Labor Market Rigidities and Informality in Colombia

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Abstract

Informality is at the center of the economic debate in Colombia, fueled by the high level prevalent in the country and the substantial increase in the size of the informal sector observed during the 1990s. We study the effect of labor market rigidities, namely the increase in non-wage costs and the minimum wage, on the size of the informal sector and the transition into and out of informality. Our estimates indicate that rises in non-wage costs and the minimum wage increase the probability of being informal. To analyze the transition between the formal and informal sectors, we measure the flow of workers and study the determinants of entry and exit into and out of informality. The evolution of labor market rigidities in Colombia during the last two decades has in general increased the rotation in the labor market, by increasing the transitions between these two sectors.

Key Words: Informality, Non-wage costs, Minimum Wage, Transitions

JEL Codes: J31, J32, J38

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1. Introduction

Informality has been at the center of the economic debate in Colombia due to the high levels prevalent in the country and its substantial increase during the 1990s. The informal sector includes a range of heterogeneous activities, from unpaid labor to a number of unregulated salaried jobs. Informality is thought to have negative implications, mainly through inferior working conditions, lack of formal insurance against illness, unemployment and/or old age, and low productivity levels for firms. Alternative definitions of informality have been proposed in the literature, each implying a different approach to this phenomenon.

The Colombian labor market is characterized by high levels of non-wage costs (NWC) and minimum wage to median wage ratio. NWC are costs faced by the employer, other than the wage. These include health and pension contributions, labor taxes[1], among others. These rigidities imply that the formal sector, where regulations are binding, is less able to adjust to the business cycle.

This paper, despite being descriptive in nature, brings new elements to our understanding of informality in Colombia and suggests directions for future research. We study the evolution of informality between 1984 and 2006; a period that includes both expansions and recessions, structural reforms of the labor market and significant variation in non-wage costs and the minimum wage. We compare alternative definitions of informality and adopt two: the definition used by the Colombian Statistics Department (DANE, for its initials in Spanish) which is based on firm size and occupation, and pension contributions. Regardless of the definition of informality, the observable characteristics of informal workers remained unchanged during the period of study. However, the relative returns of being in the informal sector deteriorated dramatically.

First, we estimate the probability of being informal as a function of individual characteristics, the business cycle and labor market rigidities. Our results suggest that rises in non-wage costs and the minimum wage are highly correlated with informal sector growth.

Next, we look at the transitions between sectors. On one hand we measure the transition flows between the formal and informal sectors, and unemployment using transition matrices. This describes, for example, what percentage of the job destruction in the formal sector is absorbed by the informal sector and how much translates into higher unemployment. On the other hand, we estimate the effect of individual covariates, the business cycle and labor market rigidities on the likelihood of switching sectors, to characterize the determinants of the decision to transit. We find that labor market rigidities are important drivers of the transition into informality, but not necessarily into formality. However, further research is needed to understand the channels through which labor market rigidities affect the transition into the formal sector.

One strand of the literature associates informality to labor market rigidities in Colombia. Núñez (2002) finds a positive relation between informality and income taxes on labor

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[1] Labor taxes refer to employer contributions to finance public social services such as job training and childcare -*parafiscales*.

revenue for the period 1988-1998. Using a firm panel from the industrial sector, Kugler and Kugler (2009) find that a 10% increase in payroll taxes decrease formal employment between 4 and 5%. Albrecht et. al (2008), in an extension of the Mortensen-Pissarides search model, point out that rises in NWC increase the size of the informal sector. Santa María et al. (2009) find that the subsidized regime, financed through NWCs, has increased the incentives to become informal and it is thus acting as a subsidy to informality.

Some authors, on the other hand, characterize informal workers and study informality from a segmentation perspective. Flórez (2002) finds that some informal workers are excluded from the formal sector, while others opt out. Perry et al. (2007) document two coexistent phenomena in the Latin American region: *exclusion* from the formal sector and its benefits as a result of labor market segmentation; and *exit* from the formal sector as some workers find better conditions in informality. Whereas in most Latin American countries the self-employed choose to be so, the Colombian self-employed are deemed an exception since they seem to be excluded from the formal sector. Bernal (2007) suggests that one half of informal workers would not accept a formal job for a wage equal to or lower than the one they currently make.

