Declining Labor Market Informality in Turkey: Unregistered Employment and Wage Underreporting

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Abstract

Abstract. This paper examines the trends in labor market informality in Turkey at two margins, unregistered employment and wage underreporting. We first document the stylized facts about the informal employment and its change over the past 15 years from 2004 to 2018. While doing this, we examine the heterogeneity in the informality across regions, sectors, firm properties and worker characteristics. Second, we decompose the change in the informality rate into its components using the Oaxaca-Blinder methodology. We find that the workforce composition change in gender, age, education, occupation, and industries explains half of the decline in the informality rate from 2004 to 2018. Finally, we analyze the wage underreporting behavior in Turkish labor market using both survey data and social security registry. We show that there has been a gap between the wages earned and the wages declared to Social Security Institution among registered employees. However, this discrepancy has declined significantly in recent years.

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Non-technical Summary

Informality in labor markets is one of the major concerns in all developing countries. Not only reduction in productivity and growth, but also lack of social safety nets for workers and their families are detrimental consequences of informality of this kind. Despite improvements over time, Turkish labor market still incorporates significant amounts of informality. Understanding structure of informality as well as the reasoning factors in the country is critical for public policy design. This study analyzes labor market informality in terms of unregistered employment and wage underreporting in Turkey.

We first document the stylized facts about unregistered employment and its changes over the period between 2004 and 2018. We particularly examine how unregistered employment differs according to worker and firm related characteristics. We find that unregistered employment is more widespread among less educated, young and female workers as well as among small firms and firms operating in agricultural and construction activities. There are also regional variations in this type of informality even after controlling for the observable worker and firm related characteristics. Second, we decompose the changes in the rate of informal employment into its components using Oaxaca-Blinder decomposition methodology. Specifically, we identify explained and unexplained causes of the change in informality over this period. We find that compositional change in the workforce can explain 51% of the reduction in informality rate. The rise in education level and firm size, and the shift from agriculture to service sector suppressed Turkey's informality rate. Overall, the decomposition analysis implies that almost 8 percentage point of the 17 percentage point decline in informality rate from 2004 to 2018 would happen even if the sample characteristics remained the same at the 2004 level and the remaining decline by 9 percentage point is due to the change in sample characteristics.

Finally, applying a cell-based approach we combine Household Labor Force Survey data and social security registrations to investigate the size of wage underreporting. We construct cells of individuals based on sector, firm size, gender, and age of workers. We show that even among formally employed individuals, there is a gap between the wages earned and the wages declared to Social Security Agency. Yet, we also show that this discrepancy between officially declared wages and actual wages has diminished during the past few years. This is partially because of the relatively high minimum wage policy.

1. Introduction

Informal employment evades labor regulations and therefore offers an extreme flexibility to both sides of the labor market, the demand side in particular. When there is an abundant labor supply, firms easily evade minimum wage restrictions, social security premiums, hiring and firing regulations through informal employment. In the absence of strict enforcement, individuals who have relatively low reservation wage and low negotiation power accept informal employment sacrificing their labor market security. This situation leads to a dual environment where part of the relatively larger firms and more established stay within the formal economy paying higher labor costs, and another part enjoys the advantages of low labor cost. Similarly, some employees have higher wages, employment security, and unemployment insurance, whereas others lack all these advantages.

Despite the regulations banning informal work, informal employment constitutes a large fraction of total employment in developing countries. Informality is a significant phenomenon in the Turkish labor market and has been on policymakers' agenda for a long period. This paper first documents the stylized facts about labor market informality and its change over the 2004-2018 period. While doing this, we examine the heterogeneity in informality across regions, sectors, firm, and worker characteristics and discuss the factors that might affect informality. From a static perspective, this explains the current determinants of labor market informality, and from a dynamic perspective, this sheds light on the causes of reduction in overall informality over 2004-2018. For this part of the analysis, we use Household Labor Force Survey micro data and national statistics when necessary.

Second, we decompose the changes in labor market informality into its components using Oaxaca-Blinder decomposition methodology. Thus, we can identify the explained and unexplained causes of the informality change over the past 15 years. Indeed, the decrease in informality is partially explained by the compositional change in employment. The share of the sectors, agriculture in particular, changed dramatically due to the structural transformation in the economic activity. Moreover, the gender composition, age, overall education, and employees' occupations are very different in 2018 compared to 2004.

Finally, we further analyze the wage underreporting behavior in the Turkish labor market. The literature on developing countries shows that wage underreporting for tax evasion purposes is widely observed (Tonin, 2011; Tonin, 2013). Even in the developed countries, the self-employed underreport their income to tax authorities for tax evasion purposes (Hurst and Pugsley, 2014). This aspect of the labor market informality is studied less in the case of Turkey due to data constraints. In this part, we aim to show that there is a gap between the wages earned and the wages declared to the Social Security Institution (SSI) even among the formally employed individuals. The wage underreporting aims to evade the tax burden, the level of which is highly correlated with the declared wage. For this part of the

analysis, we construct cells of individuals based on sector, firm size, gender, and age using both Labor Force Survey micro data and SSI data. Then, we compare the wages in the self-declared micro data and the administrative SSI data. The results exhibit significant informality due to the wage underreporting.

We find that the share of informal employment has decreased from 50.6 percent to 33.4 percent due to a combination of developments between 2004 and 2018. During the same period, wage-underreporting behavior fell significantly as well. The results show that there is tremendous variation across regions, sectors and firm sizes, and worker characteristics in terms of informality. The rate of informal employment is the highest in the agriculture sector. Construction is the second sector in the ratio of informal employment. In all industries, the informality rate is higher in small firms compared to larger ones. However, this gap across firm sizes is more evident in the manufacture of textiles sector and at an ignorable level in other mining and quarrying sector. In other words, even the small firms of the other mining and quarrying sector are likely to comply with the labor market regulations. In terms of worker characteristics, women are more likely to be employed informally than men are; and very young and senior individuals are more likely to be employed informally. Education is the most important determinant of the formality in the labor market.

Second, we find that the workforce's compositional change can explain the 51 percent of the reduction in the informality rate over the past 15 years. A higher education level, increasing firm size, and shift from agriculture to service sector suppressed Turkey's informality rate. Finally, we find that informality due to the wage underreporting is also quite widespread in Turkey. Employees and employers agree to declare a lower level of wage to the SSI for tax evasion purposes. However, the data show that this discrepancy between the officially declared wages and the actual wages has diminished during the past few years. This is partially because of the relatively high minimum wages. The minimum wage is more binding than before that the declared wages and the actual wages coincide more than before.

The rest of the paper is organized as the following. Section 2 reviews the relevant literature. Section 3 describes the two data sets that are utilized in this study. Section 4 provides a detailed descriptive analysis of the informal employment in Turkey, followed by a discussion on the potential reasons for high informality in certain sectors and regions. Section 5 presents an Oaxaca- Blinder decomposition of the informal employment in Turkey to its components. Section 6 sheds light on the wage underreporting in Turkish labor market. Section 7 concludes.

2. Literature Review

In this section, we review the papers that elaborate informal employment in terms of its determinants and effects on economic outcomes, focusing on Turkey. Previous literature on Turkey has concentrated on the informality due to the unregistered employment in the labor market, mostly exploiting the Household Labor Force Survey (HLFS) data. Başlevent and Acar (2015) provides a descriptive analysis

of labor market informality in Turkey using 2000, 2006, and 2012 waves of HLFS and points out that informal employment is more likely among female workers even after controlling for basic demographic and workplace characteristics of individuals. They provide suggestive evidence that this tendency exists partially because women get indirect access to social security benefits as a dependent. Reis et al. (2009) analyze the size, trends and determinants of informality for the period between 2001 and 2006. Since agricultural dissolution and urbanization were two major developments for the Turkish economy, an upward trend in non-agricultural informality rates was observed in this period. They also point out the heterogeneity in informality according to gender, age, education, firm size, occupation, and employment status based on HLFS data. Besides, they estimate the extent to which the institutional and structural factors explain informality by using the qualitative survey of 50 firms carried out for this study. They find that informal employment decreases in a better regulatory environment; in a production structure where agricultural activity is less prevalent and with a demographic composition with smaller shares of young individuals and rural population. Similarly, Salem et al. (2011) analyze informality trends between 2000 and 2006. They find that the decline in Turkey's total informality rate results from the inter-sectoral effect related to the decline in agricultural employment. The increase in non-agricultural employment during 2000-2006 is, on the other hand, related to the deterioration of informality within several sectors. Tansel and Kan (2017) analyze informal employment based on labor market transitions using the Survey of Income and Living Conditions in Turkey between 2006 and 2009. They find that the probability of the transition from unemployment to formal employment is half of the probability of moving from unemployment to informal employment, implying entry barriers for individuals in the formal employment.

Wage and productivity differentials between the formal-informal divide are of research interests in terms of the economic effects of informality. Using HLFS data, Aydin et al. (2010) explore the nature of labor market segmentation in Turkey into formal and informal sectors and investigate the wage levels and worker characteristics for the period 1988-2007. They also use Oaxaca-Blinder decomposition to analyze the explained and unexplained parts of the wage gap developments between formal and informal employment. Their findings show that unexplained differences constitute a significant portion of the formal-informal wage gap in 2007, while it was the human capital endowments of labor a decade ago. Regarding the wage gap between formal and informal employees, Tansel (2000; 2001) and Başkaya and Hülagu (2011) also highlight a statistically significant wage premium of formal employment using the HLFS data.

Taymaz (2009) focuses on the relationship between informality and productivity by mainly using survey-based data of about 5000 firms in Turkey that employ less than 50 workers. From the enterprise perspective, he finds a significant productivity gap between informal and formal firms. From an individual perspective, the results suggest a significant wage gap between informal and formal workers.

Although it has been perceived as a barrier to sustainable development, there are also studies arguing that informality plays a buffer role in the economy, helping the smooth transitions during expansion and recession periods (Leyva and Urrutia, 2018; Wahba and Asssaad, 2017; Alberola and Urrutia, 2019).

There is little research analyzing informality due to the wage underreporting in Turkey. A recent paper by Pelek and Uysal (2016) examines envelope wages, part of the wages paid without registration, using 2010 waves of HLFS (household level) and Survey of Earning Structure in Turkey (firm-level). They estimate a hypothetical wage distribution for the firm-level data in case of no informality based on self-reported wages in the HLFS data. The paper concludes that the wage underreporting leads to a tax loss of 18-20% in Turkey's formal sector as of the survey period. We follow a similar approach in measuring the wage underreporting by comparing the self-reported wages to the firm-reported wages. However, the data we use for firm-reported wages covers the universe of the registered wage employees and allows for dynamic analysis over time, whereas the firm-level survey used in Pelek and Uysal (2016) is limited to a cross-sectional sample of firms with at least ten employees.

