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REVISITING INFORMAL EMPLOYMENT THROUGH THE LENS OF INTERNATIONAL MIGRATION AND EMPLOYMENT PROTECTION: NEW GENDER-BASED EVIDENCE FROM TURKIYE

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ABSTRACT

Serving both as a passageway and a host country, Türkiye has emerged as a major hub in global migration movements, particularly for migrants originating from the Middle East, North Africa, and Asia. This situation has also brought about various problems in the domestic labour market, particularly informal employment. The study provides a comprehensive analysis of the gender-specific determinants of informal employment in Türkiye for the period 2000-23, emphasizing the dynamic roles of migration, gender inequality, and employment protection legislation. Utilizing the Fractional Fourier AutoRegressive Distributed Lag (FA-ARDL) model with interaction terms, the research distinguishes between male and female informal employment rates, allowing for the examination of heterogeneous effects across genders. The empirical results demonstrate that both migration and gender inequality significantly contribute to the prevalence of informal employment. Furthermore, employment protection legislation is found to moderate these effects, particularly through its interaction with migrant labour participation, indicating a complex interplay between regulatory frameworks and labour market dynamics. Granger causality tests provide evidence of both short- and long-term causal relationships, highlighting the evolving and multifaceted nature of labour market informality in Türkiye. These findings underscore the importance of integrated policy measures that address migration, gender disparities, and employment protection simultaneously to effectively reduce informality and promote equitable labour market outcomes.

KEYWORDS: Informal Employment, Türkiye's Labour Market, Female Labour Force, Unemployment, International Migration, Gender Inequality Index, Employment Protection Index, Fractional Fourier ARDL Test.

1. INTRODUCTION

Firms have increasingly resorted to informal employment as a strategy to alleviate the financial burdens associated with taxes and social security contributions. A wide range of individual and household-level characteristics have been identified as significant determinants of informal employment, including gender, age, marital status, education, head-of-household status, and number of children in the family (Losby et al., 2002; Wamuthenya, 2010; Dogrul, 2012; Liang et al., 2016; Khan & Hussein, 2021). Additionally, ethnicity, immigration status, geographic location, and regional disparities have been found to influence the likelihood of informal employment (Zuo, 2013; Perajuli, 2015).

Generally, women tend to have lower educational attainment compared to men, and since formal jobs typically require higher skills and education than informal jobs, this contributes to the higher prevalence of informal employment among women (Malta et al., 2021). On the other hand, the greater flexibility and home-based nature of work in the informal sector make it more attractive to women, leading them to accept low wages and lack of social security (Elgin & Elveren, 2021). Depending on the region and period migrants, constitute one of the main labour sources in informal economic activities. The limited rights of migrants as non-citizens in host countries, the non-recognition of their educational qualifications or certifications, low skill levels, and language barriers make them a significant source of informal employment (Maroukis et al., 2011). Employers may prefer to hire migrants because they are perceived as more exploitable, easier and cheaper to dismiss, or as a means to diversify the workforce (Standing, 2006).

In 2024, the global informal employment rate stood at 57.8 per cent total, with 59 percent for men and 56 per cent for women. In low-income countries, the rates were significantly higher – 90.4, 88.4, and 93.1 per cent, respectively. In lower-middle-income countries, the rates were 83.8, 82.3, and 86.8 per cent, respectively. In high-income countries, these figures dropped considerably to 8.45, 8.7, and 8.1 per cent, respectively (ILOSTAT, 2025). Also, migrant labour force data reveals that, as of 2022, there were approximately 284.5 million migrants worldwide. Of this total, around 255.7 million were migrants aged 15 and over, constituting the migrant working-age population. It is estimated that 167.7 million of them formed the global migrant labour force which approximately 155.6 million were employed. Men accounted for 61.3 per cent of the migrant labour force, whereas women made up 38.7 per cent (ILO,

2024).

The impact of international migration on the host country's labour market depends on the degree of substitutability or complementarity between the skills of migrant and native workers. If there is a substitutive relationship between the skill sets of the two labour groups, international migration will increase the overall labour supply, and the resulting competition between migrant and native workers may push native workers in the affected sectors toward informal employment. If a complementary relationship exists between the skills of migrant and native workers, migration will increase labour demand in the formal sector. Consequently, employment and economic growth are likely to rise. However, economic expansion may also stimulate growth and new investments in the informal sector alongside the formal sector, leading to an increase in informal employment as well (Viseth, 2021).

Considering the rapid expansion of the informal economy under neoliberal policies and the disadvantaged position of women in the labour market, the overrepresentation of women in informal employment reveals a critical gender dimension in the relationship between informal employment and overall labour market dynamics. At the same time, international migration flows – driven by economic, social, and political factors – have, in recent years, significantly influenced the labour markets of both transit and destination countries. However, there remains limited understanding of the gendered aspects of the relationship between international migration and labour market variables. The informal employment of migrants, shaped by various structural and individual factors, has underscored the need for empirical research on the nexus between international migration and informal employment, particularly to inform effective and inclusive policy-making.

Owing to its strategic geographical position, Türkiye functions as both a transit route and a destination for migrants, especially from the Middle East, North Africa, and Asia, establishing itself as a key centre in global migration flows. Furthermore, due to the Syrian civil war that began in 2011, millions of refugees have sought asylum in Türkiye. According to the World Migration Report 2024, Türkiye was the largest host country in the world in 2022 (IOM, 2024). As of 2025, Türkiye hosts approximately 4 million foreigners, including around 2.8 million Syrians (Presidency of Migration Management, 2025). In Türkiye, the informal employment rate stands at 27.7 per cent total, with 24.2 per cent for men and 34.9 per cent for women

(ILOSTAT, 2025).

