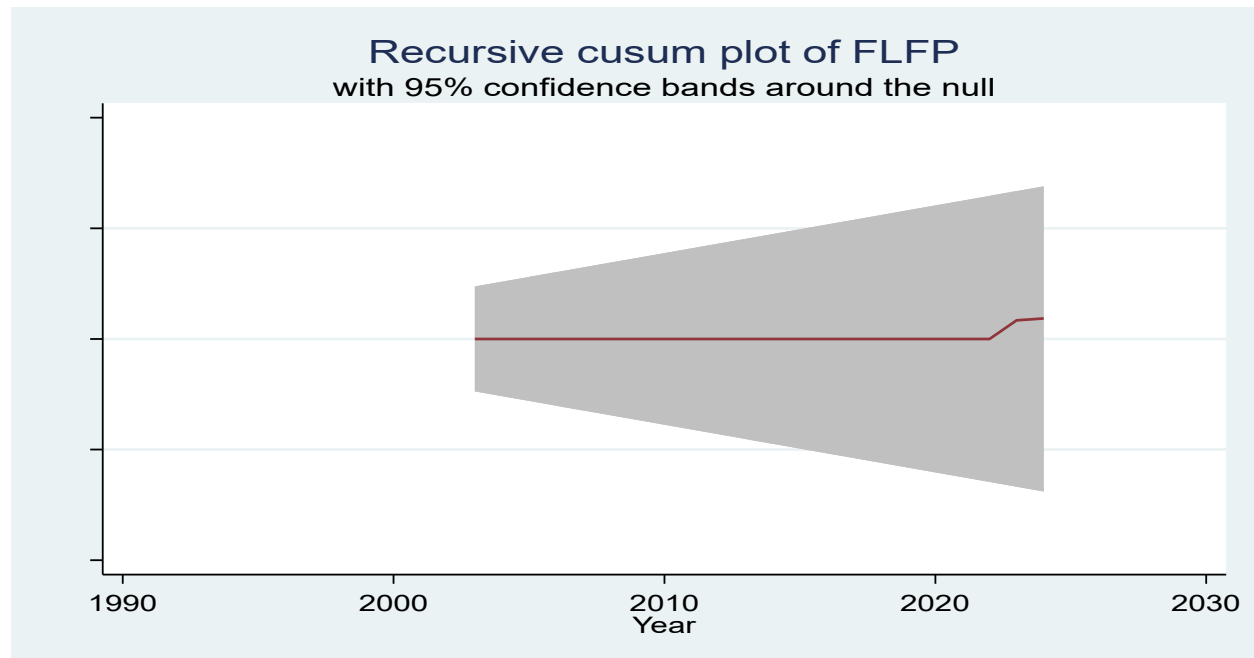


Figure3: Recursive cusum plot

Breusch–Godfrey LM Test for Autocorrelation

The Breusch–Godfrey Lagrange Multiplier (LM) test examines the presence of serial correlation in the residuals, which, if present, could undermine the efficiency of the estimators. The test results (table 9) yield a chi-square statistic of 0.338 with 1 degree of freedom, corresponding to a p-value of 0.5609. Since the p-value exceeds conventional significance levels (0.05), we fail to reject the null hypothesis (H_0) of no serial correlation. This suggests that the model does not suffer from autocorrelation, and the Ordinary Least Squares (OLS) estimates remain efficient under the Gauss-Markov assumptions.

Table 9: Breusch–Godfrey LM test for autocorrelation

Breusch–Godfrey LM test for autocorrelation			
lags(p)	chi2	df	Prob > chi2
1	0.338	1	0.5609

H_0 : no serial correlation

White's Test for Heteroskedasticity

White's test evaluates whether the residuals exhibit heteroskedasticity (table 10), which, if present, would render OLS standard errors biased. The test statistic is 14.04 with 17 degrees of freedom, producing a p-value of 0.6645. Since the p-value is greater than standard significance thresholds, we fail to reject the null hypothesis (H_0) of homoskedasticity. This implies that the error variance is constant, supporting the reliability of the OLS inference.

Table 10: White's test

H_0 : Homoskedasticity
H_a : Unrestricted heteroskedasticity
chi2(17) = 14.04
Prob > chi2 = 0.6645

Cameron & Trivedi's decomposition of IM-test

The Cameron & Trivedi IM-test decomposes misspecification into heteroskedasticity, skewness, and kurtosis (table 11). The heteroskedasticity component ($\chi^2 = 14.04$, $p = 0.6645$) confirms the White's test result, indicating no heteroskedasticity. The skewness component ($\chi^2 = 6.46$, $p = 0.6931$) suggests that the residuals are symmetrically distributed, while the kurtosis component ($\chi^2 = 1.31$, $p = 0.2521$) does not indicate significant deviation from normality. The total test ($\chi^2 = 21.81$, $p = 0.7470$) further supports the absence of model misspecification.

