Ankara Üniversitesi
SBF Dergisi,
Cilt 80, No. 1, 2025, s. 1-24

Araştırma Makalesi
DOI: 10.33630/ausbf.1485012

INFORMALITY AND FEMALE LABOR INCOME SHARE*

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Abstract

This paper presents original evidence to enhance understanding of the nexus between the informal sector and the economic well-being of women. Women encountering substantial obstacles in accessing formal employment opportunities tend to gravitate towards informal sector employment, which is characterized by lower productivity, lower wages, restricted access to credit and training, and an absence of social security coverage. Using two novel datasets of the size of the informal economy and female labor income share of 148 countries for the period 1991-2018, we show that while informality is associated with lower female labor income share in general, the results vary significantly with respect to countries with different income groups and development level. While there is not generally a significant and consistent association in high-income countries, the correlation is significantly negative in low-income countries and positive in middle-income ones.

Keywords: Informality, Gender, Labor income share

Kayıt Dışılık ve Kadınların Emek Geliri Payı

Öz

Bu çalışma kayıt dışı istihdam ile kadınların refahı arasındaki ilişkinin daha iyi anlaşılmasını sağlayacak özgün ampirik bulgular sunmaktadır. Kadınların formel sektördeki istihdam olanaklarına ulaşmalarını zorlaştıran bazı engeller olduğu için genellikle düşük verimlilik, kredi ve mesleki gelişim olanaklarına sınırlı erişim ve sosyal güvencesizlik ile özdeşleşen kayıt dışı sektörlere yönelme eğilimindedirler. 148 ülke ve 1991-2018 dönemini kapsayan kayıt dışı ekonomi ve kadınların emek geliri payı veri setlerini kullanarak, genel anlamda kayıtdışılık ile kadınların emek geliri payı arasında güçlü bir ilişki olduğunu ve bu ilişkinin farklı gelir grubundaki ülkelere ve kalkınma düzeyine göre belirgin bir şekilde farklılaştığını gösterdik. Bu iki değişken arasında genel olarak yüksek geliri grubu ülkelerde anlamlı ve tutarlı bir ilişki bulunmazken, bu korelasyonun düşük gelirli ülkelerde negatif ve orta gelirli ülkelerde pozitif olduğu görülmektedir.

Anahtar Sözcükler: Kayıt dışı, Toplumsal cinsiyet, Emek geliri payı

* Makale geliş tarihi: 16.05.2024
Makale kabul tarihi: 31.10.2024
Erken görünüm tarihi: 07.11.2024

Informality and Female Labor Income Share

Introduction

This paper aims to offer original evidence for a better understanding of the relationship between the presence of informal sector and women's economic well-being. The poor in emerging markets and developing economies frequently rely on informal economic activity. Informal employment makes up approximately 70 percent of total employment, more than half of which is self-employment (Elgin *et al.*, 2021). Globally informal employment is more common among employed men than employed women, at 63 percent and 58 percent, respectively (ILO, 2018). However, the same ratios are 87.5 and 92.1 in low-income countries (Ibid).

Extensive literature discusses the relationship between feminization of labor and informality (Chen, 2012; Chen and Carré, 2020). While the former term refers to women's increased participation in paid work and the deterioration of working conditions in previously male jobs (Anker, 1998; Standing, 1999), the latter is defined as all economic activities that contribute to the officially calculated national income but are not registered (Schneider and Enste, 2000; Elgin *et al.*, 2021). Özgür *et al.* (2021) coined the term 'feminformalization' to describe the increase in women's employment in the informal sector.

As the transition from agriculture to industry results in increased male employment and a decline in female participation in the agricultural sector, advanced stages of economic development create greater employment prospects for women thanks to increased levels of education, reduced fertility rates, and improvements in gender relations. The increase in women's labor force participation has been accompanied by a decline in job segregation and an improvement in gender wage gap since the 1980s (Benería *et al.*, 2016). Women have been employed disproportionately in labor-intensive export-oriented sectors since they are paid less than men mostly in the global south. On the other hand, women may prefer more flexible work due to care responsibilities, etc. In both developed and developing countries, women tend to bear a disproportionate amount of human reproduction and unpaid care work, which can create an unequal division of labor within the household. As a result, the informal sector can be a useful tool for women to balance their unpaid care work and market

work, while also providing a financial safety net for their households (Agergaard and Thao, 2011). Informal employment has been a key strategy for firms to increase competitive power to maintain higher profit margins (Mishra and Ray, 2010). That is why firms have extensively relied on women's employment in the informal sector while men mainly remained in the formal sector (Chen, 2012). Later, the feminization of labor expanded from labor-intensive export sectors into service sectors. Excluding agricultural activities, informality prevails in all sub-Saharan African nations, with women, on average, more frequently engaged in the informal sector. On average, the rate of informality for female workers in non-agricultural sectors surpasses that of their male counterparts by 10 percentage points (Ibid). While some studies show the effect of feminization on pay/income distribution, is negative in developing countries and positive in developed countries (Elveren, 2014; Alfani et al., 2021), Elgin and Elveren (2021) showed that the association between feminization of labor and lower income inequality is canceled by the presence of an informal sector. However, these findings are not on the ultimate effect of informality on women's income. The labor income share refers to the proportion of national income that accrues to workers in the form of wages and salaries. In many countries, women have lower labor income shares than men, reflecting gender-based wage discrimination, occupational segregation, and differences in work experience and education. This study is the first to examine this direct association between informality and female labor income share (FLIS) in countries with different income groups.