This study investigates the gender-based determinants of informal employment in Türkiye for the period 2000–23, with a particular focus on the dynamic roles of migration, gender inequality, and employment protection. The analysis employs a Fractional Fourier ARDL (FA-ARDL) model incorporating interaction terms, distinguishing between male and female informal employment rates to capture heterogeneous effects. The FA-ARDL method allows for modelling time-varying and nonlinear dynamic relationships between informal employment and migration, gender inequality, and employment protection policies parameters, enabling a more realistic and flexible analysis of the short- and long-run effects of informal employment on both women and men. Marcelli (2007), Hazans (2011), Bohn & Owens (2012), Bosh & Farré (2013), Delgado-Prieto (2024), Ceritoglu et al. (2015), Aksu et al. (2022), Çelik et al. (2021), Erkişi & Çetin (2023), Eralp (2024), and Gulek (2024) have investigated the impact of migrant labour on informal employment. However, these studies do not account for structural breaks and nonlinearity that may occur over time. This study aims to contribute to the methodological gap in the literature by adopting a method that incorporates structural breaks into the analysis. Another contribution of this study lies in modelling informal employment separately for men and women, thereby enabling a nuanced examination of how international migration, gender inequality, employment protection, and unemployment affect labour market outcomes. This method has the potential to reveal how not only economic but also sociocultural and legal factors reproduce inequalities in the labour market.

The study is organised into five chapters. The second chapter reviews the related literature. The third chapter outlines the data and methodology. The fourth chapter presents the empirical results of the study. Finally, the fifth chapter discusses the summary and conclusions.

2. LITERATURE REVIEW

The relationship between migration and informal employment has been extensively examined in recent years in terms of creating significant transformations in the labour markets of both developed and developing countries. In the literature, the effect of migrant labour on informal employment, the nature of this effect (complementarity or substitution relationship) and the findings that this effect differs through demographic variables such as gender and education come to the fore. These studies analyse the

effects in different countries, taking into account not only the volume of migration but also the skill levels of migrants, the geographical regions of origin (e.g. intra-regional or extra-regional migration), the structure of local labour markets and labour regulations. In addition, labour market regulations, unionization rates and legal protections against dismissals are also important factors shaping the level of informal employment. In this framework, the studies presented below address the effects of migration on informal employment in both quantitative and structural dimensions.

Bohn & Owens (2012), who investigated the impact of the immigrant workforce on informal employment, found that states with higher migrant concentrations are more likely to experience increases in informal employment in U.S. states during the period 2001–06. Specifically, a 1 per cent increase in migration corresponds to a 0.19 per cent rise in informal employment. Bosh & Farré (2013), examining the impact of the significant migration wave in Spain between 2000 and 2009 on the informal labour market, found that a 1 per cent increase in the migrant population led to an increase in informal employment ranging from 0.3 to 0.8 per cent. According to their findings, a 12 per cent increase in the foreign-born population during this period accounted for at least 70 per cent of the total rise in informal employment. Viseth (2021) found that a 1 per cent increase in inter-regional migration (complementary skills) to Cameroon, Ghana, and South Africa led to a 0.05 per cent rise in informal employment, whereas an increase in intra-regional migration (substitute skills) resulted in a 0.19 per cent increase in informal self-employment. Alongside intra-regional migration to these countries, native workers employed in the formal sector either lost their jobs or were compelled to turn to informal employment. The results indicated that this effect was stronger on female employment. Khan (2021) found that migrant labour flows in India increased wages, particularly for highly skilled workers in the formal sector, while exerting negative employment effects on both high- and low-skilled workers in the informal sector. Both effects are more pronounced for non-migrant male workers compared to female workers. The positive wage effect indicates a complementary, whereas the negative employment impact substitutive relationship between migrant and native workers. Hailat et al. (2023) found that the influx of refugees in Jordan increased the likelihood of native men working in the informal sector by approximately 10 per cent. Additionally, having an education level beyond secondary school reduces the

probability of informal employment. Delgado-Prieto (2024) examined the impact of Venezuelan migrants on Colombia's labour market during the period 2015–19. The findings indicate that a 1 per cent increase in migration reduces local employment by between 0.9 and 1.3 per cent. Due to the migration shock, the informal sector is affected through wage reductions, while the formal sector experiences employment cuts.

The refugee influx, particularly following the Syrian civil war, has profoundly impacted the labour market of Türkiye, which serves as a destination country. Del Carpio & Wagner (2015) argue that migrants' lack of work permits leads them to engage in informal employment, creating a supply shock in Türkiye's informal labour market and causing large-scale displacement of native workers within the informal sector. Individuals with low education levels and women are clearly excluded from the labour market and, together with those employed in the informal sector, face declining income opportunities. Using micro-level data from the 2010–13 period in Türkiye, Ceritoglu *et al.* (2015) observed that the arrival of Syrian refugees led to a decrease of about 2.2 per cent in the ratio of informal employment relative to the total population. This effect was more pronounced among individuals with low education levels, reaching 3.3 per cent, while no significant impact was observed for highly educated individuals. The decline in the ratio is attributed to the fact that, despite an increase in population due to the refugee influx, approximately 50 per cent of the newcomers exited the labour force, 32 per cent remained unemployed, and only 18 per cent transitioned into formal employment. Tumen (2016) examined the impact of Syrian refugees on Türkiye's labour market by comparing the pre- and post-migration period. The researcher found that international migration led to a net decrease of 1.8 per cent in the ratio of employment relative to the total population, an increase of 0.77 per cent in the ratio of unemployment relative, and a decrease of 1.03 per cent in the labour force participation rate. Due to the refugee influx, 43 per cent of those who lost their jobs continued to search for employment, while 57 per cent exited the labour market entirely. It was observed that men, despite becoming unemployed, remained in the labour force, whereas women tended to withdraw completely from the labour market. Aksu *et al.* (2022), in a study covering 2004–15 period, found that migrants negatively affected native employment, particularly among temporary wage workers in the informal sector, young workers with low levels of education, part-

time or self-employed women, and workers in the agriculture and construction sectors in Türkiye. It has been found that migrants, particularly in the manufacturing sector, contribute to wage increases among workers with whom they have a complementary relationship. Gulek (2024), in a study covering the 2004–16 period, examined the impact of refugees on Türkiye's labour market and found that an increase in the refugee-to-native ratio reduced both formal and informal employment opportunities for low-skilled native workers. The researcher found that a 1 per cent increase in the refugee-to-native ratio decreases formal wage employment among low-skilled native workers by 0.13 per cent and informal wage employment by 0.17 per cent.

