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Informality, Inequality, and Feminization of Labor

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Abstract

Using two novel datasets of the size of the informal economy and income inequality, this study provides evidence on the nexus of informality and inequality with particular attention to the feminization of labor, a phenomenon closely related to labor market informalization. Using annual cross-country panel data from 125 countries for 1963-2016, the study reveals a relationship between the size of the informal sector and income inequality, which is more likely to be negative in richer countries and positive in poor ones. It also shows that, while higher women's labor force participation is associated with lower income inequality, this negative correlation is cancelled by the presence of an informal sector.

1. Introduction

There has been growing interest in the relationship between the size of the informal economy and income inequality. This study aims to contribute to the literature by utilizing two novel data sets of the informal economy and income inequality. It focuses on the feminization of labor as a crucial issue in labor market informalization.

There are different definitions of the informal economy proposed in the literature. According to one common definition, the informal economy refers to all economic activities that contribute to the officially calculated national income but are not registered (Schneider and Enste 2000). Some related concepts such as 'informal sector' or 'informal employment' are also frequently used to refer to the informal economy. Although we acknowledge the distinction as noted in ILO (2018), we prefer to refer to informal sector and informal employment interchangeably throughout the paper. About 85 per cent of informal employment takes place in the informal sector while the rest is in the formal sector and households (ILO 2018).

Feminization of labor is relevant to informalization. The term refers to women's increased participation in paid work as well as to the deterioration of working conditions in previously male jobs (Anker 1998; Standing 1999). Women's labor force participation has increased significantly since the late 1970s in most countries during the shift in economic paradigm. This economic restructuring has increased job opportunities for skilled labor, mostly in core countries, and for low skilled workers in the periphery. In this era, women have been disproportionately employed in the informal sector, particularly in low-income countries. As many as 92.1 per cent of employed women in the low-income countries are informal workers (ILO 2018).

Trade liberalization in the neoliberal era has increased competition, thereby forcing firms in the formal sector to reduce their costs. They prefer to avoid government regulations to reduce their tax and social security premiums 'burden'. In parallel to this development, firms, particularly in labor-intensive export-oriented sectors, disproportionally employ female workers, who are paid less due to gender segmentation in the labor market. Firms also prefer women workers for two further reasons that enable them to fit perfectly into this new informal setting. First, their labor productivity is higher due to the temporary nature of their employment; second, flexible and home-based work suits women workers and their needs, making them accept lower pay and insecure working conditions. Consequently, firms in this era have replaced mainly male workers in the formal sector with women in the informal sector (Standing 2006). This has contributed to the deterioration of income distribution, resulting from a shift in the economic paradigm.

The expanding informal sector and increasing income inequality have been closely related in this era, which has long attracted the attention of researchers. The literature suggests two contrasting effects of the informal sector on income inequality. On the one hand, the informal sector employs low-skilled or unskilled workers, providing income to the poor and excluded, thereby reducing income inequality. On the other hand, an expanding informal sector worsens income distribution as it reduces tax revenue, which could be used to redistribute income progressively. In turn, higher income inequality feeds informality via two main channels: by decreasing human and physical capital accumulation, especially for poorer people; and by increasing demand for informal sector products.

This study aims to provide more evidence on this nexus. This is valuable for two main reasons. First, we expand the nexus of informalization and inequality by considering

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feminization of labor. This is an important issue to better understand the relationship between informality and inequality, particularly considering the lack of previous empirical work. Second, most empirical research has used the Gini coefficient to investigate the effect of the size of the informal sector on income inequality. However, such data sets are rare. We overcome this problem by using novel datasets of income inequality and wage inequality, provided by the University of Texas Inequality Project. The study also utilizes a novel dataset of the informal economy with a significant time-series dimension, provided by Elgin et al. (2019). Using these two data sets, both by far the largest available, allows us to investigate the relationship between informality and inequality more robustly for 125 countries during 1963-2016 in an annual cross-country panel dataset. There are two main findings. First, there is a positive correlation between the size of the informal sector and income inequality. However, this interacts significantly with per-capita GDP, such that the correlation weakens and even becomes negative in countries with higher per-capita GDP. Second, while a greater women's labor force participation is associated with lower income inequality, this negative correlation mostly disappears if the informal sector is relatively large.

Section 2 presents the conceptual framework of the informal economy, income inequality, and feminization of labor. Section 3 introduces the data and empirical method. Section 4 presents the estimation results. Finally, Section 5 summarizes the findings.