The rest of the paper is structured as follows: the next section briefly discusses the relationship between informality, female labor force participation, and gender wage gap. Section 3 introduces data and method, followed by presentation of results and discussion. Finally, the Conclusion section summarizes the findings.

1. A Brief Literature Review

The informal economy can be defined as all economic activities that are hidden from government regulations for different reasons. For example, a firm may avoid paying taxes, social security payments, governmental bureaucracy or strict regulations. Also, their choices to stay informal is highly connected to the quality of political institutions. There are several different concepts to refer to the informal economy, including the shadow economy, the hidden economy, the gray economy, the black economy, or the cash economy. We acknowledge the difference between informal economy, informal sector, and informal employment. While we recognize the differentiation made by ILO (2018)

between the informal sector and informal employment, in this paper we will be using the terms interchangeably. This is because the vast majority (around 85%) of informal employment occurs in the informal sector, with the remainder being split between the formal sector and households, according to ILO (2018).

Informal employment is characterized by several key features, including low productivity, low wages, limited access to credit and training, and a lack of social security coverage. Vulnerable groups, such as women, who face significant barriers to accessing formal employment opportunities, are more likely to find work in the informal sector. Women with limited education and restricted career prospects might not prioritize enhancing their skill set. They may opt to avoid entering the workforce altogether or pursue flexible employment options that enable them to balance the responsibilities of work at home and in the professional sphere. This pattern often results in women being confined to low-paying and informal positions, perpetuating a cycle of limited opportunities. Within the context of neoliberalism, employers in labor-intensive, export-oriented industries have shown a preference for female workers for three primary reasons, as elucidated by Benería et al. (2016: 115). Firstly, due to gender-based segmentation in the labor market, women typically receive lower wages. Secondly, employers can often achieve higher labor productivity with female workers who exhibit intermittent employment patterns. Thirdly, companies seeking lower risk and greater flexibility to enhance their competitive power are inclined to operate within informal settings and promote home-based work, which are predominantly carried out by female workers. Consequently, to maintain higher profit margins, employers tend to reduce the number of formal workers and increasingly rely on women in the informal sector[1] (Standing, 2006).

The process of the feminization of labor initially began within manufacturing sectors as developing countries strategically positioned themselves within the global division of labor (Joekes, 1999; Seguino, 2000a; Saraçoğlu et al., 2018). In semi-industrialized economies, the focus was

1 It is evident that the persistent wage gap between men and women contributes significantly to enhanced profitability. Several studies have explored the relationship between female employment and its impact on overall profitability in the economy. Using diverse methodologies and variables, Finnof and Jayadev (2006) examined 23 OECD countries from 1975 to 2000, Elveren et al. (2017) studied 21 OECD countries from 1970 to 2008, and Elveren et al. (2023) expanded their analysis to 130 countries from 1990 to 2019 to find a positive correlation between women's employment and both profit share and profit rate. That is, they found that increasing women's employment, accompanied by lower wages, is one factor that stimulates profit rates. Furthermore, when investigating the US manufacturing sector from 1960 to 2017, Ossa (2023) asserted that gender wage inequality initially served as a source of profitability, particularly before 1986, but this effect gradually diminished over time.

primarily on labor-intensive export industries encompassing textiles, apparel, leather products, and food processing, as well as labor-intensive assembly line work in electronics and automobiles (Çağatay and Özler, 1995; Tzannatos, 1999). However, the landscape of women's employment has evolved in more recent years, particularly in regions like Asia, where women have ventured into service sectors such as call centers and data entry. It is important to note that as semi-industrialized economies mature, the trend of feminization in export-oriented jobs may start to decline, or even reverse. For example, countries like Taiwan, Hong Kong, South Korea, Singapore, and Mexico's maquiladoras have already witnessed a reduction in the percentage of women employed in manufacturing roles. This phenomenon of "defeminization" can be attributed to the presence of "tight female labor markets that lead to upward pressure on female wages and the emergence of lower wage sites in Asia and Latin America" (Seguino and Grown, 2006: 294).

Saraçoğlu et al. (2018) have identified the process of defeminization in low-tech manufacturing sectors in the Northern hemisphere. Defeminization was initiated in the 1980s and continued throughout the 1990s and the early 2000s. Conversely, in middle-income OECD countries located in the Southern hemisphere, trends mirrored those in the North. However, in low-tech industries in some developing nations, feminization persisted (Elgin and Elveren, 2021). Thus, the trajectory of the feminization of labor is not uniform across all developing countries (Seguino and Grown, 2006). For example, certain African countries with less competitive manufacturing sectors have not experienced this trend. Instead, due to trade liberalization policies, these nations have been compelled to reduce import tariffs on labor-intensive goods like clothing. As a result, many women and men who have been laid off from the manufacturing sector have had to accept informal employment.