Formal sector employees are much more likely to be represented by labour unions; however, informal workers face higher rates of job turnover and are less likely to be integrated into collective bodies, resulting in reduced protection under labour laws and union membership (Duman, 2023). Therefore, governments attempt to curb informal employment through regulatory measures targeting the labour force. Hazans (2011), in a study covering 30 European countries during the period 2004–09, found that the share of informal employment in the labour force increases with unionization rates and immigrants. Conversely, it decreases as the employment protection legislation (EPL) wedge on labour increases. Florez & Perales (2016) investigated the impact of labour market protection on informal employment in 20 European countries during the period 2004–12. Their findings reveal that a one-point increase in the protection of permanent workers against individual and collective dismissals (EPRC) index, which represents job security for employees, reduces the likelihood of informal employment by 4 per cent. It was determined that employment protection decreases the tendency of employees to work in the informal economy, thereby reducing the overall prevalence of informal employment in a country; however, it does not affect informality among self-employed workers. However, Bosch *et al.* (2012) argue that the constitutional reform aimed at regulating the labour market was the main driver of the increase in informal employment in Brazil during the period 1983–02. According to their findings, the rise in dismissal costs, the implementation of strict restrictions on overtime, and the liberalization of union activities as a result of the constitutional reform accounted for approximately 30 per cent of the increase in informal employment.

The relationship between informal employment and gender inequality is characterised by the

concentration of women in more precarious and lower-paid jobs within the labour market. Malta et al. (2021) examined the broader presence of women in the informal sector compared to men in the context of differences in education, social norms, and legal frameworks. Their study found a strong association between women’s informal employment and gender disparities. Researchers have found that in Senegal, women are 3.4 per cent more likely to work informally compared to men. This gap increases to 8.5 per cent in urban areas. Each additional child raises the probability of informal employment among women by 1.4 per cent. Conversely, being married or having children decreases the likelihood of informal employment among men. Specifically, each additional child reduces men’s probability of working informally by 0.6 per cent. Also, completing secondary education in Senegal reduces the likelihood of informal employment by 61 per cent for women and 54 per cent for men. Joseph et al. (2022) found that gender inequality indices have a significant impact on the expansion of the informal economy in Africa. Specifically, a 1 per cent increase in female literacy rates was associated with a 3.5 per cent decrease in the informal economy across the continent. Ding et al. (2024) demonstrated that the

development of digital infrastructure in rural China improved the quality of informal employment. However, they also found that rural female workers require higher skills and education to benefit at a similar level as their male counterparts.

Çelik et al. (2021) investigated the macroeconomic determinants of informal employment in Turkey for the period 2004–20 using the ARDL bounds testing method. Their findings indicate that unemployment increases informal employment. Specifically, a one-unit increase in unemployment leads to a 0.99-unit rise in informal employment. Vidović & Ritan (2022) identified unemployment rate, exports, and economic growth as macroeconomic determinants of informal employment in their study covering 46 countries for the period 2017–19.

3. DATA AND METHODOLOGY

3.1. Data

This study investigates the relationship between informal employment and international migration, gender inequalities, and employment protection regulations in Türkiye for the period 2000–23. The descriptions of variables used in the study are presented in Table 1

Table 1: Descriptions of Variables.

Variable	Abbreviation	Source
Female Informal Employment	FEMI	ILOSTAT-Labour Force Statistics
Male Informal Employment	MALE	ILOSTAT-Labour Force Statistics
Migrant Labour Force Participation Rate	MWF	ILOSTAT-International Labour Migration Statistics
Gender Inequality Index	GII	UNDP Human Development Reports
Employment Protection Index	EPRC	OECD Employment Protection Database
Unemployment (15+)	UN	ILOSTAT-Labour Market-Related SDG Indicators

The relationship between the relevant variables and female informal employment is examined separately using Model 1, while the relationship with male informal employment is analysed using Model 2. Accordingly, the dependent variable for Model 1 is the female informal employment rate (FEMI), and the male informal employment rate (MALI) is used for Model 2. The independent variable representing international migration is chosen as the migrant labour force participation rate (MWF). To determine the impact of gender disparities on informal

employment, the Gender Inequality Index (GII) was included in the models. To assess the effect of labour protections such as unions, legislation, etc., on informal employment, the EPRC index, which represents job security for employees, was included in the models. Empirical literature has identified that informal employment is affected by labour market dynamics; therefore, the unemployment rate (UN) has been added to the models as a control variable.

The basic models of the research are as follows:

$$\text{Model 1: } FEMI_t = \beta_0 + \beta_1 MWF_t + \beta_2 GII_t + \beta_3 UN_t + \beta_4 EPRC_t * MWF_t + e_t \tag{1}$$

$$\text{Model 2: } MALI_t = \beta_0 + \beta_1 MWF_t + \beta_2 GII_t + \beta_3 UN_t + \beta_4 EPRC_t * MWF_t + e_t \tag{2}$$

Model 1 analyses the relationship between the migrant labour force participation rate and female informal employment, and Model 2 analyses male informal employment. Accordingly, the hypotheses tested for the validity of this study are as follows: H1:

Migrant labour increases informal employment. H2: Gender inequality increases female informal employment more than male informal employment. H3: Unemployment increases informal employment. H4: Employment protection decreases informal

employment.