3. Data

International Labor Organization (ILO) makes a distinction between employment in the informal sector and informal employment. Hussmanns (2004) summarizes the distinction as the following: "… the informal sector had to be defined in terms of characteristics of the production units (enterprises) in which the activities take place (enterprise approach), rather than in terms of the characteristics of the persons involved or of their jobs (labour approach)". Regarding the former categorization, 15th International Conference of Labour Statisticians (ICLS) (ILO, 2000) defined informal sector as "enterprises owned by individuals or households that are not constituted as separate legal entities independently of their owners, and for which no complete accounts are available that would permit a financial separation of the production activities of the enterprise from the other activities of its owner(s)". Regarding the latter, 17th ICLS defined informal employment as "the total number of informal jobs, whether carried out in formal sector enterprises, informal sector enterprises, or households, during a given reference period". The enterprise-based concept of employment in the informal sector and the individual-based informal employment concept are complementary and not mutually exclusive. In this paper, we use the second framework, which takes the individual as the unit of observation and use "informal employment" to refer to working individuals who are not registered at SSI. Accordingly, throughout the period, the informality ratio means the ratio of informally employed individuals to the total employment.[1,2]

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[1] World Bank (2010) points out that informal employment and underreporting are more severe forms of informality, whilst non-registration of firms is not a major concern in Turkey. Similarly, Kan and Tansel (2016) argue that social security based informality definition is preferable to enterprise definition in understanding the dynamics of the labor market in the country.

[2] Individuals aged 15 years and over and working at least one hour in the survey week or having a job to which they are related are regarded as employed.

We utilize two main data sources to investigate the dynamics of informality in Turkey. First, we use the Turkish Household Labor Force Survey (HLFS) for the years 2004-2018 to investigate the extent of informality and the variation across individual and firm characteristics. Second, we use comprehensive data on the population of all firms in Turkey provided by the Ministry of Industry and Technology to examine the underreporting behavior of firms.

The Turkish HLFS micro data sets are compiled and published by the Turkish Statistical Institute (TURKSTAT). Household Labor Force Survey, which is prepared as a repeated cross-section data, covers around 400,000 individuals aged 15 and over annually and has a considerable sample size even at the regional level. The survey collects information on a rich set of variables, including demographic characteristics including the region of residence, and labor market characteristics, including the occupation and industry of employed individuals, which are particularly important for our investigation. Table 1 provides the summary statistics of the key variable between 2004 and 2018.

Table 1: HLFS Summary Statistics (Mean Values, %)[1]

	2004	**2018**
Age[2]	38.3	41.5
Male	0.49	0.49
Years of schooling[2]	6.36	7.69
Primary education	57.72	50.40
Secondary education	17.63	18.63
Tertiary education	6.73	15.93
Employed	0.41	0.47
Wage employment	0.22	0.32
Employment in		
– Agriculture	0.29	0.18
– Industry	0.20	0.20
– Construction	0.05	0.07
– Services	0.46	0.55
Real earnings[3]	468.39	681.26
Small firms[4]	0.80	0.73
# of observations	338,132	374,172

[1] Mean values refer to the shares in total sample aged 15 years and over, except sectoral employment. Sectoral employment presents the sectoral distribution of employment.
[2] Represented in years
[3] Represented in Turkish Liras and corrected by CPI (2003=100).
[4] Firms with 10-49 employees.
Source: Household Labor Force Surveys, Authors' calculations.

The second dataset is the Entrepreneur Information System (EIS) which collects very rich administrative data on firms' balance sheet, employee number, and international trade from the Ministry of Treasury and Finance, Ministry of Trade, Ministry of Industry and Technology, and Social Security Institution. In essence, the EIS contains an employee-employer matched data that also have the balance sheet and

trade information of all firms except those operating in finance and public sector.[3] In this study, we make use of the Social Security Registry part of the EIS for the period 2009 - 2018. The data cover the registered wage employees who are not in the agriculture or finance industries. The data exclude the public sector employees as well. Thus, while comparing the wage distributions from the EIS data and the HLFS data, we restrict the HLFS sample to the wage employees who work outside the agriculture and finance industries, and who are not in the public sector.[4] The data are presented at a monthly level and on average we observe 13 million employees per month. The SSI data is made available for only the third, sixth, ninth, and twelfth month of a year. For each employee, we observe the gender, age, gross wage and the characteristics of the employer firm. This allows us to summarize the gross wages for employee groups of certain age, gender, firm size, and industry. Then, we compare these statistics with the corresponding statistics in the HLFS data.

4. Informal Employment Dynamics in Turkey

This section examines the extent and dynamics of informality across time and space in Turkey. We divide the section into two. In the first part, we investigate the heterogeneity and changes over time in unregistered employment. Here, we focus on the level and distribution of unregistered employment. Practically, this information comes from the labor force survey where it asks employed individuals whether they are registered in the social security system for their work. In the second part of this section, we discuss the potential reasons for high informal employment in Turkey's certain sectors and regions.

### 4.1. Unregistered Employment

Turkey has experienced high levels of informal employment over the last decades. Despite the declining trend, a significant proportion of employed are still working without social security. Figure 1-A shows the evolution of the informal employment for total, agriculture and non-agricultural sectors in Turkey for the period 2004-2018. The total informality rate declined from 50.1% in 2004 to 33.4% in 2018, corresponding to 17-percentage points (pp) decline. The decline was about 7.2 pp and 11.5 pp in the agriculture sector and non-agricultural sectors, respectively for the same period. Reduction in the rate of informality was sharp between 2004 and 2014, and stayed relatively stable thereafter. A higher decline in the total informality rate and the informality rate in non-agricultural sectors relative to the agriculture sector signals substantial compositional and structural changes in Turkish labor market. However, still, not only labor market institutions but also structural factors are responsible for high informal employment rates in the country. Among them, we analyze worker and firm characteristics and the distribution of employment by sectors and regions.

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[3] The data set is available for researchers on the site after the approval of the Ministry.
[4] Since firms operating in finance are not included in EIS database, we exclude them in this part of the analysis.

Figure 1-B plots the informality rates by firm size during the period 2004-2018. According to HLFS, informality is most prevalent among micro firms. In 2018, 56% of workers in micro firms (1-9 employees) are not registered for the social security system. This rate declines with the firm size, and it becomes 3.3% in relatively large firms (at least 50 employees). The high share of micro and small firms in Turkish labor market contributes to informal employment at a considerable level. However, the share of micro and small firms in overall employment has declined over time. While 80.1% of the total workforce were employed in micro and small firms (1-49) in 2004, this ratio declined to 73% in 2018. Besides, the incidence of informal employment among these firms became less widespread. Informality rate declined by 14.1 pp among firms with 1-9 employees and by 13.3 pp among firms with 10-49 employees during 2004-2018.

Figure 1-A: Informality Rates (%, 2004-2018)
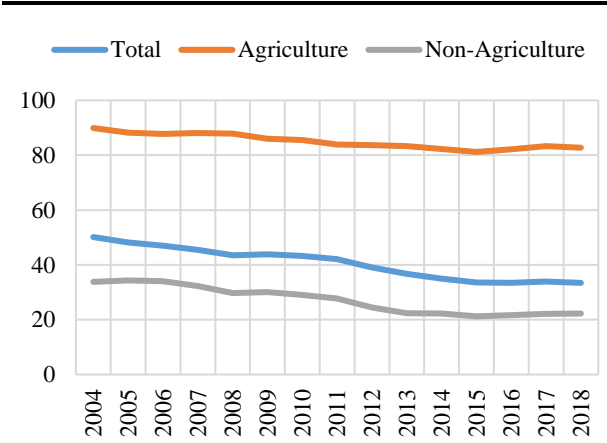
Source: Household Labor Force Surveys, Authors' calculations.

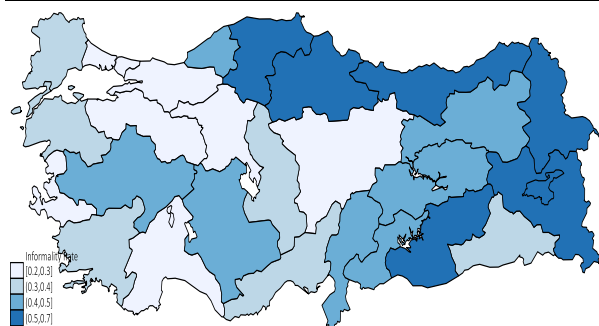**Figure 1-B: Informality Rates by Firm Size (%, 2004-2018)**
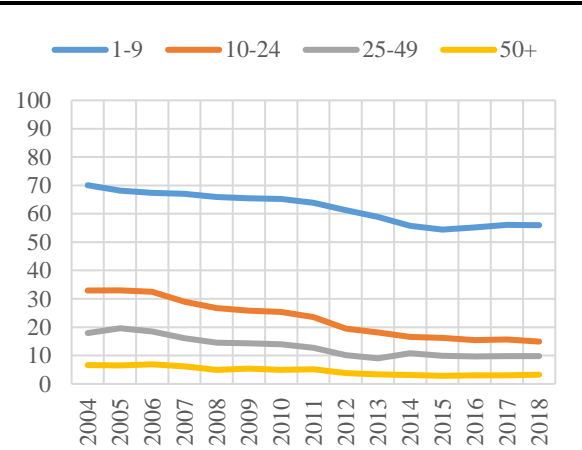
Source: Household Labor Force Surveys, Authors' calculations.

Figure 2-A and 2-B show the informality rates in 2018 at NUTS2 region level for all sectors and the non-agricultural sectors, respectively. The informality rate varies significantly across regions with a larger value in the north and eastern parts of the country.[5] Since the agricultural employment exhibits significant levels of informality, the regions incorporating intense agricultural activity involve more informality.[6] Figure 2-B excludes employment in the agriculture, however; the incidence of informal employment is still high in the east and south-eastern part of the country. Despite declining trends, these regions are still capturing the highest informal non-agricultural employment. We also observe that differences in informality rates become more dispersed as firm size increases (Figure A1-A7). Section 4.2 analyzes the regional variation in informality in more detail.

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[5] Regional data is available at Nomenclature of Territorial Units for Statistics (NUTS)-2 level, including 26 regions in the country. NUTS is a geographic classification established by Eurostat to provide a single uniform breakdown of territorial units to produce regional statistics for European Union.
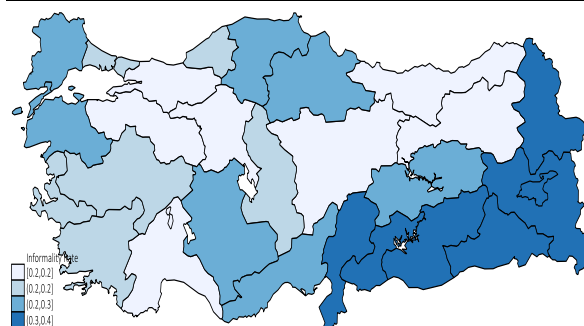[6] The correlation between agricultural employment and informality during 2004-2018 in NUTS-2 regions is 0.80.