As production processes became more subcontracted, there was a marked increase in the informalization of employment relationships. This shift led to the creation of small-scale, decentralized, and flexible jobs that offered lower pay and fewer benefits, as well as piece-rate pay for home-based production (Chen, 2012; Çağatay *et al.*, 2017). In emerging markets, the informal sector saw further development due to economic crises and IMF structural adjustment programs (Easterly, 2001; Chen, 2012). Within developing countries, women tend to rely more on informal employment. The non-agricultural sector exhibits a higher percentage of self-employment within informal employment in developing countries, with self-employment rates ranging from 60 to 70 percent, depending on the region (Chen *et al.*, 2006). Available statistics suggest that both men and women in informal employment are more likely to engage in self-employment rather than wage employment in most countries (Ibid).

Women's disproportional employment in the informal sector exacerbates the gender wage gap. Although some countries have shown improvement, the gender wage gap remains highly significant (Berik, 2000; Oostendorp, 2009; Weichselbaumer and Winter-Ebmer, 2005; Morrison et al., 2007; Aydiner-Avsar, 2010). Additionally, this improving trend is not universally consistent. While the gap has declined in certain countries (Tzannatos, 1999; World Bank, 2001; UNIFEM, 2005; Blau and Kahn, 2017), it has increased in others (Standing, 1999; Mehra and Gammage, 1999; Berik et al., 2004; Seguino and Grown, 2006). In general, recent literature, as argued by Mani *et al.* (2020), indicates that there are increasing gender gaps both in employment and wages. In developing countries, women earn approximately 73 percent of men's wages, according to the World Bank (2001). This wage gap also exists to a lesser extent in developed countries. It is worth noting, however, that the gap is not narrowing due to increasing women's wages but rather through reducing men's wages through downward harmonization of pay and work conditions, which is not an effective means of achieving gender equality. For instance, while women's wages in the United States increased from 1970 to 2011, the median male wage declined by approximately 28 percent during the same period (Looney and Greenstone, 2012). A similar pattern of downward wage convergence was observed by Zacharias and Mahoney (2009) from 1982 to 1997 in the US.

The primary determinants of the gender wage gap are closely tied to the economic structure and trade policies. Oostendorp (2009) demonstrated that the gender wage gap decreased within occupational categories in tradable but not in non-tradable industries, based on data from the ILO October survey for 83 countries spanning from 1983 to 1999. In developed economies, the gender wage gap narrowed as a result of trade and foreign direct investment (FDI), but this phenomenon was less prevalent in developing nations. This disparity can be attributed to the concept of a flattened labor demand curve, as explained by Rodrik (1997). Essentially, the availability of alternative labor sources outside the domestic economy made the labor demand curve more elastic, resulting in workers bearing the cost of increased capital mobility in the form of lower wages (Seguino and Grown, 2006). Seguino (2000b) observed the expansion of the gender wage gap in Taiwan during 1982-90, which further substantiates Rodrik's insight.

Women workers in labor-intensive firms have become increasingly mobile or "footloose" due to trade and investment liberalization. This mobility, coupled with the ability of firms to shift production locations, has reduced workers' bargaining power and, consequently, their wages (Choi 2006). In response to trade liberalization, firms have reduced costs by informalizing labor contracts through subcontracting and outsourcing. Due to their limited bargaining power,

especially for women, informal sector workers typically receive significantly lower wages compared to their formal sector counterparts (Toksöz and Memiş, 2020). Furthermore, since the wages of informal workers are often not captured in official surveys, the gender wage gap is likely to be wider than official figures suggest.

The confinement of women to informal employment amplifies their vulnerability in terms of income and job stability. Women face additional challenges in improving their skills and training. Furthermore, the potential for women to take time off from work due to pregnancy or childcare responsibilities often leads employers to favor investing in young men over young women. This phenomenon, known as "statistical discrimination" (Esping-Andersen, 2002), erodes the career prospects for women, ultimately resulting in substantial gender wage disparities between men and women, which also significantly reduces women's future pension earnings (Elveren, 2008; 2013).

In conclusion, the existing literature underscores that informality in employment is associated with lower wages and earnings for women, and women tend to be overrepresented in the informal sector. The prevalence of informal employment also contributes significantly to the gender wage gap, both within formal and informal sectors, by limiting women's access to training, education, and formal labor markets. Policies aimed at promoting formalization and ensuring equal opportunities for women in the labor market may help reduce the gender wage gap and increase women's share of labor income**.**

2. Data and Methods

We use two novel data series: The dependent variable is *FLIS (Female Labor Income Share)*, provided by Neef and Robilliard (2021) and the key independent variable is *the size of informal economy* (as percent of GDP) constructed by a study of the World Bank[2] (Elgin et al., 2021). *FLIS* refers to the sum of labor income earned by women relative to the national aggregate of labor income within a country. It is worth noting that this variable is not a measure of the rate of feminization of labor, but rather it is aggregate income earned by women. Neef and Robilliard (2021:2) compute *FLIS* directly from survey micro data for countries for which the Luxembourg Income Study and the European Union Statistics on Income and Living Conditions data are available. Then, they

2 The reported results use the dynamic general equilibrium (DGE) estimate of the World Bank data; however, results using other series are qualitatively similar.

calculate data for other countries by estimating the relationship between the female labor income share and the female wage and self-employment shares.