3.2. Estimation Strategy

Macroeconomic time series often experience structural shifts caused by factors such as economic crises, changes in policy, natural disasters, or conflicts. Zivot & Andrews (1992), Lee-Strazicich (2003, 2013), and Kapetanios (2005) developed unit root tests that account for structural breaks. However, these tests rely on exogenously determined breakpoints, and misidentification of the number and date of breaks can reduce their statistical power. Furthermore, these methods typically allow for a limited number of sharp breaks and are unable to model gradual or smooth transitions (Aydın 2019, 75). To overcome this weakness, Becker et al. (2004) and Becker et al. (2006) proposed integrating Fourier functions into unit root tests. The Fourier ADF test was developed by incorporating Fourier functions into the standard Dickey-Fuller unit root test

$$\Delta Y_t = \delta_0 + \delta_1 t + \delta_2 \sin\left(\frac{2\pi kt}{T}\right) + \delta_3 \cos\left(\frac{2\pi kt}{T}\right) + \delta_4 Y_{t-1} + \sum_{i=1}^p \alpha_i \Delta Y_{t-i} + v_t \quad (3)$$

where; t is the trend term, T is the number of observations, π is π (3.1416), k is the frequency parameter, and p is the optimal lag length, the \sin and \cos are the trigonometric components of the Fourier transformation.

Cointegration tests incorporating Fourier functions have been developed by Tsong et al. (2016), Yilanci (2019), and Yilanci et al. (2020). The FA-ARDL model is an extension of the ARDL bounds testing method proposed by Pesaran et al. (2001), which was further augmented by McNown et al. (2018) through the addition of an extra F-test. By incorporating Fourier functions into this extended framework, the FA-ARDL method enables the analysis of cointegration relationships among variables with different orders of integration ($I(0)$ and $I(1)$). This method enhances the model's ability to capture structural breaks and nonlinear dynamics flexibly and robustly. Additionally, the supplementary F-test proposed by McNown et al. (2018) provides more robust evidence regarding the cointegration status of

$$\Delta FEMI_t = \beta_0 + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + \beta_1 FEMI_{t-1} + \beta_2 MWF_{t-1} + \beta_3 GII_{t-1} + \beta_4 UN_{t-1} + \beta_5 (MWF*EPRC)_{t-1} + \sum_{i=1}^{p-1} \delta_i' \Delta FEMI_{t-i} + \sum_{i=1}^{p-1} \phi_i' \Delta MWF_{t-i} + \sum_{i=1}^{p-1} \omega_i' \Delta GII_{t-i} + \sum_{i=1}^{p-1} \varphi_i' \Delta UN_{t-i} + \sum_{i=1}^{p-1} \delta_i' \Delta (MWF*EPRC)_{t-i} + e_t \quad (4)$$

$$\Delta MALI_t = \beta_0 + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + \beta_1 MALI_{t-1} + \beta_2 MWF_{t-1} + \beta_3 GII_{t-1} + \beta_4 UN_{t-1} + \beta_5 (MWF*EPRC)_{t-1} + \sum_{i=1}^{p-1} \delta_i' \Delta MALI_{t-i} + \sum_{i=1}^{p-1} \phi_i' \Delta MWF_{t-i} + \sum_{i=1}^{p-1} \omega_i' \Delta GII_{t-i} + \sum_{i=1}^{p-1} \varphi_i' \Delta UN_{t-i} + \sum_{i=1}^{p-1} \delta_i' \Delta (MWF*EPRC)_{t-i} + e_t \quad (5)$$

where; β_1 to β_5 represent the coefficients of the lagged levels of variables, while δ , ϕ , ω , φ , and δ

equation, as proposed by Enders & Lee (2012), Omay (2015), and Bozoklu et al. (2020). Unlike conventional methods that assume a finite and specific number of structural breaks, this test allows for a continuous and periodic structure. Thus, it offers the advantage of modelling an infinite number of structural breaks by capturing both sharp and gradual transitions, as well as large- and small-scale shifts. Furthermore, it eliminates common problems associated with the inclusion of numerous dummy variables, such as an increase in the number of parameters and a reduction in degrees of freedom, both of which can weaken the power of the test. As a result, the Fourier ADF test yields more robust outcomes even in small sample sizes (Bozoklu et al. 2020).

In this study, the stationarity and nonlinearity properties of the variables are analysed using the method proposed by Bozoklu et al. (2020). Accordingly, the fractional Fourier ADF test is represented by Equation (3).

the system. In this respect, the FA-ARDL method not only retains the advantages of its predecessors but also offers enhanced power. This is because, with the inclusion of Fourier functions, the FA-ARDL method can effectively model both sharp and smooth structural breaks, as well as multiple breaks whose number and timing are unknown (Becker et al. 2006). Moreover, the critical values obtained through the bootstrap method minimize errors associated with normality assumptions in small samples, thereby providing more reliable coefficient and relationship estimates. In this method, both fractional and integer frequency values are considered when determining the optimal frequency. Fractional frequencies indicate permanent structural breaks, whereas integer frequencies correspond to temporary breaks (Christopoulos & Leon-Ledesma, 2011; Omay, 2015; Ersin & Kirca, 2024).

Equations (4) and (5) present the adjusted versions of Model 1 and Model 2 according to Yilanci et al. (2020):

denote the parameters of the lagged first-differenced regressors. $t = 1, \dots, T$ refers to the time series, Δ is the difference operator, and p is the lag length, e_t is the error term. The optimal lag length is determined using Akaike Information Criteria. The terms \sin and \cos included in the models are added to capture cyclical patterns or structural breaks in the time series.