Figure 2-A: Regional Informality Rates (%, All sectors, 2018)

Source: Household Labor Force Surveys, Authors' calculations.

Figure 2-B: Regional Informality Rates (%, Non-Agricultural Sectors, 2018)

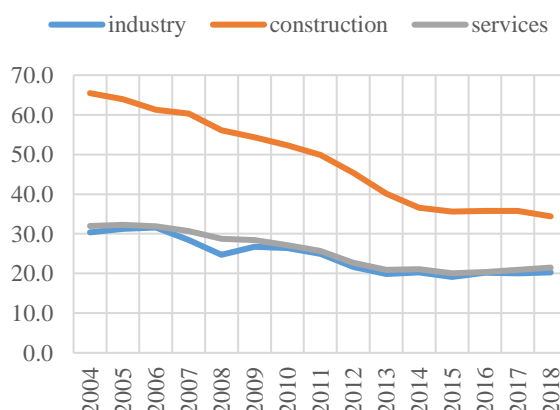Source: Household Labor Force Surveys, Authors' calculations.

Sectoral variation is another factor that explains the high informal employment in Turkey. Agricultural activities generating one-fifth of the total employment incorporates very high levels of informal employment. Within the non-agricultural sectors, construction takes the first place as of 2018 with an informality rate of 34.4% (Figure 3-B). The informality rate in industry and services was around 20% in 2018. Figure 3-A plots the sectoral share of the employment in Turkey over the last fifteen years. The structure of employment has changed considerably during the period such that the employment share of agriculture declined from 29.1% to 18.4% while the employment share of services increased from 46% to 54.9%. However, the share of employment in industry and construction has not changed significantly. Change in the structural composition of employment contributed to the reduction in informality. Figure 3-B shows that the informality in each sector is declining over the same period. Though construction still demonstrates the highest rate of informality, the greatest reduction took place in this sector.

Figure 3-A: Employment by Sectors (%, 2004-2018)

Source: Household Labor Force Surveys, Authors' calculations.

Figure 3-B: Informality Rates by Non-Agricultural Sectors (%, 2004-2018)
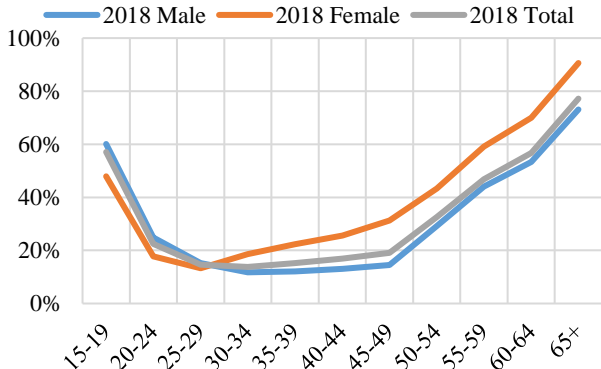

Source: Household Labor Force Surveys, Authors' calculations.

The incidence of informality also varies by worker characteristics. It is more apparent among females, young labor, less educated, and self-employed. HLFS exhibits a significant gender gap in informality, mostly because almost all females in agriculture are working without social security. While the total gender gap in informality rate is 12.7 pp in 2018, it is 3.7 for the workers engaging in non-agricultural activities. Figure 4-A suggests that the informality shows a U-shaped structure by age profile in non-agricultural sectors regardless of gender. Workers under thirty suffer from informality mainly because they have less experience in the labor market, and early pension scheme induces high levels of informality after age 50.[7]

Figure 4-B shows that the primary school graduates constitute the highest proportion of informal employment, implying that the less educated labor have greater tendency to work without social security. About one-fifth of the females working without social security are also illiterate. Figure 4-C represents a negative correlation between educational attainment and informality. Besides, the gender gap declines with education level so that among higher education graduates females have less informality than their male counterparts do. Despite the decreasing trend over time, the gender gap in informality is still the highest among primary school graduates (Figure 4-D).

Figure 4-A: Informality Rates in Non-Agricultural Sectors by Age Groups and Gender (%, 2018)

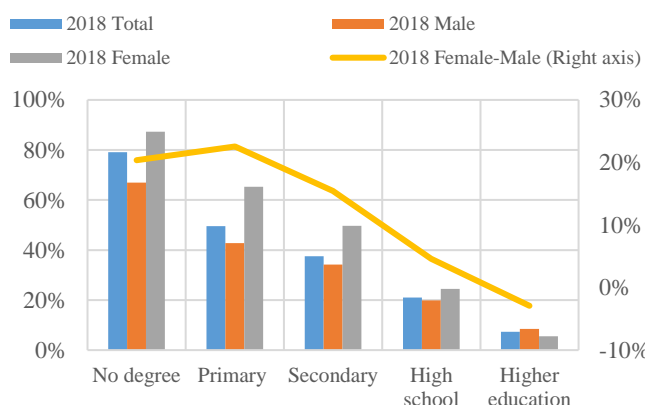Source: Household Labor Force Surveys, Authors' calculations.

Figure 4-B: Distribution of Informal Employment by Education and Gender (%, 2018)
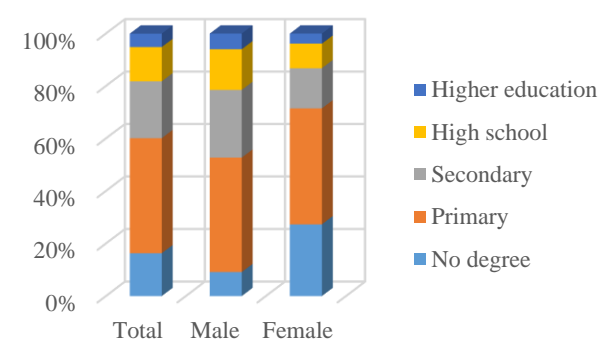
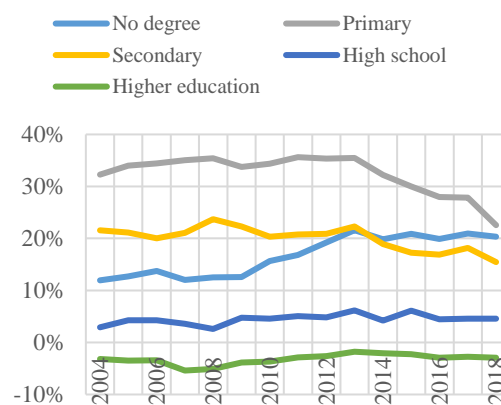Source: Household Labor Force Surveys, Authors' calculations.

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[7] In Turkey, the retirement age varies according to the age, date of labor market entry, contribution period and gender. A female (male) entering labor market for the first time between September 1999 and October 2008 with a minimum of 7,000 days of contributions or 25 years coverage with 4,500 days of contributions can retire at the age of 58 (60). With the Law No. 5510, entered into force on 1.10.2008, retirement age gradually increases for the new entrants, and reach 65 for all (OECD, 2019). According to the Law, all males (females) will retire at 65 after 1.1.2044 (1.1.2048).

Figure 4-C: Informality Rates by Education and Gender (%, 2018)

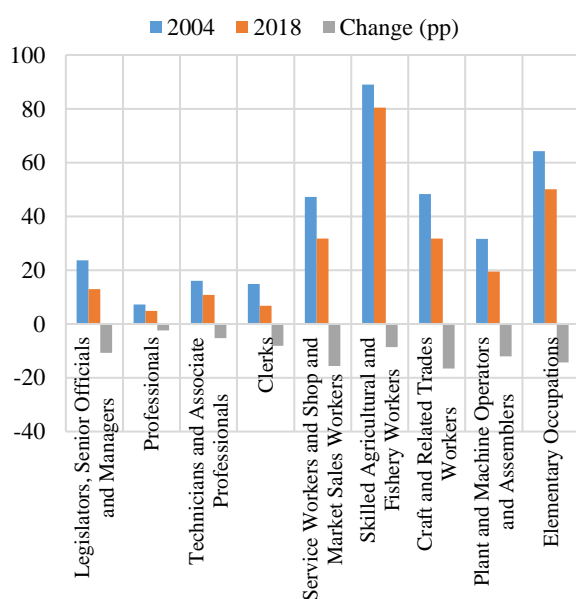Source: Household Labor Force Surveys, Authors' calculations.

Figure 4-D: Gender Gap* in Informality Rates (Percentage Points, 2004-2018)

Source: Household Labor Force Surveys, Authors' calculations.
*Calculated as female informality rate minus male informality rate.

Next, Figure 5-A and 5-B show the informality rates by profession and the distribution of employment across professions, respectively. Not surprisingly, low and medium skill occupations embody significant levels of informality. Workers in elementary occupations feature the highest rate of informal employment. Informality is also widespread among service and sales workers, comprising the highest share in total employment. Besides, the informality rate for these occupations declined significantly during 2004-2018. The reduction in the informality rates of service and sales workers, together with the increase of their share in total employment, has significantly contributed to improved overall informality in Turkey.

Figure 5-A: Informality Rates by Profession (%)

Source: Household Labor Force Surveys, Authors' calculations.

Figure 5-B: Distribution of Employment by Profession (%)
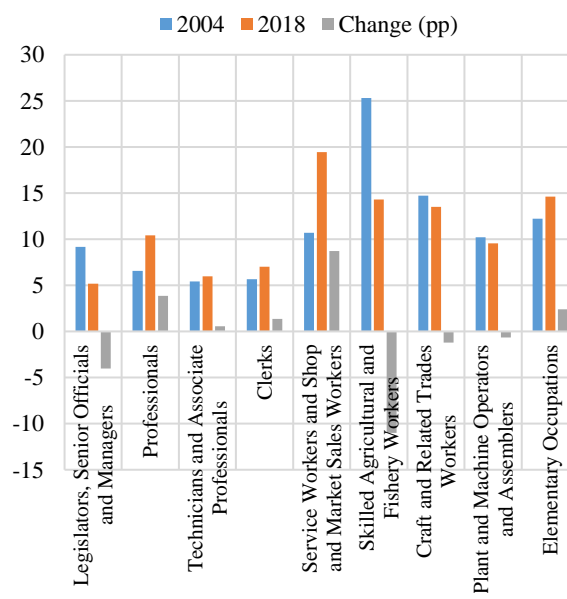
Source: Household Labor Force Surveys, Authors' calculations.

Finally, the type of the job held greatly affects the extent of informal employment. Figure 6 shows informality rates across salaried employees, employers, self-employed, and unpaid family workers. The informality is much more prominent among the self-employed and unpaid family workers in Turkey. 65.5% of self-employed and 87.3% of unpaid family workers are deprived of social security, whereas this rate is around 20% for the rest. The increase in salaried workers' share is associated with the attenuation of informality over time in Turkey. The largest reduction in informality rate is also observed among this group.