Our key explanatory variables are *the share of informal sector*, *IS*, provided by Elgin *et al.* (2021). It is calculated based on MIMIC (the multiple-indicators-multiple-causes) method. We also use *GDP per capita* (constant 2017 US dollars, PPP), *trade openness* (shares of exports and imports in GDP), *unemployment rate* (percent) and *economic growth* (GDP growth in percent) as control variables, all obtained from the World Development Indicators. We cover 148 countries from 1991-2018, which is the largest data set available. Table 1 provides descriptive summary statistics of all variables used in the empirical analysis[3].

Table 1. Descriptive Statistics

	All	Low	Middle	High
FLIS (%)	29.226	24.275	32.267	33.068
	(9.724)	(8.718)	(7.529)	(9.754)
IS (%)	31.529	38.241	35.406	19.946
	(12.529)	(9.922)	(10.991)	(7.538)
GDP per capita (thousand USD)	18.321	4.007	12.719	40.899
	(19.649)	(2.824)	(5.740)	(18.757)
Openness (%)	81.509	66.494	81.778	100.299
	(48.257)	(31.611)	(36.090)	(64.758)
Unemployment (%)	7.780	6.468	10.373	7.374
	(5.998)	(5.457)	(7.575)	(4.373)
Growth (%)	3.623	4.092	3.756	2.924
	(5.058)	(5.065)	(6.411)	(3.523)
Number of observations	3,886	1,606	1,011	1,269
Number of countries	148	61	39	48

Note: Numbers are mean values of the variables used in regressions. Standard deviations in parentheses.

3 Low refers to low-income and lower-middle income, and middle and high refer to upper middle-income and high-income, respectively. Here, we use the World Bank classification for 2018.

For the benchmark analysis we employed the panel fixed-effect method to estimate the following regression equation:

$$FLIS_{it} = \beta_0 + \beta_1 IS_{it} + \beta_2 GDPpc_{it} + \beta_3 Openness_{it} + \beta_4 Unemployment_{it} + \beta_4 Growth_{it} + \pi_i + \mu_t + \epsilon_{it}$$

where the subscripts *i* and *t* refer to countries and years, respectively, and country fixed effects (π_i) and year fixed effects (μ_t) are controlled for. Moreover, as robustness checks we also report results using fractional logit and 2SLS (two-stage least squares) fixed effect IV (instrumental variable) methods.

3. Results and Discussion

3.1. Benchmark results

Table 2 presents the benchmark results. While *GDP per capita* is positively associated with *FLIS* for all dataset and high-income countries, the association is negative in the case of low-income countries, and not robustly significant for middle-income countries. This suggests that economic development, as measured by increases in *GDP per capita* is likely to be associated with more and better economic opportunities for women in high-income countries. Similarly, *trade openness* is positively correlated with *FLIS* only in high- and middle-income countries, not in low-income countries. Women may join paid labor market when the rate of *unemployment* rises to support family budget as the added worker effect theory suggests. Different signs of unemployment variable suggest that women in low-income countries drop out from the labor market along with men while in middle- and high-income countries women join paid labor market or loss in their income is relatively less during the upsurge in unemployment, rising their income share compared to that of men.

Table 2: Estimation Results: Fixed Effects

	All	Low	Middle	High	All	Low	Middle	High
IS	-0.057***	-0.224***	0.077**	-0.082	-0.075***	-0.241***	0.087***	-0.101
	(0.017)	(0.027)	(0.030)	(0.059)	(0.017)	(0.028)	(0.031)	(0.060)
GDPpc	0.053***	-0.181**	-0.052	0.031***	0.148***	-0.434***	0.049	0.054***
	(0.010)	(0.084)	(0.030)	(0.010)	(0.017)	(0.156)	(0.055)	(0.018)
Openness	0.009***	-0.001	0.009**	0.006**	0.006***	0.000	0.008**	0.006**
	(0.002)	(0.005)	(0.004)	(0.003)	(0.002)	(0.005)	(0.004)	(0.003)
Unemployment	0.081***	-0.137***	0.046**	0.169***	0.061***	-0.129***	0.047**	0.162***
	(0.016)	(0.040)	(0.022)	(0.018)	(0.016)	(0.040)	(0.022)	(0.018)
Growth	-0.018**	0.017	-0.009	-0.048***	-0.007	0.014	-0.005	-0.045***
	(0.008)	(0.014)	(0.010)	(0.016)	(0.008)	(0.014)	(0.010)	(0.016)
IS×GDPpc					-0.006***	0.010	-0.003**	-0.001
					(0.001)	(0.005)	(0.001)	(0.001)
Observations	3,886	1,606	1,011	1,269	3,886	1,606	1,011	1,269
Countries	148	61	39	48	148	61	39	48
R-squared	0.239	0.131	0.299	0.583	0.249	0.134	0.303	0.584
F-stat (Overall)	36.43***	7.16***	12.54***	51.99***	37.15***	7.06***	12.36***	50.54***
F-stat (Country FE)	494.37***	234.26***	453.30***	768.41***	491.50***	225.54***	453.56***	748.14***
F-stat (Year FE)	10.30***	0.95	7.98***	10.88***	9.78***	0.89	7.28***	8.58***