To determine the existence of a cointegration relationship, three hypotheses proposed by Pesaran et al. (2001), McNown et al. (2018), and Sam et al. (2019) are tested against their alternatives using the $F_{Overall}$, t_{IDV} and F_{IDV} test statistics. The hypotheses are presented as follows:

$H_{0A}: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$, General F-test based on the lagged levels of dependent and independent variables ($F_{Overall}$)

$H_{0B}: \beta_1 = 0$, t-test based on the lagged level of the dependent variable (t_{IDV})

$H_{0C}: \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ F-test based on the lagged levels of independent variables (F_{IDV})

To test these hypotheses, test statistics are calculated sequentially and compared against critical values obtained through bootstrap methods. If all three test statistics exceed their respective critical values, the corresponding null hypotheses are rejected, leading to the conclusion that a cointegration relationship exists among the variables.

4. FINDINGS

4.1. Unit Root Test Results

The results of the fractional Fourier ADF unit root test is presented in Table 2. Based on the Wald F-test statistics calculated to determine the significance of the trigonometric terms, it was found that in the model with intercept, the trigonometric components of the female informal employment rate (FEMI), migrant labour force participation rate (MWF), and gender inequality index (GII) were statistically significant. In with intercept and trend models, the trigonometric terms were insignificant. These results indicate that the relevant variables exhibit nonlinear characteristics. By comparing the calculated FADF test statistics with the corresponding critical values to determine the stationarity levels of the variables, it was observed that the MWF variable is stationary at the level, whereas the FEMI and GII variables become stationary at their first differences. However, upon differencing, the trigonometric terms for the GII variable lose their statistical significance, while those for the EPRC variable become significant. For variables whose trigonometric components are found to be insignificant, it is recommended to proceed with the standard Dickey-Fuller test at this stage.

Table 2: Fractional Fourier ADF Unit Root Test Results.

Constant						
Variables	k	Min SSR	Wald F Test Statistic ^a	p	FADF Test Statistic	FADF Critical Values ^b
FEMI	3.10	30.40	6.45*	1	-0.21	-3.05
MALI	3.20	23.22	4.06	1	-0.62	-3.03
MWF	0.90	21.57	8.54**	2	-3.60*	-3.86
GII	0.50	0.01	8.43**	2	-3.38	-3.93
UN	4.30	0.12	2.62	1	-2.52	-2.95
EPRC	4.80	0.002	0.60	2	-3.50	-2.91
Δ FEMI	3.20	21.8	6.86*	2	-4.04***	-3.03
Δ MALI	3.30	21.4	4.72	1	-2.48	-3.02
Δ GII	4.40	0.00	4.43	1	-2.80*	-2.94
Δ UN	4.40	21.69	4.42	1	-3.92	-2.94
Δ EPRC	0.60	0.00	10.32**	2	-5.77***	-3.93
Constant and Trend						
Variables	k	Min SSR	Wald F Test Statistic ^a	p	FADF Test Statistic	FADF Critical Values ^b
FEMI	3.10	18.72	4.00	1	-2.10	-3.75
MALI	1.80	19.06	4.70	2	-3.90	-4.14
MWF	1.80	18.41	3.04	2	-3.30	-4.14
GII	4.40	0.002	3.26	1	-1.90	-3.64
UN	4.30	0.12	2.34	1	-2.38	-3.59
EPRC	0.10	0.002	3.33	2	-3.60	-4.26
Δ FEMI	3.20	21.7	6.43	1	-3.80	-3.73
Δ MALI	3.30	21.2	4.41	1	-2.40	-3.71
Δ MWF	1.50	24.1	4.06	1	-4.67	-4.28
Δ GII	4.40	0.00	4.16	1	-2.66	-3.58
Δ UN	4.40	21.1	3.98	1	-3.84	-3.58
Δ EPRC	4.10	0.00	1.27	0	-5.04	-3.63

Note: *, **, And *** Indicate Statistical Significance at the 10, 5 And 1 Per Cent Levels, respectively. Critical Values for The F Test Were Taken from Enders and Lee (2012). The Critical Values at the 1, 5, And 10 Per Cent Statistical Significance Levels, Presented in Tables

1A And 1B, Were Calculated as Follows: For the Model with Constant, 10.35, 7.58, And 6.35; And for the Model with Constant and Trend, 12.21, 9.14, And 7.78, Respectively. B) Bozoklu, Yilanci and Gorus (2020) Provide The 5 Per Cent Significance Level Critical Values for the Fractional Fourier ADF Test Calculated for the Models with Constant and With Constant and Trend, As Reported in Tables a And B.

Source: Authors' Calculations.

The results of the ADF unit root test, conducted for variables whose trigonometric terms were found to be insignificant, are presented in Table 3. According to the analysis findings, the

unemployment rate (UN) is stationary at the level, indicating I (0), while all other variables become stationary after first differencing, indicating I (1).

Table 3: ADF Unit Root Test Results.

Variables	Level		First Difference	
	Constant	Constant and Trend	Constant	Constant and Trend
FEMI	0.6475	-3.539*	-3.52**	-3.79**
MALI	0.1387	-3.0097	-3.95***	-4.01**
MWF	-0.76	-2.32	-4.12***	-4.22**
GII	-0.33	-2.12	-4.27***	-4.16**
UN	-3.47**	-3.34*	-	-
EPRC	-2.40	-1.98	-4.69***	-5.02***

Note: *, **, And *** Indicate Statistical Significance at the 10, 5 And 1 Per Cent Levels, respectively.

Source: Authors' Calculations.