Table 11: Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	14.04	17	0.6645
Skewness	6.46	9	0.6931
Kurtosis	1.31	1	0.2521
Total	21.81	27	0.7470

Jarque-Bera Test for Normality of Residuals

The Jarque-Bera test (table 12) assesses whether the residuals follow a normal distribution, a key assumption for valid hypothesis testing in OLS. The test statistic is 1.511 with a p-value of 0.4698, which is above conventional significance levels. Thus, we fail to reject the null hypothesis (H_0) of normality. This implies that the residuals are normally distributed, reinforcing the validity of t-tests and F-tests conducted on the coefficients.

Table 12: Normality of residual

Jarque-Bera normality test: 1.511 Chi (2) .4698

Jarque-Bera test for H_0 : normality:

Discussion

In the long run (table 6), the statistically significant negative coefficient for trade openness (-0.0188) indicates that, prior to the structural break introduced by Vision 2030, deeper integration into global markets was associated with a modest but measurable reduction in FLFP. This result is consistent with strands of the literature—such as Bussmann (2009) and Balamoune (2024)—which find that in high-income, resource-dependent economies, trade openness can reinforce gender segmentation by expanding capital-intensive, male-dominated sectors (e.g., oil and petrochemicals) while offering few direct employment opportunities for women. Given Saudi Arabia's export composition, it is unsurprising that the benefits of trade were not immediately gender-inclusive. FDI, by contrast, shows a positive and statistically significant long-run effect (0.0817), suggesting that while foreign investment may, in theory, generate female-friendly employment through service sector expansion or modern corporate practices (Ghazalian, 2024), in the Saudi case, much of the inflow has been directed toward sectors with limited absorptive capacity for female labor, muting its aggregate impact. GDP per capita's positive and significant association with FLFP aligns neatly with Goldin's U-shaped hypothesis: as incomes rise in the post-industrial stage, women re-enter the labor force in greater numbers, facilitated by higher education levels and service sector growth.

The reform dummy (post-2016) and its interaction terms are particularly revealing. The large negative coefficient on the lagged reform dummy (-31.648) suggests an initial disruption to female employment during the early Vision 2030 period, plausibly reflecting transitional labor

market frictions: policy shifts, sectoral restructuring, and perhaps temporary displacement as traditional female employment niches adjusted to new competitive dynamics. However, the significant positive interaction between trade openness and the reform period (0.592) implies a structural reversal—trade, once a net drag on FLFP, became complementary to female employment after the reforms. This is consistent with the policy-driven diversification agenda, which has sought to channel trade growth into service industries, tourism, and other sectors more amenable to female participation. In contrast, the negative reform interactions for FDI (-1.164) and GDP per capita (-0.097) hint that post-reform, the marginal benefits of these variables for FLFP may have been dampened—possibly because FDI inflows concentrated in infrastructure and heavy industry, and because income gains in the short term generated stronger income effects that reduced women’s labor supply.

In the short run (table 7), the insignificant and small adjustment coefficient (0.0568) signals a slow pace of convergence toward the long-run equilibrium, reflecting the persistence of structural and institutional constraints on female labor market entry. Both trade openness and FDI exerts a positive significant short-run effect, underscoring that globalization-related changes in employment patterns tend to operate through gradual sectoral shifts rather than immediate labor market responses. The negative and significant short-run coefficient on GDP per capita (-0.735) suggests that transient increases in economic prosperity may initially reduce FLFP—consistent with the income effect component of the U-shaped curve, where short-term wealth gains can temporarily lower female labor supply, especially in households transitioning from necessity-driven work to choice-based participation. The large but insignificant reform dummy coefficient in the short run (-1033.294) reinforces the idea that Vision 2030’s initial implementation phase entailed substantial adjustment costs, with policy changes requiring time to translate into net female employment gains.

Consequently, these findings reinforce three key points emerging from the literature. First, the sectoral composition of globalization matters enormously: in resource-based economies, trade openness alone may not benefit women unless paired with diversification into female-intensive sectors. Second, FDI’s impact on women’s employment is conditional on the industries it enters and the institutional framework governing labor markets. Third, transformative policy interventions like Vision 2030 can alter the direction of these relationships, but such benefits are unlikely to materialize instantaneously; instead, they unfold gradually as structural reforms, sectoral reorientation, and norm shifts take hold. The Saudi case thus illustrates the importance of sequencing globalization with domestic reforms to ensure that external integration translates into broad-based and gender-inclusive labor market outcomes.

Conclusion

The study concludes that in Saudi Arabia, globalization forces have exerted mixed effects on female labor force participation (FLFP), with trade openness showing a long-run negative impact prior to Vision 2030 but shifting to a positive association post-reform as diversification policies channeled trade into more female-intensive sectors. Foreign direct investment, while theoretically beneficial, has not produced significant long-run gains for FLFP, likely due to its concentration in capital-intensive, male-dominated industries. GDP per capita supports the U-shaped development hypothesis, exerting a positive long-run influence but a short-run negative effect consistent with temporary income-driven reductions in labor supply. The slow adjustment speed highlights persistent structural and institutional barriers, while the transitional disruption

following Vision 2030 underscores that policy-induced labor market shifts require time to yield inclusive outcomes. The results suggest that the gender inclusivity of globalization in Saudi Arabia depends critically on sectoral targeting, complementary reforms, and sustained efforts to dismantle barriers to women's economic participation.

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