Notes: All models include a constant, country fixed effects and year dummies.
Standard errors in parentheses *** p<0.01, ** p<0.05

3.2. Robustness Check

We examine several robustness check issues in our estimations. First, we check whether our regressions suffer from potential multicollinearity. Since the problem may arise from especially *unemployment* and *growth*, we include *unemployment* and *growth* in the regression equation separately, but the results are not affected (Table A1). Moreover, we identify the potential presence of multicollinearity by calculating the variance inflation factor (VIF) for each set of estimations in this study. Mean (maximum) VIF values are calculated as 1.44 (2.11) for the whole sample, 1.16 (1.28) for the low-income countries, 1.06 (1.12) for the middle-income countries, and 1.39 (1.80) for the high-income countries. These very low VIF values suggest that there is no empirical evidence of severe multicollinearity for any set of estimations in this study. On the other hand, to address potential endogeneity issues, we use two alternative approaches. First, we use first lagged values of all independent variables instead of level values (Table A2). Second, using all the lagged independent variables as instruments for their levels, we reiterate our analysis with an IV-2SLS method to take the endogeneity into account (Table A3). Finally, we check whether the predictions of the dependent variable fall outside [0,1] interval. Although we have a continuous dependent variable in [0,1], the predictions could fall outside this interval. Fractional logit regression captures particular nonlinear relationships and fits a regression for the mean of dependent variable conditional on explanatory variables. In other words, fractional logit model restricts that the predictions of the dependent variable are contained in [0,1]. To avoid model misspecification and dubious statistical validity, we repeat the same analyses with the fractional logit method as our dependent variable, FLIS, is a ratio between 0 and 1 (Table A4). The results of robustness check analyses are provided in appendix, and they are generally consistent with the benchmark analysis, strengthening our main findings.

3.3. Discussion

The results on the association between *informality* and *FLIS* deserve careful discussion. Overall, when the whole dataset is used, *informality* is negatively correlated with *FLIS*. That is, in countries where the *informal sector size* is larger, *FLIS* is lower, even after controlling for various control variables, including *GDP per capita*. However, this result also changes dramatically with respect to income groups. For high-income countries there is no significant association between *informality* and *FLIS*. This is not unexpected as the size of informal economy, and therefore women's informal employment is not sizeable in high-income countries. As Table 1 above shows, the average size of the

informal sector as a share of national income is as high as 38 percent in low-income countries, whereas it is only about 20 percent in high-income countries. The same ratio is 31.5 percent for the entire dataset. Moreover, the correlation between *informality* and *FLIS* is negative for low-income economies, but turns out to be positive for middle-income ones. That is, for low-income countries higher informality is associated with lower *FLIS*, while for middle income countries higher *informality* is associated with higher *FLIS*. As well known, women are disproportionally employed in the informal sector (Elgin, 2020). However, work conditions both in the formal and informal sector as well as the relative pay of women to men are significantly different in low- and middle-income countries. Gender pay gap is particularly more adverse in low-income countries (Kucera and Xenogiani, 2009). Women in low-income countries were primarily employed in the textile and garment manufacturing sectors, whereas in middle-income countries, they tended to work in electrical equipment and electro-technical industries (Joekes, 1987; Toksöz and Memiş, 2020). This result is further supported by the regressions including the interaction term with *GDP per capita*, where this term suggests that, while increasing *GDP per capita* weakens the negative effect of *IS* on *FLIS* for low-income countries it weakens the positive effect for middle-income countries.

The result that the correlation between *informality* and *FLIS* changes dramatically with respect to income groups with no significant association in high-income countries, a negative association in low-income countries, and a positive association in middle-income countries, can be explained by several factors. One such factor is obviously, economic development, which together with income level play a significant role in shaping the relationship between *informality* and *FLIS*. In low-income countries, the informal sector may be larger and more prevalent due to limited formal employment opportunities, lack of labor regulations, and inadequate social protection measures. As a result, women in low-income countries may be more likely to engage in informal work, leading to a negative association between *informality* and *FLIS*. In contrast, in high-income countries, the formal sector tends to dominate, and informal work is relatively small, leading to no significant association between *informality* and *FLIS*. Another important factor is the relevance of gender/social norms, which may influence the relationship between *informality* and *FLIS*. In some middle-income countries, there may be cultural or societal norms that restrict women's participation in formal employment or discourage them from seeking formal jobs. As a result, women in these countries may be more likely to engage in informal work, which could explain the positive association between *informality* and *FLIS* in middle-income countries. It is important to note that in low-income countries, the constraints on women's formal employment may be less due to cultural norms alone and more driven by economic limitations, such as the