2. Conceptual Framework

2.1 Informality and Inequality

There has been growing interest in the relationship between informality and income (or wage) inequality. The informal sector has become prevalent in many countries, particularly in

developing countries within the neoliberal paradigm, regardless of their chosen approach (Schneider and 2003; Elgin and Öztunalı 2012). During this era, previously atypical work (i.e. temporary, part-time, or informal employment) has become typical. The bulk of workers are employed in low-paid jobs because few decent jobs were created during this period. This has strengthened labor market segmentation (Rani 2008). Trade liberalization with fierce competition has forced firms in the formal sector to reduce prices and adjust production according to relative prices between the formal and informal sectors to preserve their market shares. Firms, therefore, cut down their costs, mainly via labor cost, by hiding economic activities from governmental regulation to reduce their tax and social security premiums 'burden' (Mishra and Ray 2010). Trade liberalization has thus created low-paid jobs, particularly in developing countries, which has increased income inequality by pushing wages down overall and widening the wage gap between skilled and unskilled workers. Blanchard and Landier (2002) show that low wages and increased job insecurity cause income inequality by suppressing upward mobility among atypical workers.

There are several channels through which informalization of labor market might affect income inequality (Schneider and Enste 2000; Mishra and Ray 2010; Dell'Anno 2016a) while income equality also has feedback effects on the size of informal sector. On the one hand, informal sector firms employ low-skilled or unskilled workers, thereby providing an income to the poor and excluded, which improves income distribution.[1] On the other hand, an expanding

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[1] There are two contrasting views on this issue (Williams 2014). According to the marginalization thesis, marginalized people, such as the unemployed and low-income groups, are more likely to participate in the informal sector. Therefore, this group disproportionately benefits from the informal sector. According to the reinforcement thesis, these marginalized populations benefit less from the informal economy than those who are employed and

informal sector increases income inequality as it reduces tax revenue, which could have been used for progressive income redistribution. In return, higher income inequality feeds informality via two main channels: by decreasing human and physical capital accumulation; and by increasing demand for informal sector products.

Negative impact of informalization on income distribution

An increasing informal sector shrinks tax revenues and social security payments. This means that governments have fewer funds to use to redistribute income (e.g. investment in infrastructure and public education, and welfare programs), causing higher income inequality. The decline in the tax and social security bases in turn causes higher budget deficits and increased tax rates (Schneider and Enste 2000; Schneider and Klingmair 2003; Mishra and Ray 2010). This forces governments to increase the tax rate to address the leaks in revenue, which creates a vicious circle because higher tax rates encourage firms and individuals to remain in or switch to the informal economy. The informal economy also aggravates lack of trust in government and institutions, which encourages more corruption and illegal activities among angry citizens.

Positive impact of informalization on income distribution

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higher-income groups due to the lack of resources to engage in the informal sector (e.g. a car), having fewer opportunities, and the lack of skills to perform informal jobs. Therefore, the informal sector does not reduce inequality in the economy but rather reinforces it. Williams (2014:14) argues for the case of the UK that the two theses are incompatible. Marginalized groups do more informal work yet gain less benefit from the informal economy. In other words, the informal economy actually strengthens the inequalities that the formal economy creates.

The informal economy mostly employs those who cannot find jobs in the formal sector, providing a source of income for low or unskilled workers, and serving as a safety net when unemployment is high. The sector increases workers' skill levels, thereby increasing human capital accumulation in the overall economy. Thus, by providing job opportunities for low-income workers, the informal economy may to some extent improve income distribution.

Effect of income inequality on the informal sector

Increasing income inequality feeds back into the informal sector through two mechanisms. First, particularly in developing countries, products from the formal and informal sectors can be considered as substitutes for each other, with informal sector production associated with lower quality. Therefore, as inequality rises, demand for the informal sector's low-quality products will increase (Mishra and Ray 2010) while the relative benefits of joining the formal sector decline (Chong and Gradstein (2007). Both effects favor the informal sector. Second, the large number of wealth-constrained individuals associated with higher inequality might increase the size of the informal sector. Without access to formal credit mechanisms, these wealth-constrained individuals and firms are less likely to operate in the formal sector, where fixed costs are much higher than in the informal sector (Mishra and Ray 2010). Moreover, income inequality is associated with gender inequality and lower female incomes, and the latter is negatively correlated with the fertility rate. That is, a more unequal distribution of assets raises the fertility rate, and, under the assumption of an imperfect capital market, it reduces productive investments in human capital per capita because families do not have sufficient access to credit.

A growing empirical literature has investigated the relationship between income inequality and the informal sector. Rosser et al. (2000, 2003) found a significant positive relationship between income inequality and the informal sector in 16 and 18 transition economies in the 1990s. They argued that a growing informal sector reduces tax revenues, which in turn reduces the impact of government income redistribution policies. Ahmed et al. (2007) on 52 countries, and Dell'Anno (2008) and Amarante and Arim (2017) on Latin American countries also found a positive relationship. In a cross-country analysis for 1990–2000, Chong and Gradstein (2007) found that rising inequality in a country is associated with growth of the informal sector. Mishra and Ray (2010)'s findings from around 40 countries in 2002-2006 suggested that higher inequality leads to a larger informal economy. Winkelried (2005) and Binelli (2016) on Mexico, Krstic and Sanfey (2007) on Bosnia and Herzegovina, Krstic and Sanfey (2011) on Serbia, Elveren and Özgür (2016) on Turkey, Zuo (2016) on China, Ariza and Montes-Rojas (2017) on Colombia, Amarante and Arim (2015) on Chile, Ecuador, and Uruguay, and Amarante et al. (2016) on Uruguay all reported positive relationships between informality and income inequality.