The paper is divided into 7 sections. The following section compares alternative definitions of informality; section 3 describes the evolution of labor market rigidities while in section 4 informal workers are described in terms of their observable characteristics. In section 5 we estimate the effect of NWC and the minimum wage on the size of the informal sector and in section 6 we study the flows between sectors and their determinants. The last section concludes.

2. The Evolution of Informality

2.1 Data Description

We use the Colombian Household Survey 1984-2006, a repeated cross-section carried out by the National Statistics Department. The survey collects information on demographic and socioeconomic characteristics of the population, such as gender, age, marital status and educational attainment, together with labor market characteristics for the population aged 12 or more including occupation, job type, income and industry sector of employment.

Dictated by data availability our analysis focuses on Colombia's eleven main cities between 1984 and 2000, and the thirteen main ones for the period 2001-2006. In particular we use the *Informality Module* in the household survey, which allows for several empirical definitions of informality as described in the next subsection. This module was available every two years before 2001 (except for 1990), and yearly thereafter. We use observations with a complete set of covariates and restrict the sample to workers between 15 and 70 years of age, who report working between 16 and

84 hours per week. The size of the weighted samples ranged from 1.7 million workers in 1984 to about 6.5 million in 2006.

2.2 Informality Definitions

Alternative definitions of informality, usually dictated by data availability, have been proposed in the literature. This section characterizes the evolution of informality using the definitions available in the Household Survey, and explores the extent to which informality definitions involving compliance (or non-compliance) with labor market regulations concur with the one related to firm size and occupation.

Let us start by introducing the definition of informality used by DANE, which is similar to the one proposed by the International Labor Office. Informal workers: (i) work in firms with 10 or fewer employees; (ii) are unpaid family aids and housekeepers; (iii) are self employed (except for independent professionals and technicians); or (iv) are business owners of firms with 10 or less employees. Since it is largely driven by firm size and worker occupation, we will refer to it as the *Firm Size and Occupation* definition of informality. Note that even though the negative aspects of informality have to do with lack of insurance, this definition does not explicitly include any criteria related with labor market regulations. Thus, this definition has been criticized in the literature for not measuring the phenomenon directly.

We also consider definitions related to *social protection contribution* that capture whether workers have access to the benefits associated with formal employment. The first social protection definition has to do with old-age insurance: we define formal workers as those who make *Pension* contributions. The next informality criterion is *health contribution[2]* - *Health* in what follows. Note that according to Colombian Law, workers should contribute *individually* to social security. However, if an individual has health insurance the spouse, children and parents are also covered. Therefore, covered spouses have no incentive to contribute as law-abiding families are double-taxed for health insurance. In this paper, we consider workers who are covered by spousal/family insurance or who work but are covered by the subsidized regime as informal. Finally, we consider the *Health and Pension* criterion that defines workers as informal if they do not contribute to both health *and* pension. Being the most comprehensive criterion, it implies the highest levels of informality.

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[2] Informality behaves very differently when measured by health access instead of health contribution, mainly due to the expansion in the "subsidized regime" (free health insurance provided to the poor).