Figure 6: Informality Rates by Employment Type and Gender (%, 2018)
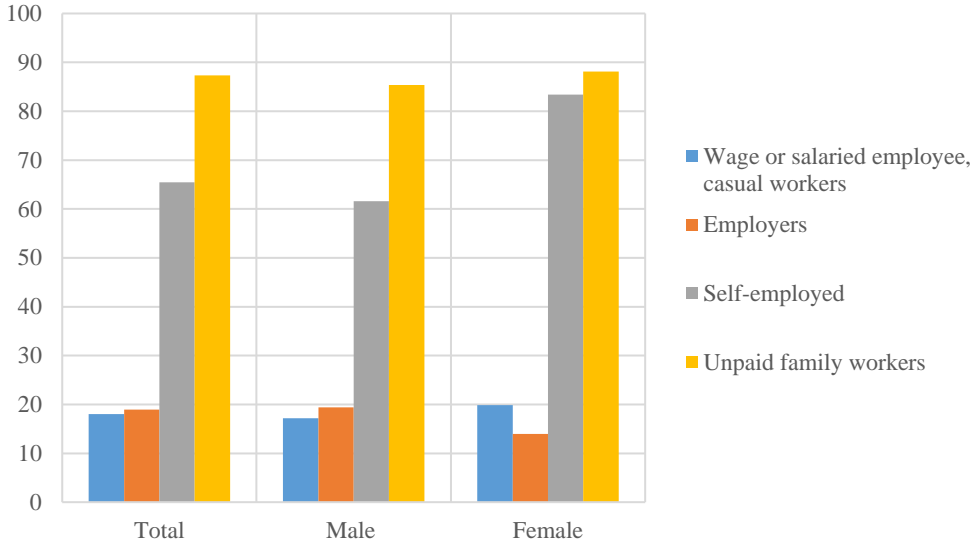
Source: Household Labor Force Surveys, Authors' calculations.

In section 5, we carry out Oaxaca-Blinder decomposition analysis to understand better the contribution of the structural changes in the worker and firm characteristics to the decline in the total informality rate over the last fifteen years in Turkey.

4.2. Potential Reasons of High Informality

The descriptive analysis so far has shown that there is significant variation in informality rate across sectors, firm sizes, regions, levels of education, occupations hold, and the types of employment. Among those characteristics, an individual's employment status seems to play the most crucial role in the probability of unregistered employment (Figure 6). 87% of unpaid family workers and 65% of self-employed are not registered for the social security system in 2018 while the rates are around 18% among wage employees. The most likely explanation for very high rates of unregistered employment among unpaid family members is that the Social Security Law exempts the spouses who work free of charge and all household members working in the same house from the mandatory social security registration. The law also includes exemptions for self-employed agricultural workers and paid agricultural workers who work with temporary service contracts. The existence of exceptions in the labor law and the nature of jobs carried out by unpaid family workers, self-employed, and even paid workers in agriculture make

it difficult to detect and enforce social security registration. Because registration for social security can be avoided lawfully in some instances, in this section, we focus on a more restricted sample that only contains positive wage earners in non-agricultural sectors.[8] This restricted sample further excludes the public sector employees, informal employment of which are not possible. Our goal in generating a selective sample is to focus on the employees, unregistered employment of whom can be more directly defined as informal employment and has a larger room for improvement and policy intervention. According to 2018 HLFS data, informal employment rate of this restricted sample is around 14 percent.

Table 2 reports the joint distribution of informal employment by sector and worker specific characteristics including skill, education, and age among the salaried workers in non-agricultural private sectors. The construction sector stands out as the sector with the highest informal employment rate among all types of occupation, levels of education, and age groups. Regardless of the sector in which they work, informal employment is much higher among those who work in elementary jobs, which requires basic skills. In line with the occupation, informal work is much more common among those with a low education level. In terms of age groups, informality seems to be much more prevalent among the youth and the upper middle age adults. The high rate of informal employment among young people can be partially attributed to Turkey's strict employment protection laws. It is a well-known fact that employers have less information about the abilities of young workers who have no or very little work experience. Besides, due to the minimum wage levels, employers are not compensating the productivity differentials of youth that leads them for informal work. The inadequacy of flexible work arrangements may make it harder for firms to employ youth with little labor market experience formally. Besides, the informality rate is even higher among the upper middle-aged employees. High informality among the elderly is related to the early retirement policies of the 90s that allow the workers whose first registration to the social security system goes back to the years before 1998 to retire at the age of 50. In 2018, among OECD countries, the lowest normal retirement age applied in Turkey, equaling 48 for women and 51 for men (OECD, 2019). Retired individuals are allowed to work formally. Yet, their employers must pay a social security support premium, which encourages them to employ the retired individuals informally. Since social security contributions paid after retirement does not affect the amount of pension received, retired individuals also prefer to work informally. In 2018, the estimated number of pensioners who work informally was about 3.5 million in the country.[9]

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[8] We define an individual as a positive wage earner if her monthly wage is higher than 30% of the minimum wage level. Among those, we exclude individuals whose monthly wages are too high (more than 20 times the minimum wage level) to prevent extreme values distorting the sample averages. Relaxing both restrictions does not change the findings.

[9] Following the methodology proposed by the World Bank (2010), we calculate an indicative number based on the administrative records of Social Security Institution and the HLFS. This number is obtained by extracting the formally employed pensioners from the estimated number of working pensioners. Estimated number of pensioners is calculated by the number of pensioners in labor force minus unemployed pensioners based on HLFS.

Table 2: Informal Employment Rate of Salaried Workers in Non-Agricultural Private Sector (%)

	Type of Occupation			Level of Education			Age Group		
	Elementary	Operators	Technicians & Professionals	Elementary & Below	Middle & High	College	15-24	25-49	50-64
Manufacturing	15	13	2	18	10	3	25	7	23
Construction	34	21	4	27	20	7	29	17	33
Services	21	16	5	25	15	5	23	9	32

Source: Household Labor Force Survey, 2018, Authors' calculations.

We previously showed in Figure 2-B that informal employment varies considerably across NUTS2 regions in Turkey even after excluding agricultural employment. To be more elaborate about the potential reasons for regional differences, we regressed the indicator of being informally employed on a constant and several control variables, including the type of occupation, sector, and education, using the 2018 HLFS data for our restricted sample. Then we retrieved the residuals from this estimation to see whether there are still regional differences after controlling the effects of observable characteristics. Figure 7 presents the weighted means of these residuals at the NUTS2 region level. The picture is not very different from the unconditional means in Figure 2-B, suggesting that there exists significant variation across regions independent of the job and worker specific characteristics.

Figure 7: Residual Informality by NUTS2 regions
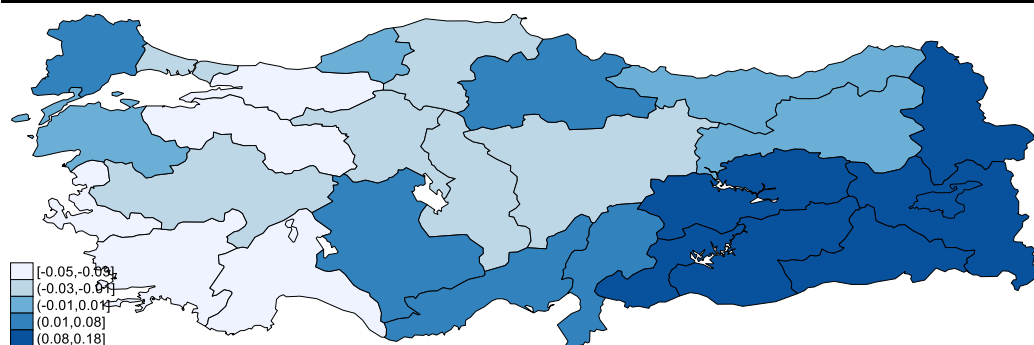
Source: Household Labor Force Survey, 2018, Authors' calculations.

A potential explanation for substantial variation in informal employment rates across regions is the difference in income and living standards across regions. The minimum wage is applied only at the national level, and there is no regional flexibility in Turkey, unlike the common practice in other countries with similar regional differences. Therefore, the minimum wage is binding at differing rates across regions. In Figure 8, we plotted the regional means of the residuals we obtained from the regression exercise in the previous paragraph against the minimum wage to mean wage ratio, a commonly used measure to present how binding the minimum wage is in a country or region. A higher residual value here implies a higher informal employment rate when controlled for the type of

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Unemployed pensioners are derived from the total number of pensioners in labor force by assuming that unemployment rate among pensioners is same as the non-agricultural unemployment rate in the country in 2018.

occupation, sector, and education. The figure reveals a very strong positive correlation between the informal employment rate and the minimum wage to mean wage ratio, suggesting that the inequalities in regional economic conditions may be an important driver of the regional variation in informality rates. The regions in central, east, and southeast Anatolia, where the minimum wage to mean wage ratio is high, have a higher rate of informality even after controlling for the employees and employers' baseline characteristics.

Figure 8: Relation between Informality and the Minimum Wage to Mean Wage Ratio
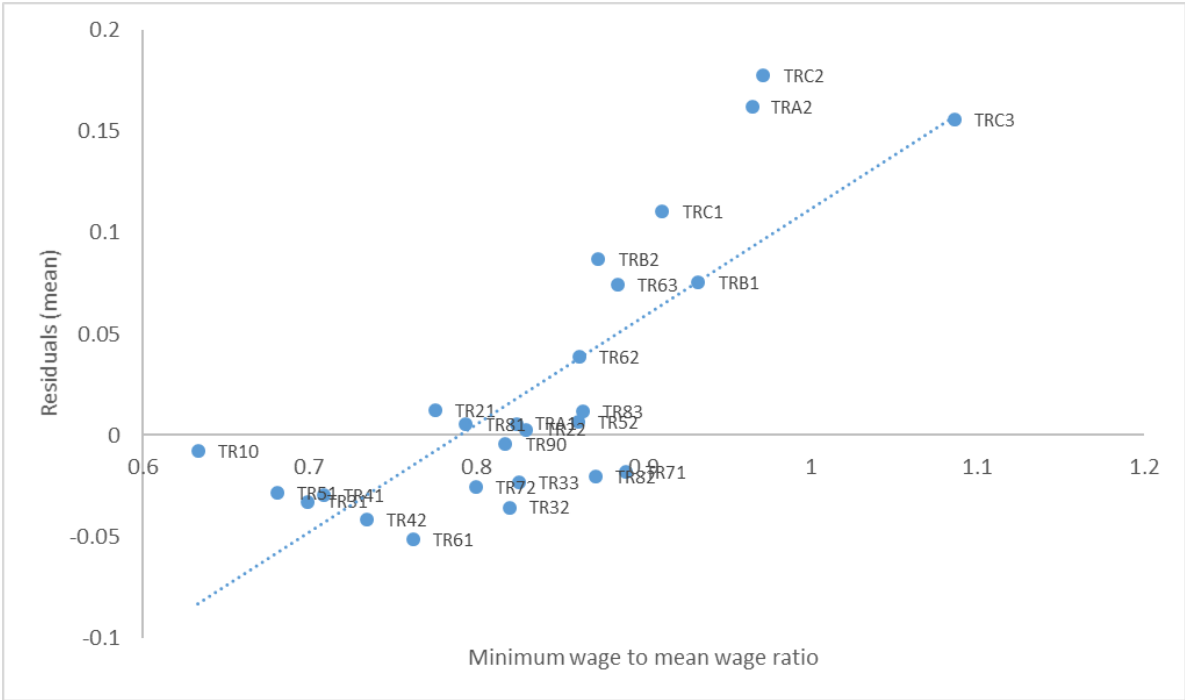
Source: Household Labor Force Survey, 2018, Authors' calculations.