However, other studies report insignificant or even negative relationships between inequality and informality. Eilat and Zinnes (2002), for example, found no significant relationship between the size of the informal economy and income inequality in transition countries. Gutiérrez-Romero (2007) on Latin America and Sub-Sahara showed that, while the correlation between the size of the informal economy and inequality is positive for developed countries, it is negative for developing countries. After studying 16 transition countries with a dynamic real business cycle model, Dell'Anno and Solomon (2014 reported an inconclusive

relationship between income inequality and the informal sector. Finally, Dell'Anno (2016b), using average values from 1999 to 2007 for 118 countries in a cross-sectional regression, found a negative relationship between informality and inequality.

These inconclusive findings on the relationship between income inequality and the size of informal sector are due to measurement issues for both inequality and informality, and the nonlinear relationship between the variables, as underscored by Gutierrez-Romero (2007). Regarding the measurement of income inequality, Valentini (2009) notes two issues (cited in Dell'Anno 2016b). First, most income inequality indices measure *declared* incomes, which yields a biased comparison of countries that have informal sectors of different sizes.[2] Second, he argues that it is implausible to assume that unobserved income grows uniformly along with income distribution. This is because the correlation between the size of informal sector and income inequality depends on the predominant nature of the unobserved income. That is, "if the unobserved income is higher (lower) for the poorer than for the richer, we could have a positive (negative) relationship between the size of informal economy and income inequality, or vice versa" (Dell'Anno 2016b: 345). Regarding measurement of the informal economy, Dell'Anno and Solomon (2014) note that the regressions are likely to yield insignificant or negative relationships between the informal sector and income inequality if the former is calculated by a currency approach, modified electricity consumption, and derived from statistics compiled by national agencies, whereas it is more likely to show a significant positive relationship if the size of the informal sector is calculated by the MIMIC approach. These differences are very much related to the observed variables used as indicators or causes of the informal economy.

2.2 Informality and Feminization of Labor

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[2] Since we use the manufacturing pay inequality index and an estimated household income inequality index derived from the former, our results do not include such a bias.

The term feminization of labor refers to women's increased participation in paid work as well as to the deterioration of working conditions in previously male jobs (Anker 1998; Standing 1999). There is a U-shaped long-term relationship between women's share of employment and a country's level of economic development (Pampel and Tanaka 1986; Goldin 1995; Çağatay and Özler 1995; Gaddis and Klasen 2011; Verick 2018). During the shift from agriculture to industry, increased productivity benefits men more than women as men are more educated while women withdraw from the agricultural sector. However, higher stages of economic development generate more job opportunities for women as their education levels rise, fertility rates fall, and gender relations change to allow them to work in the labor market (Goldin 1995; Çağatay and Özler 1995). Therefore, women's labor force participation has increased significantly in most countries since the late 1970s. The neoliberal era has also been associated with a decline in job segregation and an improvement in the female/male wage ratio caused by reductions in the gender gap in education and employment experience (Benería et al. 2016). During this era, employers in labor-intensive, export-oriented sectors have particularly preferred female workers for three main reasons (Benería et al. 2016: 115). First, women are paid less due to gender segmentation in the labor market; second, employers achieve higher labor productivity with women workers due to their intermittent employment; third, firms seeking r lower risk and higher flexibility to increase competitive power prefer informal settings and home-based work, which are mainly performed by women workers. Thus, to maintain higher profit margins, employers reduce the number of formal workers and extensively rely on women in the informal sector (Standing 2006).

The economic paradigm shift that began in 1980 mostly increased job opportunities for skilled labor in *core* countries but for low skilled workers in the *periphery*. During this economic

restructuring, men mainly remained in the formal sector whereas women were disproportionately employed in the informal sector. The literature suggests some demand and supply factors to explain this pattern. Regarding the demand factors, discrimination against women in the formal sector, either due to employers' pure bias against women and/or due to maternity leave or women's intermittent work life, forced women to consider job opportunities in the informal sector. Regarding the supply factors, the informal sector is more advantageous for women in terms of balancing homework and market work and providing a safety net for the household.