4.2. Cointegration And Causality Test Results

The relationships between informal employment and independent variables were analysed using the FA-ARDL method within the framework of Model 1 and Model 2 specified in Equations (4) and (5). In the first stage of the FA-ARDL procedure, the long-run relationship between the variables was examined for Models 1 and 2, and the results are presented in Table 4. Firstly, the optimal frequency values (k) used in the Fourier functions were calculated for both models. These values were determined as 2.1 for Model 1 and

3.4 for Model 2. Since these frequencies are fractional, they indicate that structural changes have a permanent effect on the cointegration relationship. For the cointegration relationship between variables to be accepted in the FA-ARDL procedure, all three null hypotheses mentioned above must be rejected based on the $F_{Overall}$, F_{IDV} and t_{IDV} test statistics. As shown in Table 4, the calculated test statistics for both models exceed the bootstrap critical values. These results clearly confirm the cointegration relationship between the series by jointly rejecting all three null hypotheses for both models.

Table 4: FA-ARDL Bounds Test Results.

		Model 1 (2, 1, 2, 1, 0)			Model 2 (1, 2, 2, 2, 1)			
k		2.1			3.4			
		Bootstrap Critical Values			Bootstrap Critical Values			
Tests	Test Stat.	0.99	0.95	0.90	Test Stat.	0.99	0.95	0.90
$F_{Overall}$	7.90**	6.67	4.77	3.99	15.8*	25.5	17.4	12.5
t_{DV}	-4.44**	-4.6	-3.99	-3.66	-4.61***	-4.5	-3.2	-2.4
F_{IDV}	8.60**	6.83	4.70	3.84	19.03**	20.1	11.3	8.5

Note: *, **, And *** Indicate Statistical Significance at the 10, 5 And 1 Per Cent Levels, respectively. Bootstrap Critical Values Were Generated Using 1,000 Simulations.

Source: Authors' Calculations.

Following the confirmation of cointegration relationships among the variables for both models, the estimated long-run coefficients and the short-run coefficients obtained from the error correction model are presented in Table 5.

It was found that the MWF, GII, and UE have a positive effect on FEMI in Model 1. The long-run coefficient for MWF, considered the main explanatory variable, is estimated as 5.98. This finding implies that a 1 per cent increase in MWF leads to a 5.98 per cent increase in FEMI ($p < 0.01$). A

coefficient greater than one indicates a highly elastic long-run relationship between the variables, meaning that informal employment is highly sensitive to changes in the migrant labour force. Additionally, the interaction term (EPRC*MWF) yields a statistically significant negative coefficient of -1.46 ($p < 0.05$). This finding suggests that an increase in the EPRC index mitigates the amplifying effect of the MWF on FEMI. In this context, a 1 per cent increase EPRC index, resulting from improvements in unionization or legal regulations aimed at

protecting migrant workers, leads to a decrease of 1.46 per cent in FEMI ($p < 0.05$). A 1 per cent increase in GII and UE variables leads to an increase in FEMI

by 1.98 per cent ($p < 0.01$) and 0.64 per cent ($p < 0.05$), respectively.

Table 5: FA-ARDL Estimation Results.

Model 1				Model 2			
Variables	Coefficient	t-Statistic	Probability	Variables	Coefficient	t-Statistic	Probability
Long Run Coefficient				Long Run Coefficient			
MWF	5.98	3.95	0.00	MWF	4.33	23.95	0.00
GII	1.98	6.71	0.00	GII	1.40	75.75	0.00
UN	0.64	2.84	0.02	UN	0.29	8.50	0.00
EPRC*MWF	-1.46	-3.22	0.01	EPRC*MWF	-0.89	-11.96	0.00
C	-13.09	-2.90	0.02	C	-9.03	-23.68	0.00
Short Run Coefficient				Short Run Coefficient			
$\Delta FEMI_{t-1}$	-0.46	-3.43	0.01	ΔMWF	1.38	18.86	0.00
ΔMWF	1.89	14.32	0.00	ΔMWF_{t-1}	-2.35	-30.51	0.00
ΔGII	0.04	0.78	0.46	ΔGII	0.67	30.11	0.00
ΔGII_{t-1}	-0.34	-3.34	0.01	ΔGII_{t-1}	-0.82	-23.95	0.00
ΔUN	0.13	7.18	0.00	ΔUN	0.29	36.85	0.00
ect_{t-1}	-0.39	-8.29	0.00	ΔUN_{t-1}	-0.13	-18.70	0.00
				$\Delta EPRC*MWF$	-0.60	-12.83	0.00
				ect_{t-1}	-1.53	-46.63	0.00
Fourier Coefficient				Fourier Coefficient			
COS (k=2.1)	0.02	4.82	0.00	COS (k=3,4)	-0.06	-38.73	0.00
SIN (k=2.1)	0.01	2.74	0.03	SIN (k=3,4)	-0.11	-35.87	0.00

Source: Authors' Calculations.

The short-run coefficients for the MWF and the UN are estimated as 1.89 and 0.13, consistent with the long-run coefficients ($p < 0.01$). On the other hand, a 1 per cent increase in FEMI in the previous period results in a -0.46 per cent decrease in FEMI in the current period ($p < 0.05$). Similarly, a 1 per cent increase in GII in the previous period leads to a -0.34 per cent decrease in FEMI in the current period ($p < 0.05$). These findings may be explained by the exploitative, insecure, and unstable nature of informal employment, as well as by increased gender inequality, both of which often drive women to withdraw from the labour market, either partially or completely, in the following period. In addition, the impact of increased labour inspections, formal employment incentives targeting women (such as tax reductions and hiring subsidies), support for female entrepreneurship, and policies aimed at reducing gender inequality may also play a role.