The tax burden on labor is also an important contributor to informal employment in Turkey. The tax wedge is quite high, particularly for workers with families and for low wage earners. In 2019, the total tax wedge for a one-earner couple was 37.5% of the labor cost, which is the third-highest among the OECD countries (OECD, 2020). However, several employment subsidies on social security contributions are provided by the government to foster formality and increase tax collection rates. Still, many firms intend to either hire informally or report gross wages at lower levels than the actual amount to avoid the tax burden.

Finally, the rigidity of employment laws exacerbates informal employment by increasing the labor related costs associated with formal employment. Redundancy costs, mandatory employment of vulnerable groups, rules for mass layoffs and uncommon use of atypical work contracts weaken the flexibility in hiring and firing workers resulting in informal employment. According to the latest data, Turkey has the most protective employment regulations on temporary forms of employment among

OECD countries (OECD, 2020). ILO also emphasize the importance of labor market flexibility in reducing the informal employment and recommends the formalization of non-standard forms of employment such as temporary employment, part-time and on-call work, temporary agency work, dependent self-employment, and multi-party employment (ILO, 2019).

5. Decomposition of the Change in Informality into its Components

In this section, we apply a non-linear Oaxaca-Blinder decomposition[10] to compute the individual contributions of each worker and firm specific characteristics to the 17 pp decline in total informality rate between 2004 and 2018 (from 50.1% to 33.2%). We first estimate a Probit model to obtain the coefficients of each individual and work related characteristics that explain the informal employment in period A and period B. Then, following Yun (2004), we obtain the individual contributions of each covariate on the change in informal employment probability from period A to period B using the detailed decomposition equation below.[11]

$$\overline{Y_t} - \overline{Y_{t-1}} = \sum_i^{K+1} W_{\Delta X}^i \left[\overline{\phi(X_t \beta_t)} - \overline{\phi(X_{t-1} \beta_t)} \right] + \sum_i^{K+1} W_{\Delta \beta}^i \left[\overline{\phi(X_{t-1} \beta_t)} - \overline{\phi(X_{t-1} \beta_{t-1})} \right] \quad (1)$$

$\Phi(X\beta)$=prob(Y=1) is the standard normal cumulative distribution function where Y is the Nx1 vector of binary choice variable, X is NxK matrix of independent covariates, and β is a Kx1 vector of coefficients. $W_{\Delta X}^i$ and $W_{\Delta \beta}^i$ are defined as

$$W_{\Delta X}^i = \frac{(\overline{X_t^i} - \overline{X_{t-1}^i})\beta_t^i}{(\overline{X_t} - \overline{X_{t-1}})\beta_t}, \quad W_{\Delta \beta}^i = \frac{\overline{X_{t-1}^i}(\beta_t^i - \beta_{t-1}^i)}{\overline{X_{t-1}}(\beta_t - \beta_{t-1})}.$$

The first summation part of equation (1) represents the part of the predicted change in the informality that is due to the changes in worker and firm related characteristics (explained effect), and the second summation represents the part due to structural changes in the labor market (unexplained effect). We divided the fifteen-year period into three five-year periods to see whether these effects are homogenous within shorter time windows. The worker-related explanatory variables we employed in estimations are age, age squared/100, and set of dummies for being male, highest educational level obtained, employment status and occupation whereas the firm-related explanatory variables are firm size and sector dummies. As suggested by Yun (2005), we exploit normalized equations to remove the invariance

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[10] This methodology is mostly utilized to decompose wage gaps in formal-informal divide. Aydın et al. (2010) follow Oaxaca-Blinder decomposition to analyze the change in the size of the wage gap between formal and informal employment in Turkey. Tansel (2000) and Tansel (2001) also provide Oaxaca-Blinder decomposition of the formal/informal wage gap using probit and multinomial logit estimations respectively.

[11] We use the non-linear decomposition developed by Yun (2000, 2004), applying Oaxaca-Blinder decomposition for models with binary dependent variables. For robustness purposes, we applied the non-linear decomposition technique proposed by Fairlie (2005) that uses sequential replacement in calculating the individual contributions of independent variables while Oaxaca-Blinder uses mean characteristics. The nonlinear decomposition results from Fairlie (2005) technic are of similar sign and magnitude to those we obtained from Oaxaca- Blinder.

problem resulting from the choice of reference category when a set of dummies are involved in decomposition. All standard errors are clustered at the NUTS2 level, and sample weights are used to ensure national representativeness. The results are in Table 3.[12]

The predicted rate of informality declined by 16.9 pp between 2004 and 2018. Table 3 shows that 8.7 pp (51.7%) of this decline can be attributed to the changes in the characteristics, whereas the unobserved improvement in formality rates can explain 8.2 pp (48.3%) of it. Putting differently, informality rate would decline by 8.2 pp in 2018, if sample characteristics remained same at 2004 level, and further decline by 8.7 pp due to the change in the sample characteristics. The contribution of the change in the composition of characteristics is highest between 2014 and 2018 (147.6%), while lowest between 2009 and 2013 (18.4%). Changes in the characteristics contribute more than 100% to the predicted change in the probability of informal employment between 2014 and 2018. This implies that structural informality increased during this period. Indeed, the total informality rate would increase by 0.8 pp in 2018 if the labor market composition remained at the 2014 level. However, the informality rate declined by 1.7 pp thanks to the downward pressure due to the compositional change in labor market.

Among all firm and individual characteristics, changes in the firm size contributed most to the decline in informality over the last fifteen years. 3.4 pp of the decline in the informality rate during 2004-2018 is explained by the changes in firm size. This might result from the facts that informality among small firms capturing the highest level, and the share of small firms declined over time. The rise in workers' educational attainment also contributed significantly to the attenuation of informality in this period. The share of primary school graduates among workers declined from 62.5% to 50.4%, while the share of high school graduates increased from 11.3% to 25.3% between 2004 and 2018. Overall, the changes in workers' educational attainment explain 2.7 pp of the decline in informality rate during the observation period. Fairris and Jonasson (2016) find a similar result for Brazil. They show that the increase in workers' educational attainment explains 7.5% of the decline in informal employment rate in urban Brazil during the period 2000-2010.

The changes in sectoral composition of firms is also another contributor to the decline in informality rate and explains 10.8% of the reduction during the entire period, corresponding to a 1.8 pp decline. The changes in composition of sectors were mainly due to the significant decline in the share of agricultural employment. Our decomposition analyses for subsamples of 5-year periods imply that the contribution of the sectoral composition changes was not homogenous during the entire period. We found no composition effect at all for the period 2009-2013. Indeed, Figure 3-A shows that the employment shares of macro sectors were pretty stable during the period 2009-2013 probably because of the declining business dynamism and rising food prices in the aftermath of the global financial crises in 2008

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[12] The results of the probit regression estimates using informal employment dummy as the dependent variable for the years 2004, 2008, 2009, 2013, 2014 and 2018 are presented in Table A1.

(Hatunoğlu, 2011). Again our findings on the contribution of sectoral composition change are in line with Fairris and Jonasson (2016)'s analysis for Brazil.

Table 3: Decomposition of the Change in Informality Rates

Informal Employment								
Estimation Period	2004-2018		2004-2008		2009-2013		2014-2018	
	Estimate	Contribution (%)	Estimate	Contribution (%)	Estimate	Contribution (%)	Estimate	Contribution (%)
Informality rate in group 1	0.332*** (0.025)		0.434*** (0.037)		0.367*** (0.031)		0.332*** (0.025)	
Informality rate in group 2	0.502*** (0.039)		0.502*** (0.039)		0.437*** (0.034)		0.350*** (0.029)	
Difference	-0.169*** (0.018)		-0.067*** (0.013)		-0.071*** (0.010)		-0.017** (0.008)	
Explained effect	-0.087*** (0.016)	51.7	-0.047*** (0.010)	69.6	-0.013 (0.008)	18.4	-0.026*** (0.006)	147.6
Unexplained effect	-0.082*** (0.007)	48.3	-0.020** (0.009)	30.4	-0.058*** (0.005)	81.6	0.008* (0.005)	-47.6
Contributions of Covariates								
Male	0.004*** (0.001)	-2.5	0.001 (0.001)	-1.1	0.002*** (0.001)	-3.2	0.001*** (0.000)	-7.1
Age	-0.005** (0.002)	2.8	-0.003*** (0.001)	4.6	-0.002* (0.001)	2.1	0.001 (0.001)	-6.8
Education	-0.027*** (0.003)	15.7	-0.010*** (0.002)	15.0	-0.005*** (0.002)	7.0	-0.008*** (0.001)	47.6
Occupation	0.007* (0.003)	-4.0	0.004 (0.003)	-6.3	0.001 (0.001)	-1.4	0.000 (0.001)	-2.4
Employment status	-0.015*** (0.004)	9.0	-0.011*** (0.003)	16.1	-0.002 (0.002)	2.4	-0.004** (0.002)	22.1
Firm size	-0.034*** (0.006)	19.8	-0.017*** (0.003)	24.7	-0.007** (0.003)	10.2	-0.010*** (0.002)	59.4
Sector	-0.018*** (0.004)	10.8	-0.011*** (0.004)	16.6	-0.001 (0.002)	1.3	-0.006*** (0.001)	34.9
# of observations in group 1	170,125		139,860		164,176		170,125	
# of observations in group 2	136,902		136,902		145,934		171,328	

Source: Household Labor Force Surveys, Authors' calculations.
Note: (1) Change in informality rate is calculated as the difference between the beginning and ending years of the estimation period. Group 2 is the beginning year, and Group 1 is the ending year. Effect of age is the combined effect of age and age squared/100. Education, occupation, employment status, firm size and sector are also combined effects of the relevant categorical variables.
(2) Education categories: Illiterate, Literate with no degree, primary, basic or junior high school, high school, and higher education graduates. Employment status categories: Wage or salaried employee, or casual workers, employers, self-employed and unpaid family workers. Occupation categories: Managers, professionals, technicians and associate professionals, clerical support workers, services and sales workers, skilled agricultural, forestry and fishery workers, crafted and related trades workers, plant and machine operators and assemblers, and elementary occupations. Firm size categories: 1-9, 10-24, 25-49 and 50+ employees. Sector categories: Agriculture, industry, construction, and services.
(3) Since data is available at individual level, sample weights are used to ensure national representativeness. Standard errors, clustered at Nuts2 level, are reported in parentheses. *p<0.1, **p<0.5, ***p<0.01.