The neoliberal era, on the one hand, has generated more employment opportunities for highly-educated women in high-paying jobs. However, it has provided atypical jobs for less-educated women – lower-paid casual work based on temporary contracts and home-based work – in the export-oriented informal sector in lower income countries. The feminization of labor expanded first in the manufacturing sector as developing countries specialized in low-cost manufacturing with respect to the global division of labor (Joekes 1999; Seguino 2000; Perrons 2004; Saracoglu et al. 2018).The feminization of labor was significant in semi-industrialized economies specializing in labor-intensive export sectors, such as textiles, apparel, leather products, food processing, as well as electronics and automobiles which heavily rely on assembly, a labor-intensive activity (Çagatay and Özler 1995; Tzannatos 1999). More recently, women's employment has extended into service sectors, such as call centers and data entry, particularly in Asia. However, especially focusing on manufacturing in developing countries, recent studies suggest that "the relationship between trade expansion and feminization is not definitive and uniform" (Wood 1991; Kucera and Milberg 2000, 2003; Kongar 2007; Özay 2015; Saracoglu et al. 2018:2). Most recently, Saracoglu et al. 2018 showed that defeminization in low-tech manufacturing sectors in the North that began in the 1980s continued through the 1990s and

early 2000s. In the South, while the patterns in middle-income OECD countries were similar to the North, in some developing countries feminization in low-tech industries continued.

Overall, the global level of informal employment, excluding agriculture, is 50.5 per cent (ILO 2018). The share of informal employment is as high as 86 per cent in Africa while 25 per cent of employment is informal in Europe and Central Asia (ILO 2018). Although globally informal employment is more common among employed men then employed women, at 63 and 58 per cent, respectively, the same rations are 87.5 and 92.1 in low-income countries. Moreover, women hold the most vulnerable positions in informal employment, such as domestic workers, home-based workers, or contributing family workers (ILO 2018). In the neoliberal era, economic restructuring and globalization have strengthened the links between the formal and informal sectors, making the distinction between the formal and informal sector increasingly vague (Beneria 2001). To increase their competitiveness and profits, firms in the formal sector have increasingly relied on outsourcing and subcontracting in the informal sector, thereby encouraging informality and poor working conditions.

Although there has been improvement in some countries, the gender wage gap is still highly significant (Berik, 2000; Oostendorp 2009; Weichselbaumer and Winter-Ebmer, 2005). Women have been mostly employed in lower-paid secondary positions with limited mobility towards higher-paid, skilled jobs, or to supervisory positions due to patriarchal norms embedded in cultural, political, legal, and economic institutions (Seguino, 1997; Berik et al., 2009).

The effect of gender inequality on economic growth has been documented in the feminist literature (Berik et al. 2009). The use of 'less skilled' and lower-paid female workers directly reduces unit costs as women are perceived as more productive than men in certain jobs. With their 'nimble fingers', women are supposedly more consenting and less inclined to worker

unrest, more suited to tedious work, and more reliable and trainable compared to men (Elson and Pearson 1981). In addition, based on a divide and rule approach regarding labor, women help to suppress male wages by lowering their bargaining power against employers.

2.3 Feminization of Labor and Income Inequality

In this paper we examine the impact of both informality and feminization on income inequality as well as wage inequality. The relationship between informality and inequality is widely documented in the literature as reviewed above, whereas there is less empirical research on that between feminization (e.g. women's labor force participation or gender inequality) and income (or wage) inequality. Gender inequality impacts income inequality both directly via gender wage inequality and indirectly via inequalities in opportunities (Gonzales et al. (2015). The gender wage gap and the gender gap in labor force participation rates widen income inequality. Inequalities in access to education, health provision, financial markets, and resources worsen income distribution. Such inequalities between women and men also have long-term impacts via their differing effects on boys and girls.

Gonzales et al. (2015) showed that different aspects of gender inequality, such as gaps in labor force participation, educational attainment, and parliamentary representation, as well as the UN's Gender Inequality Index, have negative impacts on income distribution. Increasing employment opportunities for highly-educated women during the neoliberal era has contributed to household income inequality through so-called assortative mating (Greenwood et al 2014). Costa et al. (2009) used a simulation analysis to show that an increase in women's labor force participation reduced inequality in eight Latin American countries. Elveren (2014) found for 58 countries during 1990–2005 that higher women's labor force participation increases income inequality in developing countries whereas it reduces it in developed countries.

The gender gap has an ambiguous effect on pay inequality. First, due to the gender segregation of employment, which causes an oversupply in the women's labor force, it is expected that increasing the number of women in the labor market reduces average wage levels for women, thereby causing higher pay inequality. Second, increasing the number of women workers as a reserve army of the unemployed can depress men's wages, which exacerbates pay inequality by equalizing wages downward. According to the crowding hypothesis, however, this effect may be insignificant due to job segregation between males and females – at least to a certain degree in developed countries. Finally, increasing the number of highly-educated female workers reduces the skill premium, which lessens pay inequality (World Bank, 2001). Hence, the overall effects of gender inequality on the gender gap and gap in labor force participation on pay inequality are ambiguous.