scarcity of formal jobs and weaker infrastructure supporting formal employment. Our findings suggest that even if cultural restrictions exist, the dominant factor limiting women's formal employment in low-income countries is the economic environment itself, where informal work is often the primary option due to a lack of formal jobs. In middle-income countries, on the other hand, where formal employment opportunities are more available, cultural or societal norms become a more significant, standalone factor. In these settings, women may technically have access to formal jobs, but cultural expectations or norms may discourage them from pursuing these roles, pushing them into informal work instead. A third factor could be the type of informal work that may also vary across income groups. In low-income countries, informal work may be predominantly in subsistence agriculture or informal small-scale businesses, which may not provide significant income opportunities for women. In contrast, in middle-income countries, informal work may include a wider range of activities, such as informal labor in manufacturing or services sectors, which may offer relatively higher incomes for women compared to low-income countries. This could explain the positive association between *informality* and *FLIS* in middle-income countries. Finally, the fourth factor is the effect of policy and institutional factors. These could be labor regulations, social protection measures, and formalization policies, also play a role in shaping the relationship between *informality* and *FLIS*. In high-income countries, labor regulations and social protection measures are generally more robust, which may reduce the need for women to engage in informal work and hence result in no significant association between *informality* and *FLIS*. In contrast, in low-income countries, the lack of labor regulations and social protection measures may push more women into informal work, resulting in a negative association between *informality* and *FLIS*. In conclusion, the relationship between *informality* and *FLIS* is complex and can vary depending on income levels, economic development, gender norms, type of informal work, and policy and institutional factors. It is essential to consider these factors when interpreting the results and understanding the dynamics of informal work and female labor income share across different countries and income groups.

3.4. Policy Recommendations

Drawing from our findings, we provide some policy recommendations. In low-income countries, it is imperative to stimulate the emergence of formal employment opportunities for women. This involves a multifaceted strategy. Encouraging sustainable economic growth can significantly expand the formal job market, providing women with viable employment options. Governments should consider sectoral diversification and investment attraction as key drivers of growth. Also, strengthening labor regulations not only safeguards workers but

also ensures that women, in particular, enjoy equitable working conditions and job security within the formal sector. Robust social protection measures, including unemployment benefits and healthcare, act as a safety net for workers. Extending these measures ensures that women have the confidence to transition from informal to formal work. Creating formal employment opportunities is crucial. For example, Khera (2016) shows that although gender-targeted policies may increase female labor force participation and stimulate economic growth, failing to create formal jobs increases unemployment, informality, and gender wage gaps in India. In other words, creating employment for women may be challenging. It may stimulate economic growth at the expense of higher informality and gender wage gap.

Empowering women through education and skills development is essential in improving their employability within the formal sector. Tailoring vocational training programs to align with the demands of the formal job market ensures that women acquire relevant skills that meet industry needs. Education programs should be designed to cater to the unique needs and aspirations of women, addressing gender-specific barriers that hinder access to quality education. Encouraging women's continuous skill development helps them adapt to evolving job market requirements and enhances their human capital.

In middle-income countries where informality correlates positively with female labor income share, policies should challenge and reshape gender and social norms that may inhibit women's access to formal employment. Implementing campaigns and initiatives to challenge and transform discriminatory norms and practices is essential. Promoting gender equality creates an enabling environment for women to participate fully in the formal labor market. Empowering women with knowledge and resources enables them to assert their rights and leverage formal employment opportunities effectively.

Countries where informality negatively correlates with female labor income share should prioritize strengthening labor regulations and social protection. Rigorous enforcement of existing labor laws guarantees that workers, whether in the formal or informal sector, are protected and have access to legal remedies. Extending social protection programs to informal workers provides them with safety nets and essential services, fostering a conducive environment for formalization. Initiating incentives and support mechanisms for informal workers transitioning to the formal labor market facilitates a smooth integration process. It is imperative to extend social security protection because pension reforms during the neoliberal era have increased women's vulnerability by reinforcing the connection between pension benefits and one's lifelong earnings (Elveren, 2013: 36). The pension systems have not eliminated women's dependency; rather, they have transformed the nature of this dependency. In the

traditional system, dependence was largely on male family members, whereas in the current version, it predominantly hinges on the labor market (ibid, p. 36).

Addressing the gender gap in access to credit and financial services is vital in promoting women's engagement in formal employment. Studies show that individual use formal and informal financial services as complements and the interaction between monetary and financial sector policies plays a key role in financial inclusion to prevent individual from moving to underground financial tools (Deléchat *et al.*, 2021; Mengistu and Perez-Saiz, 2021). Facilitating women's access to credit empowers them to invest in formal businesses or education, ultimately boosting their employability within the formal sector. Encouraging entrepreneurship among women involves providing resources, mentorship, and networking opportunities, nurturing aspiring female entrepreneurs. Some studies have shown that women's increasing access to financial assets reduces gender inequality and increases economic development (Cabeza-García *et al.*, 2019; Elveren and Kırmızıoğlu, 2022). In this context, the research findings of Elveren and Kırmızıoğlu (2022), spanning 156 countries over the period from 1991 to 2019, carry significant relevance. Their study revealed a positive correlation between financial development and the share of female labor income in high-income countries. However, this relationship was not observed in low-income countries. The key takeaway from their study is that financial development in economically disadvantaged countries falls short of being inclusive enough to generate economic opportunities for women. This discovery underscores the urgent need to prioritize and enhance financial inclusion, particularly in low-income nations.