Our decomposition analysis for the entire period in Table 3 shows that workers' employment status is also a significant contributor to the decline in the informality but at a lower rate (explains about 1 pp of the decline in informality rate). The decompositions reveal that the workers' age structure reduces the informality rate over time, whereas the gender composition increases it. The share of females in the workforce increased considerably during the period due to the significant rise in female labor force participation. Since the probability of informal employment among females is higher, the rise in female employment share had a deteriorating impact on formal employment. This contribution is also

increasing over time (1.1% for 2004-2008, 3.2% for 2009-2013, and 7.1% for 2014-2018) mainly because of the rapid increase in female labor force participation in recent years. Fairris and Jonasson (2016) also found that the increasing share of female employment worsened informality in Brazil, with 16% contribution. Finally, Table 3 shows that the change in workers' occupational structure does not significantly explain the reduction in informality rate over time.

6. Wage underreporting

The wage underreporting is another form of the informality in labor market and often used to avoid tax by reporting the administrative wage below the actual wage. Diagnosing the level of wage underreporting is not trivial since no information regarding the official wage exists in the HLFS data. Therefore, this phenomenon is mostly discussed within the framework of anecdotal information rather than the actual data. In this section, we aim to reveal the level of wage underreporting in Turkey by comparing the cell level mean wages between the individual level SSI data and the HLFS data. Since the HLFS relies on respondents' answers, the wage declarations are considered to be more realistic than the declarations to the Social Security System. For subgroups of employees, we have the opportunity to compare the distribution of wages between the reality and the registered economy. Through these comparisons, we drive conclusions about the extent of underreporting across regions, sectors and size classes. Since the two samples are not identical in terms of worker and job-related characteristics, we generated comparable sub-samples from them. To make the two data sets more comparable, we restricted the HLFS sample to wage earners who work for full time with at least 40 hours a week, declare to be registered in the social security system, earn at least 95% of the minimum wage and not more than 20 times the minimum wage, and are employed in non-agricultural private sector firms. Thus we exclude those who are self-employed, employers, and unpaid family workers; those who work in agriculture; and those who work for the public institutions as they are not covered in the wage employee data of the SSI. The SSI data is reported on a monthly basis while the HLFS is annual. Therefore, we took the 6th month of the SSI data as a representative of the year. As in HLFS, we restrict the sample to full-time workers, which is composed of employees with at least 25 days of social security contribution in a month. Also, the wages in SSI are converted to net wages by subtracting the employers' social security contribution (21% of the gross wage).

Figure 9-A to 9-D compare the average wages in the two datasets for sub-samples we have formed based on firm size, sector, gender, and age group for 2009-2018. If the administrative wage to self-reported wage ratio is below 1, we interpret it as an indicator of wage underreporting. Figure 9-A plots the wage underreporting trend over time by firm size. Wage underreporting concentrates in micro and small firms as in the informal employment. The average wage in micro firms (1-9 employees) reported in administrative data set was 27% percent lower than the average wage of the same group in HLFS in 2009. The difference was about 18% for small firms with 10-49 employees. Some studies on European

countries endorse this finding as well. For instance, using Special Eurobarometer Surveys on undeclared work and envelope wages, Williams and Padmore (2013) and Williams and Horodnic (2017) find that small firms are more likely to underreport wages. Similarly, Kriz et al. (2007) show that there is a greater tendency to pay envelope wages among smaller firms in Estonia. For larger Turkish firms with 50 or above employees, there is no sign of wage underreporting as of 2009. In fact, the average wage in administrative data set is about 10% higher than the average wage in HLFS. This is in line with the income measurement error in surveys resulting from the fact that the income estimates from surveys underestimate the actual income. The underestimation in surveys is usually explained by survey respondents' tendency to underreport their income and the income nonresponse by high wage earners. Therefore, the level of underestimation of income in surveys becomes higher for samples with greater share of high-income earners (Moore et al., 2000). Considering the usual wage underestimation in surveys, the wage underreporting we display in figures 9-A to 9-B should be interpreted as a lower bound.

Wage underreporting is prevailing in the construction sector, according to Figure 9-B. Wage underreporting also exists in the services sector with a lower rate, while there is no sign of wage underreporting in the manufacturing sector. Similarly, using a nationally representative survey of FYR Macedonia for 2015, Williams and Bezeredi (2017) find that workers in construction are significantly more likely to underreport wages than workers in any other sector, except agriculture. Also, Williams and Padmore (2013) show that whilst 12.5% of construction workers have envelope work arrangements, it is less prevalent in manufacturing and personal services industries. We found no difference between male and females in terms of exposure to wage underreporting (Figure 9-C) but age seems to play an important role as shown in Figure 9-D. Particularly, wage underreporting is found to be more widespread among younger workers until 2016. This might result from the greater tendency of tax evasion among younger and elderly workers compared to middle aged workers (Kriz et al., 2007). Similar findings in regard to underreporting of wages by age are encountered in other studies as well (e.g. Williams and Bezeredi, 2017; European Commission, 2013; Williams and Padmore, 2013; Kriz et al., 2007).

Wage underreporting has declined substantially for all groups of individuals since 2009 but the most visible decline occurred in 2016, the year in which the minimum wage rose by about 30%. All sub-samples we formed from the two data sets experienced a 10-15 percentage point decline in the wage underreporting in response to the minimum wage hike. Despite the rapid decline in recent years, wage underreporting is still remarkable in micro firms and the construction industry.
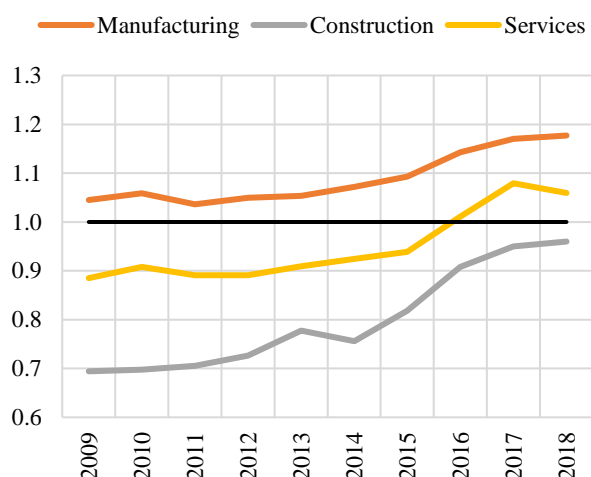
Figure 9-A: Wage Underreporting by Firm Size*
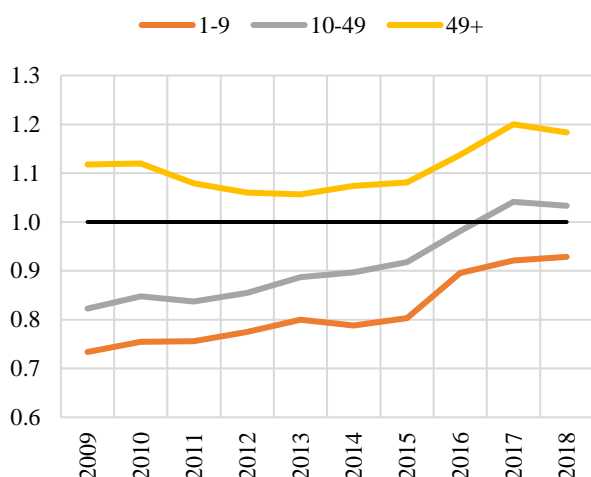
━━━ 1-9   ━━━ 10-49   ━━━ 49+

Source: EIS and Household Labor Force Surveys, Authors' calculations.

*Wage underreporting is defined as the administrative wage to self-reported wage ratio.

Figure 9-B: Wage Underreporting by Sector*

━━━ Manufacturing   ━━━ Construction   ━━━ Services

Source: EIS and Household Labor Force Surveys, Authors' calculations.

*Wage underreporting is defined as the administrative wage to self-reported wage ratio.

Figure 9-C: Wage Underreporting by Gender*

━━━ Male   ━━━ Female

Source: EIS and Household Labor Force Surveys, Authors' calculations.

*Wage underreporting is defined as the administrative wage to self-reported wage ratio.
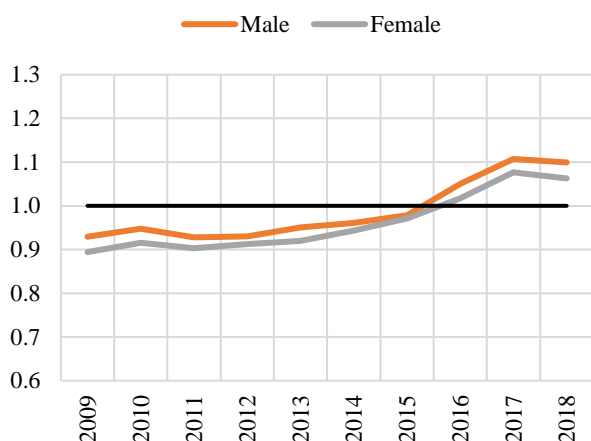
Figure 9-D: Wage Underreporting by Age Group*

━━━ 15-24   ━━━ 25-49   ━━━ 49+

Source: EIS and Household Labor Force Surveys, Authors' calculations.

*Wage underreporting is defined as the administrative wage to self-reported wage ratio.
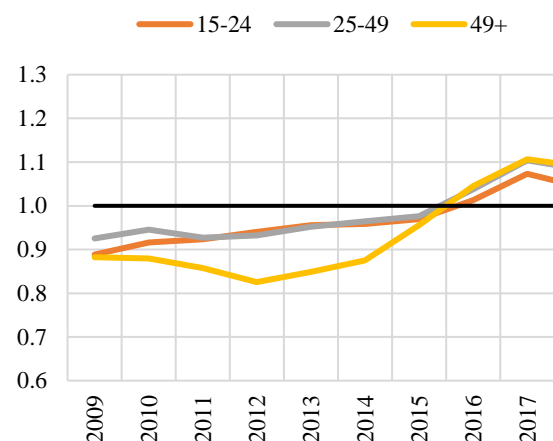
7. Conclusion

Informality continues to be a significant phenomenon of the Turkish labor market and has been at the forefront of the policymakers' agenda for a long period. In this paper, we first document the stylized facts about the labor market informality and its change over the period between 2004 and 2018 using Household Labor Force Survey micro data. While we document that the share of informal employment in total employment decreased from 50.6% to 33.4% over the past fifteen years, we highlight a tremendous variation across regions, sectors, firm sizes, and worker characteristics.