3. Data and Method

3.1 Data

Informality

Several different methods are frequently used in the literature to measure the size of the informal economy. We use the updated version of a novel data set on the size of informal economy provided by Elgin et al. (2019), based on the two-sector dynamic general equilibrium (DGE) model of Elgin and Öztunalı (2012). This unbalanced panel data set covers 161 countries from 1950 to 2016. These estimates reflect several different dimensions of informality with outstanding country and year coverage to produce by far the largest dataset of informality using the specific DGE method, and the only one going back to the 1950s. However, because the time variation of the DGE estimates relies on several strong assumptions, we checked for robustness with the estimates from Elgin et al. (2019) based on the multiple-indicators-multiple causes

(MIMIC) method as well as the data series on informal employment (as % of total non-agricultural employment) provided by employment surveys through the ILO,[3] albeit with a smaller time dimension from 1993 to 2016.

Inequality

Considering the sparse coverage in time and inconsistent definitions and different quality of data among countries of the Gini coefficient (Galbraith and Conceição 2001 and Galbraith and Kum 2005), we use two different data sets. Due to those problems, Galbraith, Lu, and Darity (1999) computed a measure for manufacturing pay inequality using Theil's formula (Theil 1972). The University of Texas Inequality project (UTIP) provided the index, called UTIP-UNIDO industrial pay inequality. UTIP-UNIDO is a global panel dataset of industrial pay-inequality measures for 151 countries from 1963 to 2015, based on the UNIDO Industrial Statistics. We call this data set *Theil*. Our second data set, the Estimated Household Income Inequality Data Set (EHII), is derived from the econometric relationship between *Theil*, other control variables, and the World Bank's Deininger & Squire data set. The set covers 147 countries from 1963 to 2015. We call this data set *EHII* (see Galbraith et al. (2015) for a comparison of *EHII* with other major data sets).

We also utilize the Standardized World Income Inequality Database (SWIID), computed by Solt (2019), for the robustness check. The SWIID is based on reported Gini indices from several sources, including the OECD Income Distribution Database, the Socio-Economic Database for Latin America and the Caribbean generated by CEDLAS and the World Bank, Eurostat, the World Bank's PovcalNet, and the UN Economic Commission for Latin America

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[3] We do not provide these additional results due to space constraints. However, they are available upon request from the corresponding author.

and the Caribbean. Solt (2019) used the data provided by the Luxembourg Income Study as the base dataset. The SWIID provides Gini values[4] for 196 countries from 1960 to the present.

Other control variables

GDP per capita and economic growth were obtained from Penn World Tables 8.1. (PWT). Trade openness, measured as the sum of the share of imports and exports in GDP (at current PPPS), is also taken from PWT. Unemployment rates and female labor force participation rates were acquired from the World Development Indicators.

3.2 Method

In our panel data regression analyses, we use two different methods with different sets of control variables, and stratify our dataset according to different levels of income per capita. In the benchmark analysis, we estimate the following regression equation using the panel fixed-effects estimator:

$$INEQ_{it} = \alpha_1 + \beta IS_{it} + \boldsymbol{\theta X_{it}} + \pi_i + \mu_t + \epsilon_{it}$$

Here, for country *i* and year *t*, *INEQ* denotes the inequality measure used as the dependent variable, *IS* denotes the informal sector size as a percentage of GDP. The coefficient estimate β measures the magnitude and direction of the impact of the informal economy on income inequality. In all regressions, a vector of control variables ($\boldsymbol{X_{it}}$), country fixed effects (π_i), and year fixed effects (μ_t) are controlled for. In addition to the benchmark estimates with the whole dataset, we also report panel fixed-effects regression results after stratifying the dataset

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[4] SWIID reports Gini series calculated using both disposable and market income. In our robustness checks, we only report estimation results using the Gini constructed by market income; however, using Gini with disposable income does not qualitatively affect our reported results.

into three categories: low, middle, and high-income countries. All regressions are reported separately, using EHII, THEIL, and SWIID indices of income inequality.

Suspecting that endogeneity could bias our benchmark results, we also take an instrumental variable, two-stage least square (IV-2SLS) approach to illustrate how income inequality and informality might be related to each other. Therefore, we consider instrumental variables that cause shocks to the independent variables (including the controls) but not directly to the dependent variable, income inequality. To this end, we use all the lagged independent variables as instruments for their levels. In this case, in the first stage, we regress all the independent variables on their respective lags, and then use the predicted values as regressors in the second stage, where the dependent variable is income inequality. In both stages, country fixed effects (π_i) and year fixed effects (μ_t) are controlled for.

4. Results and Discussion

4.1 Benchmark Results

Below are the results of the panel regression analyses on the nexus of informality, inequality, and the feminization of labor, presented in three main sets. The first set of results is fixed-effect regressions based on several model specifications. These results are presented for dependent variables of *EHII* and *Theil* in Table 2 and Table 3, respectively. The second set is the results with respect to different income levels, presented in Table 4. Finally, considering possible endogeneity issues, the results of the 2SLS-IV regressions are reported in Table 5. The descriptive statistics are presented in Table 1.