It was found that the MWF, GII, and UE have a positive effect on MALI in Model 2. However, the coefficients are smaller compared to those in Model 1. Indeed, the long-run coefficient for the MWF is estimated to be 4.33. This finding indicates that a 1 per cent increase in MWF leads to a 4.33 per cent increase in male informal employment ($p < 0.01$). Moreover, the interaction term (EPRC*MWF), included in the model, is again found to be negative and statistically significant ($p < 0.01$), similar to Model 1. The coefficient of this variable is estimated as -0.89. This finding suggests that an increase in the EPRC index reverses the positive effect of MWF on MALI.

In this context, resulting from improvements in unionization or legal regulations aimed at protecting migrant workers, leads to a decrease of -0.89 per cent in MALI ($p < 0.01$). As observed, the positive or negative effects of the explanatory variables are more pronounced in female informal employment compared to male informal employment.

The Fourier terms are statistically significant in both models, confirming the presence of periodic fluctuations in informal employment, which may be attributed to cyclical factors or policy-driven shifts. Therefore, the inclusion of Fourier functions in the models ensures that even subtle structural breaks are not overlooked, leading to more robust and reliable findings. Finally, the error correction term is found to be negative in both models, indicating that short-run deviations are eliminated over the long-run, and the system converges back to its long-run equilibrium. Narayan and Smyth (2006) state that when the absolute value of the adjustment coefficient exceeds one, the convergence process may fluctuate but tends to stabilize over time. In Model 2, the estimated value greater than one suggests that the adjustment process toward the long-run equilibrium is prolonged and volatile, indicating delayed and unstable convergence dynamics.

Following the identification of long-run relationships, a Granger causality test based on the error correction model was conducted using the FA-ARDL (2, 1, 2, 1, 0) and (1, 2, 2, 2, 1) models developed for female and male informal employment, respectively. The results of the test are presented in

Table 6.

Table 6: Granger Causality Test Results Based on the FA-ARDL Error Correction Model.

Causality Periods Dependent Variable	Short-Run				Long-Run
	Δ MWF	Δ GII	Δ UN	Δ (EPRC*MWF)	ect _{t-1}
Δ FEMI	4.35** (0.0369)	44.16*** (0.00)	0.09 (0.75)	-	8.45 (0.00)
Δ MALI	59.46*** (0.00)	63.63*** (0.00)	70.56*** (0.00)	204.41*** (0.00)	52.88 (0.00)

Note: **, And *** Indicate Statistical Significance at the 5, And 1 Per Cent Levels, respectively.

Source: Authors' Calculations.

According to the findings, both short-run and long-run Granger causality exist from only MWF and GII to FEMI in Model 1. In contrast, Model 2 reveals short-run and long-run causality from all explanatory variables to MALI.

The short-run causality relationships indicate that both female and male informal employment rates are affected by past shocks in migrant labour force

participation, gender inequality, unemployment rate, and the interaction variable, revealing a dynamic interrelationship among these factors. The long-run causality relationships further support the short-run findings. These results confirm that, in Türkiye, MWF, GII, UE, and the EPRC index are significant determinants of both female and male informal employment rates.

Table 7: Diagnostic Test Results.

Diagnostic Tests	Model 1		Model 2 with Interaction terms		
	Test Statistic	Probability	Test Statistic	Probability	Decision
Breusch-Godfrey LM test	2.12	0.11	2.17	0.22	No Autocorrelation
ARCH Test	0.07	0.77	1.84	0.17	No variance
Jarque-Bera test	3.59	0.16	0.46	0.79	ϵ_t normally distributed.
Ramsey RESET test	0.04	0.95	0.94	0.37	Model specifications correct
Csum	Stable		Stable		
Csum ²	Stable		Stable		
Adj. R2	0.99		0.99		

Source: Authors' Calculations.

The diagnostic test results for both models are presented in Table 7. The outcomes of these tests indicate that the models are reliable and well-specified, confirming the robustness and validity of the estimated results.

5. DISCUSSION AND CONCLUSION

The effects of migrant labour, gender inequality, employment protection legislation, and unemployment on informal employment among men and women in Türkiye are investigated using the FA-ARDL method. This method allows for the incorporation of structural breaks into the model and enables the control of non-parametric cyclical fluctuations, thereby providing more flexible and robust short- and long-term estimates.

Findings show that, migrant labour has a positive effect on both female and male informal employment. These results are in line with Hazans (2011), Bohn & Owens (2012), Bosh & Farré (2013), and Gulek (2024). The fact that the coefficient is greater than one indicates that the long-run relationship between the variables is highly elastic; in other words, both female and male informal employment are highly sensitive to changes in migrant workforce participation. This effect is more

pronounced for female than for male informal employment. The participation of migrants in the labour market leads to the displacement of native formal employment, pushing native workers – particularly women – into informal employment. This result supports the findings of Tumen (2016) and Ceritoglu et al. (2017) and implies a substitutive relationship between the skills of migrants and those of native workers. Thus, migrants tend to replace native workers, especially women, in low-skilled jobs.

Short and long run coefficients of the employment protection interaction variable (EPRC*MWF) are negative. This indicates that the positive and strong effect of migration on both female and male informal employment is reversed by the effect of employment protection legislation. This finding is very important in terms of proving that employment protection legislation reverses the tendency of migrant labour to work in the informal sector.

There is a positive and relationship between gender inequality and both female and male informal employment. This finding is consistent with the results of Malta et al. (2021) and Joseph et al. (2022). The fact that the coefficient for gender inequality is larger in the model for female informal employment

than for male informal employment suggests that gender inequality pushes women more strongly into informal work. This, in turn, leads to lower earnings, reduced well-being, and ultimately a deepening of gender inequality. In short-run, the negative coefficient of lagged gender inequality implies that gender inequality in the previous period reduces current female informal employment. Although this may appear contradictory, it can be explained by a general decline in female labour force participation. Moreover, the coefficient for lagged gender inequality is higher in the model for male informal employment, indicating that as gender inequality increases, male informal employment decreases at a faster rate compared to that of women. This result may reflect a process in which women are increasingly excluded from the labour market, while men are prioritized in access to formal employment. Therefore, although the decline in informal employment may seem like a positive development, it may in fact indicate a gendered exclusion from labour markets.