Second, we decompose the changes in labor market informality into its components using Oaxaca-Blinder decomposition methodology. Thus, we can identify the explained and unexplained causes of the change in informality over the past fifteen years. We find that the compositional change in the workforce can explain 51% of the reduction in informality rate. The rise in education level and firm size, and the shift from agriculture to service sector suppressed Turkey's informality rate. Overall, the decomposition analysis implies that almost 8 pp of the 17 pp decline in informality rate from 2004 to 2018 would happen even if the sample characteristics remained the same at the 2004 level and the remaining decline by 9 pp is due to the change in sample characteristics. This estimation is significantly helpful in understanding the overall change in informality rates and for further policymaking.

Finally, we investigate the wage underreporting in Turkey as another form of labor market informality. In this part of the analysis, we construct cells of individuals based on sector, firm size, gender, and age using both Household Labor Force Survey micro data and Social Security Registry data. We show that even among the formally employed individuals, there is a gap between the wages earned and the wages declared to the social security registration. However, the data show that this discrepancy between the officially declared wages and the actual wages has diminished during the past few years. This is partially because of the relatively high minimum wages in recent years. The minimum wage is more binding than before, so that declared wages and actual wages coincide more than before.

Our analyses highlight that informality is more prevalent among micro firms and less skilled labor. This implies that policies aiming to reduce informal employment might emphasize the policies fostering human capital. Improvements in the quantity and quality of the education system will increase the employability of labor in formal jobs. Improving active labor market policies, particularly on-the-job trainings for youth, also equip required skills of the unemployed to get into the jobs with social security. Moreover, the labor market's regulatory framework aggravates informal employment by limiting firms' ability to hire formally. Enhancing labor market flexibility might help formalization of firms. Besides, wage subsidies aiming at reducing labor cost to employers might also stimulate formal employment. In Turkey, wage subsidies, can be applied to all workers and firms, or can be worker-sector-region specific, are mostly in the form of social security premium and tax reductions. While across-the-board subsidies might reduce both informal employment and wage underreporting, targeted subsidies might generate substitution effect as well. Employers might prefer to substitute elder employees for younger ones when social security premiums are subsidized for them. Thence, how and to what extent wage subsidies are effective in the increase of formality are crucial and can be a question for further research.

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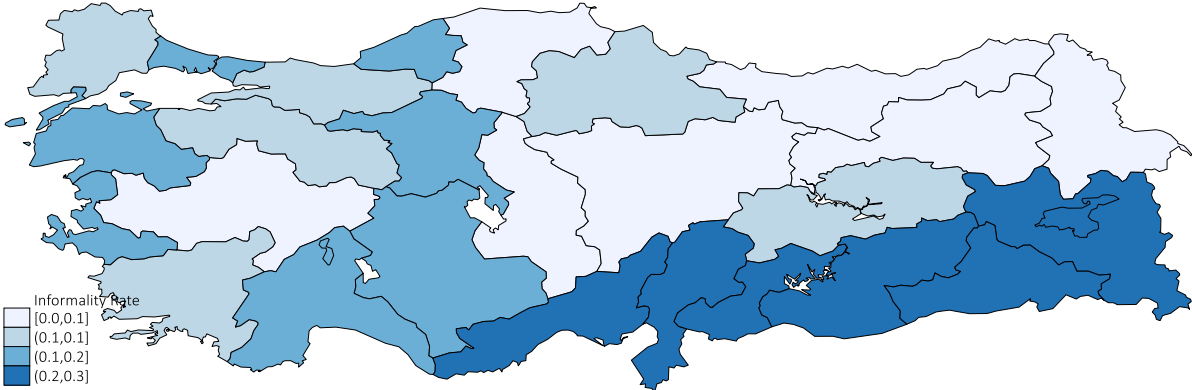
Appendix:

Figure A1: Informality Rates for Firms with 1-9 Employees by Region (NUTS2 level, 2018)
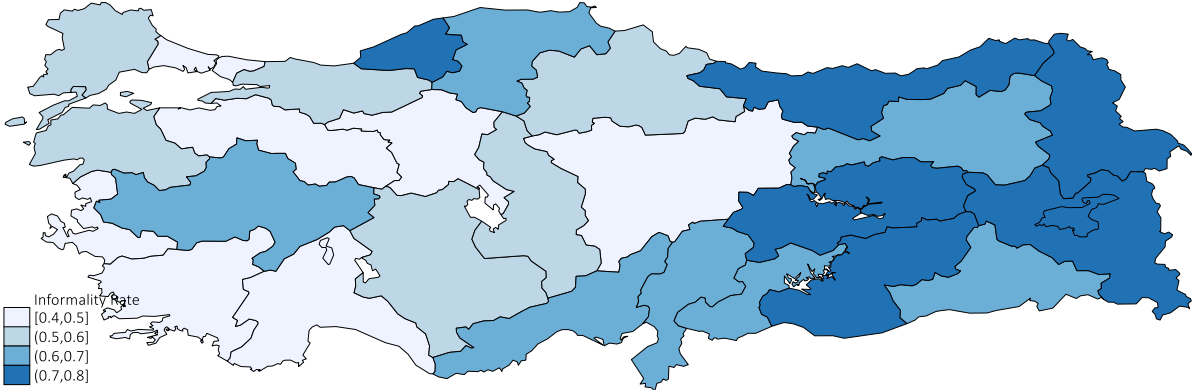
Source: Household Labor Force Surveys, Authors' calculations.

Figure A2: Informality Rates for Firms with 10-24 Employees by Region (NUTS2 level, 2018)

Source: Household Labor Force Surveys, Authors' calculations.

Figure A3: Informality Rates for Firms with 25-49 Employees by Region (NUTS2 level, 2018)
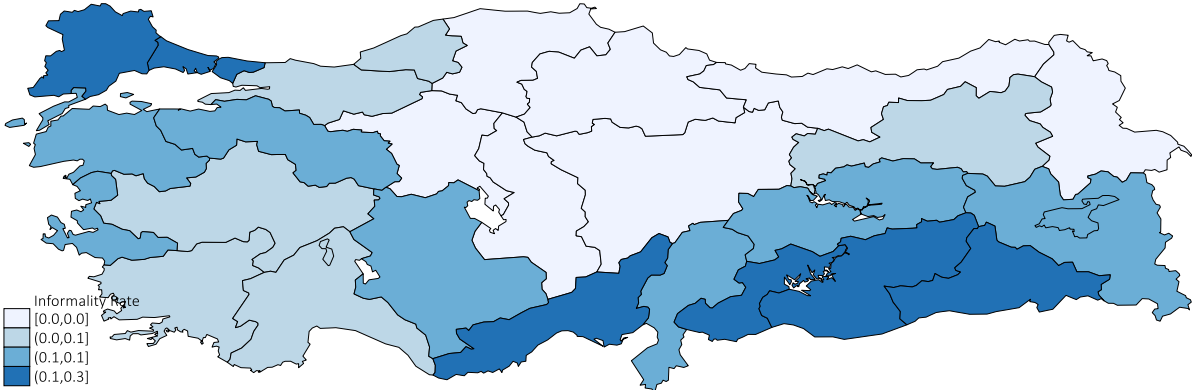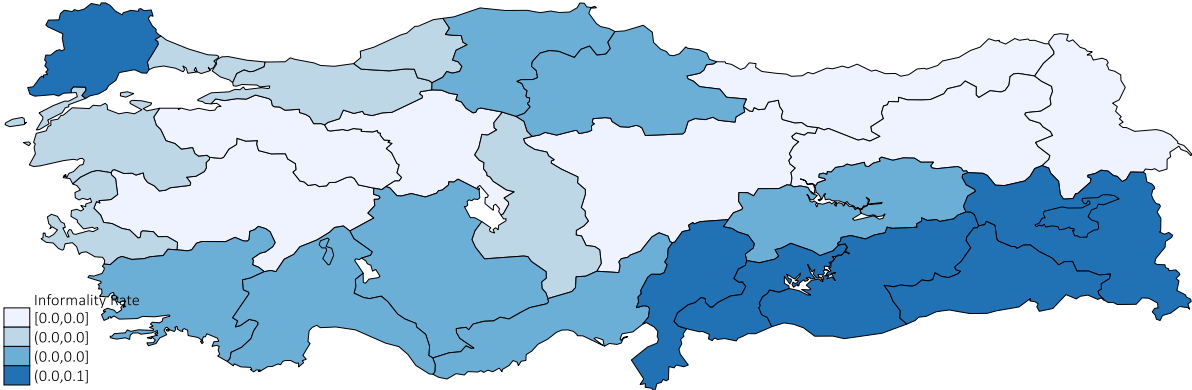

Source: Household Labor Force Surveys, Authors' calculations.

Figure A4: Informality Rates for Firms with 50+ Employees by Region (NUTS2 level, 2018)

Source: Household Labor Force Surveys, Authors' calculations.

Figure A4: Informality Rates in Non-Agricultural Sectors for Firms with 1-9 Employees by Region (NUTS2 level, 2018)
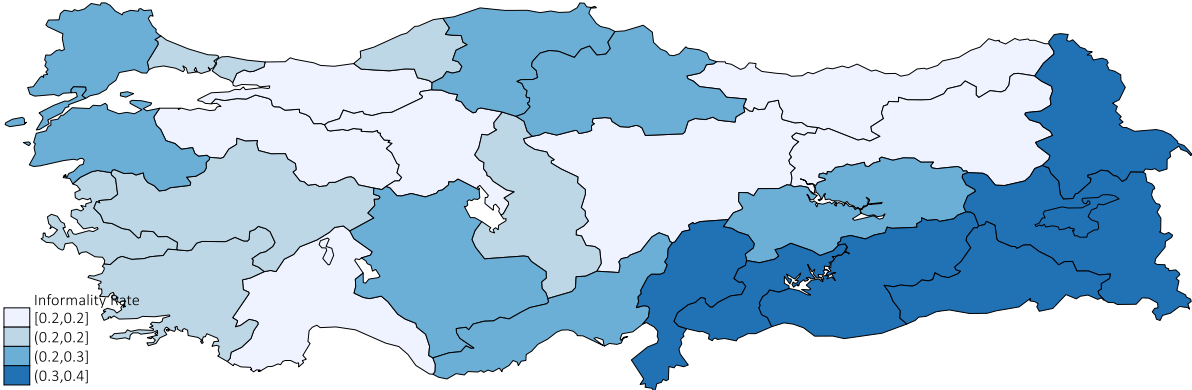
Source: Household Labor Force Surveys, Authors' calculations.