Table 1: Summary Statistics of the Dataset

	Mean	Std. Dev.	Min	Max	Obs.
Theil Index (%)	5.02	6.65	0.04	75.48	4262
EHII	42.51	7.33	0.58	62.85	4168
Informal Sector Size (% of GDP)	35.10	14.73	7.92	112.56	7708
GDP per capita (thousand USD)	12.85	19.88	0.16	238.58	8483
Trade Openness (%)	48.54	51.79	0.01	1500.42	8534
Growth (%)	0.49	0.52	-0.57	2.05	8354
Unemployment (%)	8.28	6.23	0.10	51.50	4758
FLFPR (%)	45.69	15.73	1.93	94.40	3199
Gini Index	43.70	6.74	1.90	68.60	4863

Table 2 reports the benchmark regression results using *EHII* as the dependent variable. The results are very consistent with respect to all model specifications. In all the fixed-effects regressions, while economic growth and trade openness have no significant effect on income inequality, the signs of the estimated coefficients of *IS* (e.g. the size of informal sector), *GDP per-capita* and *unemployment* are positive. This finding of a positive relationship between the informal sector and income inequality is in line with other major studies (Rosser et al. 2000, 2003; Ahmed et al. 2007; Dell'Anno 2008; Chong and Gradstein 2007). However, the estimated coefficient of the interaction term between GDP per capita and *IS* is also significantly negative in all regressions. This indicates that the nature of the informality-inequality nexus may be different in poorer and richer countries. That is, informal sector size and EHII are positively correlated for countries below a threshold level of GDP per capita whereas the correlation becomes negative at higher levels. This is an important finding in that it suggests that the negative effect of the informal sector on income distribution, via tax revenue losses, is higher than its positive effect, via being the employer of last resort for the poor and excluded in poor countries. This is also confirmed by the findings in Table 4, which presents the results by income levels. The existence of a non-linear relationship is underscored by Gutierrez-Romero (2007).

The results in Table 2 show that higher unemployment is associated with higher income inequality, which is an expected result in the context of the reserve army of the unemployed. That is, a higher rate of unemployment lowers the bargaining power of workers, pushing down wages and increasing income inequality. In four out of five specifications, the results suggest that increasing women's labor force participation reduces income inequality. This is in line with the findings of Gonzales et al. (2015), Costa et al. (2009), and Elveren (2014). However, it is also important to note that the coefficient of the interaction term between female labor force participation rate and informal sector size is significantly positive. This is a critical finding in that although increasing women's labor force participation improves income distribution, this effect is cancelled out by the worsening effect of the informal sector. In other words, the positive effect of the informal sector outweighs the negative effect of FLFPR, making the overall effect positive.

Table 2: Panel Regressions

Dep. Var.: EHII

	FE	FE	FE	FE	FE	FE	FE
IS	16.89*	17.23*	17.34*	9.64***	17.38*	7.25	19.65*
	(6.19)	(6.21)	(6.07)	(5.65)	(6.65)	(7.76)	(6.33)
GDP per-capita	0.17*	0.16*	0.16*	0.11**	0.13**	0.21*	0.17*
	(0.06)	(0.06)	(0.06)	(0.05)	(0.06)	(0.05)	(0.05)
IS GDP-cap	-1.03*	-1.02*	-1.00*	-0.84**	-0.88*	-1.02	-0.90*
	(0.38)	(0.37)	(0.35)	(0.35)	(0.26)	(0.28)	(0.28)
FLFPR	-0.04***	-0.04***	-0.05*			-0.14*	-0.01
	(0.03)	(0.03)	(0.03)			(0.05)	(0.03)
IS FLFPR						0.38*	
						(0.12)	
Openness	0.94	0.95		1.22			
	(1.60)	(1.60)		(1.33)			
Growth	1.14			1.31			
	(2.85)			(1.65)			
Unemployment					0.08**	0.14*	0.13*
					(0.04)	(0.04)	(0.04)
R-squared	0.35	0.35	0.34	0.27	0.29	0.37	0.35
Observations	2191	2194	2194	3904	2765	2015	2015

All regressions include a constant as well as country and year dummies. Robust standard errors are reported in parentheses. *, **, *** denote 1, 5 and 10% confidence levels, respectively. The number observations in each regression are different due to the significant differences in the size of each series.

Comparing Tables 2 and 3, the results show that while the informal sector has a highly

significant positive effect on income inequality, *EHII*, it has no significant effect on wage

inequality, *Theil*. This is not an unexpected result since *Theil* measures wage inequality between

skilled and unskilled manufacturing workers, which reflects the formal sector pay gap.