Gender-responsive social policies play a pivotal role in supporting women's labor force participation and reducing their reliance on informal work. Implementing paid maternity leave policies ensures that women can balance work and family responsibilities effectively, fostering gender equality. Making quality childcare services accessible and affordable to working mothers alleviates caregiving burdens, enabling greater workforce participation. Promoting flexible work arrangements accommodates women's diverse needs, encourages work-life balance, and fosters gender equality in the paid labor market.

To guide evidence-based policymaking, countries should invest in improved data collection and monitoring. Gathering gender-disaggregated data on informality, labor income share, and related variables enhances policymakers' understanding of informal work dynamics and its impact on women. Establishing effective monitoring mechanisms enables the regular assessment of policy effectiveness, facilitating adjustments as needed to reduce informality and improve female labor income share over time.

Recognizing that policy recommendations should be tailored to specific national contexts and that multiple factors contribute to the dynamics of informal work and female labor market outcomes, a comprehensive, adaptable, and context-sensitive approach is essential. Such an approach addresses economic, social, and gender-related dimensions, offering a promising path to reducing informality and enhancing FLIS across diverse income groups and countries.

Conclusion

Using two novel datasets of the size of the informal economy and female labor income share of 148 countries for the period 1991-2018, our study reveals a complex relationship between informality and the female labor income share that varies by income groups.

Globally, we find a negative correlation, indicating that countries with larger informal sectors tend to have lower female labor income share. This holds true even after adjusting for various factors, including GDP per capita. However, a closer look at income groups uncovers nuanced patterns. In high-income countries, where informal sectors are small, no significant association exists between informality and female labor income share. Conversely, low-income countries show a negative correlation due to limited formal job opportunities and weaker labor protections. Middle-income countries, characterized by diverse informal sectors, exhibit a positive correlation, influenced by economic development, gender norms, and the nature of informal work. Policy and institutional factors also play a role. Robust labor regulations and social protections in high-income nations reduce women's reliance on informal work. Conversely, low-income countries lack such safeguards, pushing women into informal jobs.

In summary, informality's impact on female labor income share varies by income level, economic development, gender norms, informal work types, and policy contexts. We believe that our study has crucial implications for the development of the right policy design towards informality. A gradual downsizing of informal sector while providing jobs for women in the formal sector is the key strategy. That is, it is crucial to consider the employer of last resort role of the informal sector to the poor, particularly women. Tailored strategies addressing economic growth, gender equality, education, labor regulations, social protection, financial inclusion, and data-driven policymaking are essential to mitigate informality's negative effects and promote gender equity. We also think that more research is very much needed on this topic. We especially think that future research should focus on the underlying economic mechanism behind this result.

Declarations of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

Table A1: Fixed Effects (with/without Unemployment/Growth)

	All	Low	Middle	High	All	Low	Middle	High
IS	-0.080***	-0.239***	0.077***	-0.128**	-0.080***	-0.232***	0.075**	-0.137**
	(0.016)	(0.028)	(0.028)	(0.059)	(0.017)	(0.028)	(0.030)	(0.062)
GDPpc	0.146***	-0.455***	0.049	0.060***	0.151***	-0.414***	0.033	0.070***
	(0.017)	(0.156)	(0.055)	(0.018)	(0.017)	(0.157)	(0.054)	(0.019)
Openness	0.007***	0.002	0.008**	0.004	0.006***	-0.000	0.007**	0.008***
	(0.002)	(0.005)	(0.004)	(0.003)	(0.002)	(0.005)	(0.004)	(0.003)
Unemployment	0.059***	-0.128***	0.045**	0.167***				
	(0.016)	(0.040)	(0.022)	(0.018)				
Growth					-0.006	0.012	-0.002	-0.066***
					(0.008)	(0.014)	(0.010)	(0.017)
IS×GDPpc	-0.006***	0.010**	-0.003**	-0.002**	-0.006***	0.011**	-0.003**	-0.003***
	(0.001)	(0.005)	(0.001)	(0.001)	(0.001)	(0.005)	(0.001)	(0.001)
Observations	3,900	1,607	1,013	1,280	3,886	1,606	1,011	1,269
Countries	148	61	39	48	148	61	39	48
R-squared	0.248	0.136	0.302	0.572	0.246	0.128	0.300	0.556

Notes: All models include a constant, country fixed effects and year dummies.
Standard errors in parentheses *** p<0.01, ** p<0.05

Table A2: Fixed Effects (with lagged values of independent variables)