A positive and significant relationship between the unemployment rate and both female and male informal employment has been identified, aligning with the empirical findings of Çelik et al. (2021) and Vidović & Ritan (2022). This result indicates that an increase in the unemployment rate compels both women and men to resort to informal employment.

In Türkiye, various legal and institutional measures have been undertaken to reduce gender inequality. Significant legislative reforms have been enacted to ensure equal rights for women in both the labour market and the public sector. Moreover, numerous awareness-raising and support programs addressing violence against women, educational equality, and economic empowerment have been implemented by governmental bodies and non-governmental organizations. Efforts to increase girls' school enrolment through scholarships and incentive programs are ongoing, alongside initiatives aimed at enhancing women's vocational and technical skills. Additionally, Türkiye is committed to international gender equality frameworks, such as the United Nations Commission on the Status of Women. Despite these efforts, persistent gender inequality in Türkiye's labour market contexts raises questions about the effectiveness of current policies and practices. In light of this, the following policy recommendations are proposed: i) Improving the quality of the education system: Investments in both human and physical capital necessary for high-quality education should be increased. Additionally, greater emphasis should be placed on vocational

education; the quality of vocational high schools and vocational training courses must be enhanced and integrated with employment generation projects to make them more attractive and relevant to society. ii) Enhancing the effectiveness of legal implementation: It is crucial to ensure not only the existence but also the effective enforcement of existing legal frameworks. This requires regular monitoring, performance evaluation, and systematic improvement of implementation mechanisms. iii) Expanding educational support and incentives: Increasing access to education for girls and women, particularly in rural areas, remains a priority. Scholarships, transportation support, and family outreach programs should be strengthened and widely disseminated. iv) Raising societal awareness: Gender equality should be framed as a collective societal responsibility, with awareness campaigns engaging media, educational institutions, and religious and civil society actors actively. v) Supporting women's economic empowerment: More tangible support for female entrepreneurship, employment, and career advancement is needed. This includes expanding microcredit programs, cooperatives, and gender-sensitive workplace policies.

In recent years, Türkiye has undertaken a series of legal and institutional reforms aimed at promoting the integration of migrants into the labour market. In this context, significant progress has been made in the regulation of work permits—most notably through the enactment of legislation in 2016, which granted individuals under temporary protection the legal right to access formal employment. To enhance the employability of migrants and foster social cohesion, the Turkish Employment Agency has implemented a variety of programs, including vocational training courses, on-the-job training activities, and career counselling services. These programs have been designed to include both migrants and Turkish citizens, with the goal of fostering a shared workplace culture and mutual adaptation. Moreover, to support the entrepreneurial potential of migrants—particularly women and youth—various initiatives such as entrepreneurship training, grant support schemes, and mentorship programs have been introduced. These efforts aim not only to facilitate migrants' access to the labour market but also to empower them as self-reliant and productive economic actors within Turkish society. In collaboration with international organizations—most notably the ILO—Türkiye has implemented a series of joint initiatives aimed at promoting social cohesion, workplace integration, occupational health

and safety, and entrepreneurial capacity among migrants. These efforts have included grant schemes and mentorship programs designed to support migrant entrepreneurship. In addition, Turkish language courses have been offered to improve migrants' language proficiency and overcome communication barriers in both social and professional settings.

However, macroeconomic challenges in recent years—particularly soaring inflation, declining purchasing power, reduced overall welfare, and persistently high youth unemployment—have contributed to growing public resentment toward migrant workers. A widespread perception has emerged that migrants are taking jobs from local workers or driving down wages in certain sectors. These social tensions and negative public sentiments have, in turn, created political obstacles to the implementation of further regulatory reforms aimed at improving the working conditions and labour market integration of migrant workers. Simplifying the work permit process, recognizing foreign diplomats and vocational qualifications, expanding mentorship mechanisms for migrant workers, and ensuring the active operation of migrant integration centres—particularly during periods of increased migration—are all critical measures for reducing informal employment among migrants. Furthermore, empirical models that include employment protection legislation as an interaction variable suggest that such regulations can counterbalance the tendency of migrant labour to be absorbed into the informal sector. In light of this, expanding labour protection laws, strengthening the role of trade unions, and extending these rights to

migrant workers are essential steps toward promoting formalization, ensuring equitable labour conditions, and fostering inclusive labour market participation.

From the employer's perspective, the primary motivation for hiring informal labour is the desire to reduce employment-related costs. Therefore, it is crucial to reduce the tax burden and social security contributions associated with labour. In this regard, the government should activate incentive programs that prioritize the promotion of formal employment. In Türkiye, employers are legally required to register and ensure domestic workers who are employed for ten days or more through the Social Security Institution. However, in practice, registering workers who are employed on a daily basis—such as those providing cleaning services across multiple households—is highly challenging and not feasible within the current system. To address this issue, a daily micro-insurance mechanism could be introduced for informal, short-term labour. Under this model, employers would be able to purchase digital or paper-based daily insurance vouchers from the social security authority and provide them to the worker. These vouchers could then be submitted electronically via a mobile application or similar digital platform to notify the institution. Such a system could significantly reduce informal employment, especially in day-to-day household work, while extending social protection coverage to an often-overlooked segment of the labour force. In conclusion, a comprehensive approach integrating labour market regulations, social integration policies, and economic incentives is necessary to combat the determinants of informal employment

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