Moreover, self-employment, the form of work most of women (as well as men) work as own-

account workers or contributing family workers, is a major source of informal employment. This

further reinforces our supposition that, *Theil* does not reflect the pay/income of this group. The

literature does not specify how the informal sector affects the wage inequality. Rather, it

influences income distribution by providing income mainly to the poor and excluded and by

reducing tax revenues that could be used to redistribute income. This finding also suggests that

the effect of the informal sector on inequality is highly sensitive to how inequality is measured.

Table 3: Panel Regressions

Dep. Var.: Theil

	FE	FE	FE	FE	FE	FE
IS	0.08	0.12	0.11	0.04	0.08	0.07
	(0.08)	(0.09)	(0.09)	(0.06)	(0.09)	(0.09)
GDP per-capita	-0.000	-0.000	-0.000	-0.001	0.001	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
IS GDP-cap	-0.001	-0.000	-0.001	-0.002	-0.01*	-0.005
	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)
FLFPR	0.000	0.000	0.000			0.001)
	(0.000)	(0.000)	(0.000)			(0.001)
Openness	-0.01**	-0.009**			-0.007	
	(0.004)	(0.005)			(0.005)	
Growth	0.08**				0.03	
	(0.03)				(0.03)	
Unemployment					-0.000	0.000
					(0.000)	(0.000)
R-squared	0.11	0.12	0.11	0.11	0.10	0.09
Observations	2240	2243	2243	4011	2848	2061

All regressions include a constant as well as country and year dummies. Robust standard errors are reported in
parentheses. *, **, *** denote 1, 5 and 10% confidence levels, respectively. The number observations in each
regression are different due to the significant differences in the size of each series.

4.2 Robustness Checks

Table 4 reports the regressions results with respect to the three different income levels for *EHII* and *Theil*. The low category corresponds to a GDP per capita below 5,000 USD; the middle category includes countries between 5,000 and 15,000 USD; the high-income category includes those above 15,000 USD. The results show that the positive relationship between the informal sector and both income inequality and wage inequality holds only for low-income countries. This suggests that the informal sector has no significant effect on inequality in countries with a relatively small informal sector, considering the negative correlation between GDP level and the size of informal sector. As in Table 2, the sign of the interaction term between GDP per capita and informal sector size is negative and significant, but only for high-income countries for *EHII*. This suggests that expanding the informal sector in rich countries reduces income inequality as the informal sector provides more job opportunities for the poor and excluded.

Table 4: Panel Regressions: Different Income Levels

	EHII			Theil		
	Low	Middle	High	Low	Middle	High
IS	50.67*	15.04	17.49	0.57*	-0.28	0.12
	(9.34)	(15.36)	(21.31)	(0.15)	(0.37)	(0.12)
GDP per-capita	0.19	-0.16	0.19*	0.008	-0.01	0.001
	(1.21)	(0.32)	(0.04)	(0.01)	(0.01)	(0.0003)
IS GDP-cap	0.36	-0.79	-0.79*	0.002	0.002	-0.002
	(3.06)	(0.94)	(0.30)	(0.04)	(0.02)	(0.003)
FLFPR	0.03	-0.01	-0.02	0.0004***	0.001	0.001
	(0.03)	(0.04)	(0.03)	(0.0002)	(0.001)	(0.001)
Unemployment	0.15***	0.11**	0.17**	0.0006	0.0004	0.0006
	(0.08)	(0.05)	(0.07)	(0.001)	(0.001)	(0.0005)
R-squared	0.40	0.27	0.52	0.36	0.24	0.14
Observations	211	630	1174	214	641	1206

All regressions include a constant as well as country and year dummies. Robust standard errors are reported in parentheses. *, **, *** denote 1, 5 and 10% confidence levels, respectively.

Table 4 also confirms the positive relationship between unemployment and income inequality and the lack of any significant effect of unemployment on wage inequality, as shown in Tables 2 and 3. The findings also suggest that female labor force participation has no significant effect on income or pay inequality for different national income levels. Only *Theil* has a (weak) significant relationship, showing that increasing women's labor participation exacerbates wage inequality in low-income countries. This suggests that increasing women's labor force participation in poor countries does not suppress men's wages due to gender segregation in employment, but rather reduces women's average wage levels. Thus, FLFPR does not reduce wage inequality, which supports the findings of Elveren (2014).

Moreover, considering possible endogeneity, we also used 2SLS-IV regressions, as shown in Table 5. These results confirm the main findings from the previous regressions that a larger informal sector is associated with higher income inequality, as well as the reserve army of the unemployed argument. In addition, in line with Table 2, the coefficients of the interaction terms between the informal sector and GDP per capita, and between the informal sector and FLFPR are negative and positive, respectively.