	All	Low	Middle	High	All	Low	Middle	High
(Lag)IS	-0.072***	-0.239***	0.054*	-0.074	-0.091***	-0.256***	0.067**	-0.097
	(0.017)	(0.027)	(0.030)	(0.059)	(0.017)	(0.028)	(0.031)	(0.060)
(Lag)GDPpc	0.056***	-0.197**	-0.059*	0.034***	0.155***	-0.468***	0.067	0.064***
	(0.010)	(0.085)	(0.030)	(0.010)	(0.018)	(0.158)	(0.055)	(0.018)
(Lag)Openness	0.008***	-0.003	0.009**	0.006**	0.005**	-0.002	0.008**	0.006**
	(0.002)	(0.005)	(0.004)	(0.003)	(0.002)	(0.005)	(0.004)	(0.003)
(Lag)Unemployment	0.060***	-0.147***	0.036	0.134***	0.040**	-0.139***	0.037*	0.126***
	(0.016)	(0.040)	(0.022)	(0.018)	(0.016)	(0.040)	(0.022)	(0.018)
(Lag)Growth	-0.020***	0.017	-0.006	-0.069***	-0.008	0.015	-0.002	-0.065***
	(0.008)	(0.015)	(0.010)	(0.016)	(0.008)	(0.015)	(0.010)	(0.017)
(Lag)IS×(Lag)GDPpc					-0.006***	0.010**	-0.004***	-0.002*
					(0.001)	(0.005)	(0.001)	(0.001)
Observations	3,886	1,606	1,011	1,269	3,886	1,606	1,011	1,269
Countries	148	61	39	48	148	61	39	48
R-squared	0.238	0.136	0.307	0.574	0.248	0.138	0.313	0.575

Notes: All models include a constant, country fixed effects and year dummies.
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A3: Fixed Effects IV (2SLS) Results

	All	Low	Middle	High	All	Low	Middle	High
IS	-0.044**	-0.258***	0.061	-0.017	-0.072***	-0.262***	0.072*	0.030
	(0.020)	(0.041)	(0.041)	(0.073)	(0.024)	(0.034)	(0.039)	(0.095)
GDPpc	0.048***	-0.166	-0.057*	0.020*	0.149***	-0.245	0.086	-0.026
	(0.012)	(0.105)	(0.033)	(0.011)	(0.031)	(0.422)	(0.077)	(0.043)
Openness	0.012***	-0.005	0.012**	0.010***	0.007**	-0.005	0.011**	0.011***
	(0.003)	(0.007)	(0.005)	(0.004)	(0.003)	(0.008)	(0.005)	(0.004)
Unemployment	0.075***	-0.157***	0.038	0.149***	0.052***	-0.155***	0.036	0.160***
	(0.018)	(0.046)	(0.031)	(0.020)	(0.020)	(0.050)	(0.031)	(0.021)
Growth	-0.057***	0.069	0.001	-0.159***	-0.024	0.063	0.013	-0.177***
	(0.021)	(0.077)	(0.021)	(0.052)	(0.028)	(0.099)	(0.025)	(0.065)
IS×GDPpc					-0.006***	0.003	-0.004**	0.003
					(0.001)	(0.013)	(0.002)	(0.002)
Observations	3,737	1,544	972	1,221	3,737	1,544	972	1,221
Countries	148	61	39	48	148	61	39	48
R-squared	0.231	0.119	0.298	0.594	0.244	0.121	0.302	0.554

Notes: All models include a constant, country fixed effects and year dummies.
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A4: Fractional Logit Results

	All	Low	Middle	High	All	Low	Middle	High
IS	-0.422***	-1.455***	0.396**	-0.314	-0.549***	-1.518***	0.453***	-0.597*
	(0.115)	(0.159)	(0.158)	(0.303)	(0.114)	(0.167)	(0.161)	(0.315)
GDPpc	0.001**	-0.011*	-0.003**	0.000	0.007***	-0.021**	0.002	0.003***
	(0.001)	(0.006)	(0.001)	(0.001)	(0.001)	(0.009)	(0.003)	(0.001)
Openness	0.042***	-0.014	0.034**	0.027	0.026***	-0.008	0.033*	0.029*
	(0.010)	(0.018)	(0.017)	(0.017)	(0.010)	(0.019)	(0.017)	(0.017)
Unemployment	0.370***	-0.940***	0.214	0.723***	0.247***	-0.911***	0.219*	0.625***
	(0.074)	(0.194)	(0.134)	(0.089)	(0.073)	(0.193)	(0.133)	(0.095)
Growth	-0.085	0.098	-0.060	-0.280***	-0.017	0.089	-0.041	-0.246***
	(0.057)	(0.088)	(0.058)	(0.095)	(0.054)	(0.088)	(0.056)	(0.094)
IS×GDPpc					-0.032***	0.038*	-0.016**	-0.018***
					(0.003)	(0.020)	(0.008)	(0.005)
Observations	3,886	1,606	1,011	1,269	3,886	1,606	1,011	1,269
Countries	148	61	39	48	148	61	39	48
Pseudo R-squared	0.039	0.036	0.022	0.038	0.039	0.036	0.022	0.038

Notes: All models include a constant, country fixed effects and year dummies.
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1