Figure A5: Informality Rates in Non-Agricultural Sectors for Firms with 10-24 Employees by Region (NUTS2 level, 2018)

Source: Household Labor Force Surveys, Authors' calculations.

Figure A6: Informality Rates in Non-Agricultural Sectors for Firms with 25-49 Employees by Region (NUTS2 level, 2018)
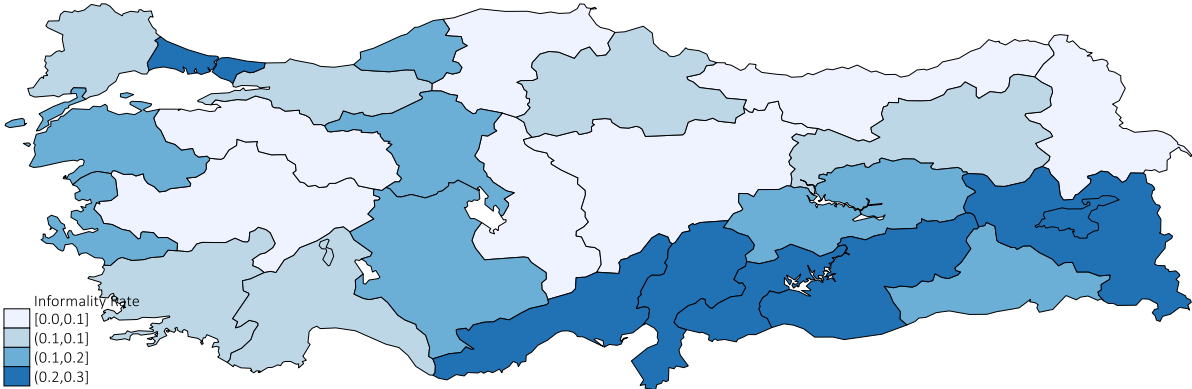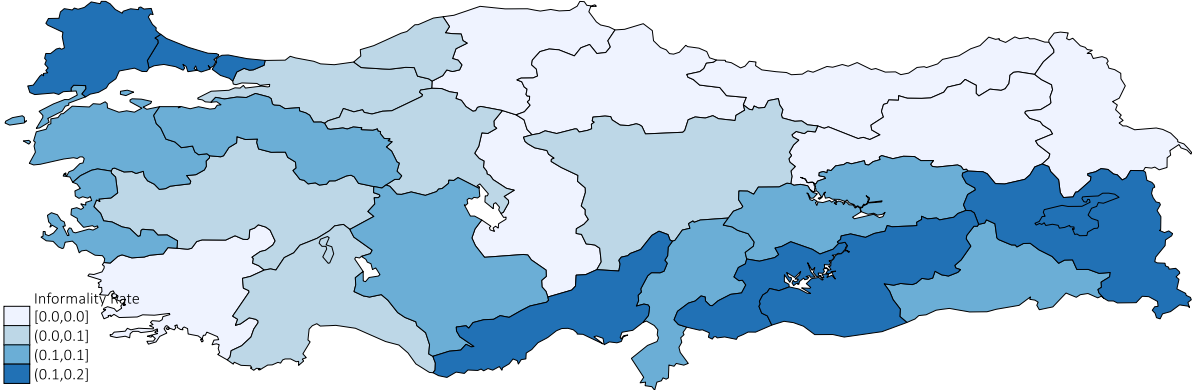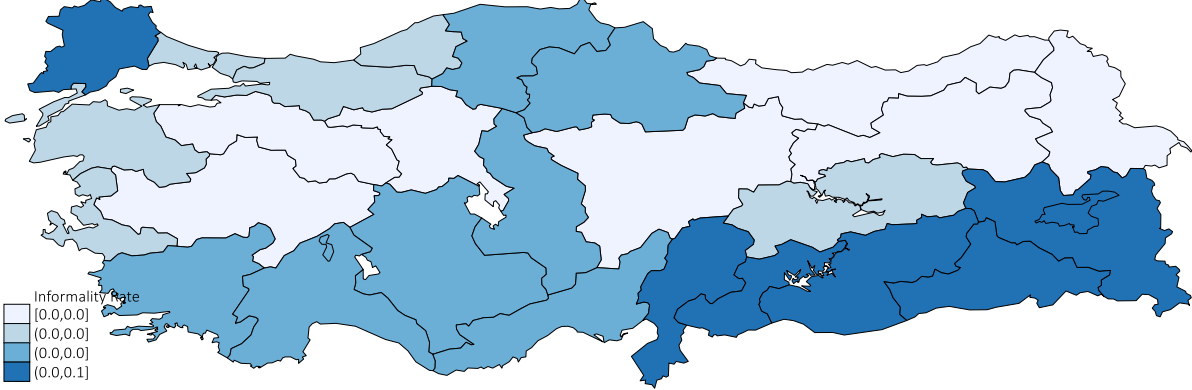

Source: Household Labor Force Surveys, Authors' calculations.

Figure A7: Informality Rates in Non-Agricultural Sectors for Firms with 50+ Employees by Region (NUTS2 level, 2018)

Source: Household Labor Force Surveys, Authors' calculations.

Table A1: Probit Regression Estimate Results

Dependent Variable: Informal Employment Dummy

	2004	**2008**	**2009**	**2013**	**2014**	**2018**
Male	-0.37***	-0.44***	-0.43***	-0.47***	-0.42***	-0.29***
	(0.05)	(0.06)	(0.05)	(0.06)	(0.06)	(0.04)
Age	-0.11***	-0.13***	-0.13***	-0.12***	-0.12***	-0.15***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age Squared	0.12***	0.17***	0.16***	0.14***	0.16***	0.18***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Education						
− Literate w/o Schooling	-0.13*	-0.19***	-0.11*	-0.11**	-0.23***	-0.24***
	(0.07)	(0.05)	(0.06)	(0.05)	(0.06)	(0.07)
− Primary	-0.60***	-0.63***	-0.56***	-0.52***	-0.63***	-0.62***
	(0.10)	(0.06)	(0.08)	(0.06)	(0.09)	(0.08)
− Secondary	-0.77***	-0.73***	-0.64***	-0.62***	-0.79***	-0.80***
	(0.11)	(0.08)	(0.09)	(0.07)	(0.09)	(0.10)
− High school	-1.00***	-1.02***	-0.91***	-0.93***	-1.04***	-0.98***
	(0.11)	(0.08)	(0.09)	(0.08)	(0.09)	(0.10)
− Higher education	-1.21***	-1.22***	-1.10***	-1.20***	-1.31***	-1.21***
	(0.12)	(0.09)	(0.10)	(0.09)	(0.10)	(0.10)
Occupation						
− Legislators, Senior Officials and Managers	-0.62***	-0.47***	-0.46***	-0.57***	-0.53***	-0.54***
	(0.04)	(0.04)	(0.04)	(0.10)	(0.06)	(0.06)
− Professionals	-0.85***	-0.78***	-0.79***	-0.77***	-0.65***	-0.61***
	(0.12)	(0.07)	(0.11)	(0.07)	(0.09)	(0.05)
− Technicians and Associate Professionals	-0.62***	-0.63***	-0.53***	-0.57***	-0.49***	-0.39***
	(0.05)	(0.06)	(0.07)	(0.04)	(0.04)	(0.03)
− Clerks	-0.85***	-0.81***	-0.74***	-0.83***	-0.82***	-0.68***
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)
− Service Workers and Shop and Market Sales Workers	-0.24***	-0.31***	-0.20***	-0.26***	-0.25***	-0.25***
	(0.05)	(0.03)	(0.03)	(0.07)	(0.04)	(0.05)
− Skilled Agricultural and Fishery Workers	-0.41***	-0.72***	-0.49***	-0.59***	-0.64***	-0.60***
	(0.14)	(0.13)	(0.12)	(0.11)	(0.12)	(0.11)
− Craft and Related Trades Workers	-0.29***	-0.24***	-0.21***	-0.25***	-0.26***	-0.22***
	(0.03)	(0.03)	(0.03)	(0.05)	(0.03)	(0.03)
− Plant and Machine Operators and Assemblers	-0.30***	-0.26***	-0.25***	-0.39***	-0.33***	-0.30***
	(0.08)	(0.04)	(0.07)	(0.03)	(0.04)	(0.03)
Employment status						
− Wage or salaried employee, casual workers	-0.72***	-0.98***	-0.62***	-0.80***	-0.76***	-0.75***
	(0.08)	(0.10)	(0.10)	(0.08)	(0.10)	(0.08)
− Employers	-1.21***	-1.31***	-0.85***	-1.21***	-1.16***	-0.97***
	(0.07)	(0.08)	(0.08)	(0.10)	(0.09)	(0.08)
− Self-employed	-0.84***	-0.89***	-0.39***	-0.55***	-0.44***	-0.26***
	(0.07)	(0.07)	(0.06)	(0.05)	(0.05)	(0.04)
Firm size						
- 1-9 workers	1.63***	1.59***	1.48***	1.43***	1.46***	1.44***
	(0.11)	(0.06)	(0.06)	(0.05)	(0.05)	(0.04)
- 10-24 workers	0.98***	0.90***	0.83***	0.75***	0.79***	0.73***
	(0.06)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)
- 25-49 workers	0.58***	0.57***	0.50***	0.41***	0.55***	0.47***
	(0.06)	(0.02)	(0.03)	(0.03)	(0.04)	(0.06)

Table A1: Probit Regression Estimate Results (Contd)

Dependent Variable: Informal Employment Dummy						
	2004	**2008**	**2009**	**2013**	**2014**	**2018**
Sector						
- Industry	-0.79***	-0.85***	-0.60***	-0.73***	-0.70***	-0.57***
	(0.13)	(0.11)	(0.12)	(0.10)	(0.11)	(0.11)
- Construction	-0.20*	-0.39***	-0.20*	-0.45***	-0.52***	-0.52***
	(0.12)	(0.11)	(0.11)	(0.09)	(0.11)	(0.09)
- Services	-0.86***	-0.89***	-0.71***	-0.85***	-0.82***	-0.78***
	(0.12)	(0.10)	(0.11)	(0.08)	(0.09)	(0.08)
Constant	3.59***	4.04***	3.41***	3.32***	3.41***	3.54***
	(0.25)	(0.21)	(0.20)	(0.21)	(0.21)	(0.20)
# of observations	136,902	139,860	145,934	164,176	171,328	170,125

Source: Household Labor Force Surveys, Authors' calculations.
Note: (1) Reference category is illiterate for education, unpaid family workers for employment status, elementary occupations for occupation, 50+ employees for firm size, and agriculture for sector.
(2) Since data is available at individual level, sample weights are used to ensure national representativeness. Standard errors, clustered at Nuts2 level, are reported in parentheses. *p<0.1, **p<0.5, ***p<0.01.

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