Table 5: Panel Regressions: IV Regressions

Dep. Var.: EHII			
IS	11.72**	21.52*	-3.45
	(5.83)	(7.32)	(8.88)
GDP per-capita		0.09**	0.25*
		(0.04)	(0.05)
IS GDP-cap			-1.36*
			(0.29)
Unemployment		0.19*	0.15*
		(0.06)	(0.05)
FLFPR		-0.007	-0.17**
		(0.04)	(0.07)
IS FLFPR			0.53*
			(0.17)
Wald	0.00	0.00	0.00
Observations	3885	1713	1713

All regressions include a constant as well as country and year dummies. Robust standard errors are reported in parentheses. *, **, *** denote 1, 5 and 10% confidence levels, respectively. The number observations in each regression is different due to the significant differences in the size of each series.

Table 6: Panel Regressions with Gini Index

Dep. Var.: EHII

	FE	FE	FE	FE	FE	FE	FE
IS	16.08*	15.80*	16.08*	1.66	8.31***		
	(4.75)	(4.63)	(4.70)	(4.46)	(4.99)		
GDP per-capita	0.19*	0.20*	0.21*	0.21*	0.18*	0.25*	0.26*
	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.06)	(0.06)
IS GDP-cap	-0.92*	-0.95*	-0.91*	-1.03*	-0.69**	-0.90*	-1.18*
	(0.31)	(0.30)	(0.31)	(0.32)	(0.28)	(0.32)	(0.34)
FLFPR	-0.07**	-0.07**	-0.08*			-0.09**	-0.13**
	(0.03)	(0.03)	(0.04)			(0.04)	(0.06)
IS FLFPR						0.16**	0.17**
						(0.08)	(0.08)
Openness	0.97	1.01			1.65***		
	(0.77)	(0.79)			(0.91)		
Growth	-0.26				1.55		
	(1.90)				(1.32)		
Unemployment						0.10*	0.12*
						(0.03)	(0.03)
R-squared	0.38	0.38	0.37	0.27	0.29	0.37	0.36
Observations	2647	2649	2649	4607	3871	2515	2649

All regressions include a constant as well as country and year dummies. Robust standard errors are reported in parentheses. *, **, *** denote 1, 5 and 10% confidence levels, respectively. The number observations in each

As a final robustness check, we replicated our regressions with the Gini index series from the SWIID (constructed using market income). The estimation results presented in Table 6 are very similar to those in Table 2, where the dependent variable is *EHII*. Specifically, the correlation between informal sector size and the Gini index significantly interacts with GDP per capita while the correlation between female labor force participation and the Gini index interacts with informal sector size. However, somewhat differently from Table 2, we did not include informal sector size on its own in the last two regressions, as its estimated coefficient's significance was highly reduced both. (p-value being larger than 0.8)

5. Conclusion

This study aimed to provide the first evidence on the nexus of informality, inequality, and the feminization of labor. Using novel data sets of the size of the informal sector and income inequality (and as well as wage inequality), the study shed light on the relationship for 125 countries between 1963 and 2015.

There were two main findings. First, there is a strong positive correlation between informal sector size and income inequality. This finding, based on many countries and an extended time period, supports and strengthens evidence in other major studies in the literature (Rosser et al. 2000, 2003; Ahmed et al. 2007; Dell'Anno 2008; Chong and Gradstein 2007). Our study also showed that the nature of the informality-inequality nexus may differ between poorer and richer countries in that it is more likely to be a positive relationship in poor countries and a negative relationship in rich ones. This finding is in accordance with the literature, which suggests a nonlinear relationship between these variables (Gutierrez-Romero 2007).

Second, this study investigated the strong linkage between informality and feminization of labor, specifically its effect on income inequality. The findings suggest that increasing women's labor force participation reduces income inequality, supporting the early findings of Gonzales et al. (2015) and Costa et al. (2009). However, the beneficial effect of women's labor force participation rate is cancelled out by the worsening effect of the informal sector on income inequality. This important finding suggests that economic policies aiming to increase women's labor force participation alone may have limited benefit unless they address the significant linkage between informalization and the feminization of labor. Therefore, these policies have to be enriched with several fiscal policy tools addressing informality, such as improving tax enforcement.

Women are disproportionately employed in the informal sector due to both demand and supply factors. On the one hand, employers take advantage of lower pay and women's intermittent working life to attain higher productivity from women per dollar. On the other hand, women find the informal sector more advantageous for balancing housework and market work and providing a household safety net. Furthermore, although the gender wage gap has declined, it remains associated with the formal sector as women experienced no such improvement in the informal sector.

The biggest challenge for women, and the root cause of gender inequalities in the labor market, is balancing housework and market work, given that they do 2.5 times more unpaid care work than men (Çağatay et al. 2017). Public investment in social care helps create more decent job opportunuties for women, thereby reducing both gender inequalities and overall income inequality. Policy simulations show that an economic policy expands social care services rather

than allocating more resources to conventional male-dominated sectors generates more jobs and higher economic growth (Çağatay et al. 2017).

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