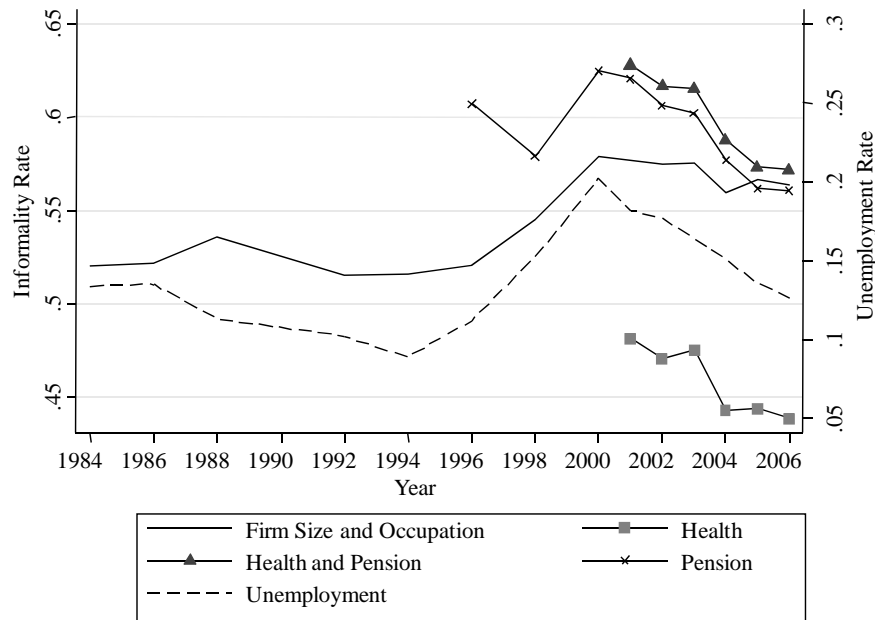**Figure 1. The Evolution of Informality by Definition**

Figure 1 presents the evolution of the informality rate for the period 1984-2006 across alternative definitions[3]. According to *Firm Size and Occupation*, informality was stable around 52% from 1984 to 1996, grew steadily between 1996 and 2001 to 56%, and remained at this level until the end of the period. This increase is sizable and is at center of the domestic debate. Under *Pension*, the percentage of informal workers increased from 1998 to 2001, and then continually decreased until 2006. Informality as measured by health decreases between 2001 and 2006. Moreover, informality is higher if measured through pension contributions as compared to health contributions, suggesting either that workers value health over old-age insurance, or the existence of informal insurance mechanisms such as those linked to double-taxation. Informality measured by *Health and Pension* follows closely the *Pension* criterion, though at a slightly higher level.

The dotted line, measured on the right axis, is the urban unemployment rate. Whereas the informality definitions that have to do with Health or Pension seem to follow the cycle, the *Firm Size and Occupation* definition doesn't. For the 2001-2006 period, a time of economic expansion, informality was stable according to the *Firm Size and Occupation* definition, but decreasing when measured using definitions related to social security compliance.

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[3] The time series for each definition is presented according to data availability.

2.3 To What Extent do Alternative Definitions of Informality Concur?

Despite the difference in levels, the *evolution* of informality measured by *Pension* and *Health* is very similar. Taking a closer look to the composition of these groups, those classified as informal under *Health* are almost a subset of those classified as informal in *Pension*: on average one percentage point of those considered informal using the *Health* criterion are formal under *Pension* (consistent with the slight difference in levels observed between *Pension* and *Health and Pension* in Figure 1). Since the *Pension* definition captures the relevant information regarding informality measured by labor market regulation compliance and it is available for a longer period than Health, it will be used in the remainder of the paper as the benchmark definition for compliance of labor market regulations.

The levels of informality suggested by *Pension* are similar to those measured by *Firm Size and Occupation*. However, the question of whether these alternative definitions are classifying the same workers as informal remains. To address this, we first present a Venn diagram (Figure 2) portraying the extent to which these definitions coincide for year 2006, where the observed informality levels under both definitions are almost identical (around 56% as will be shown in Figure 4).

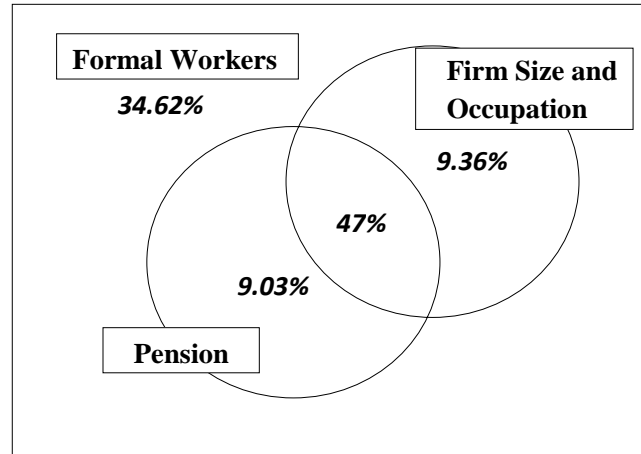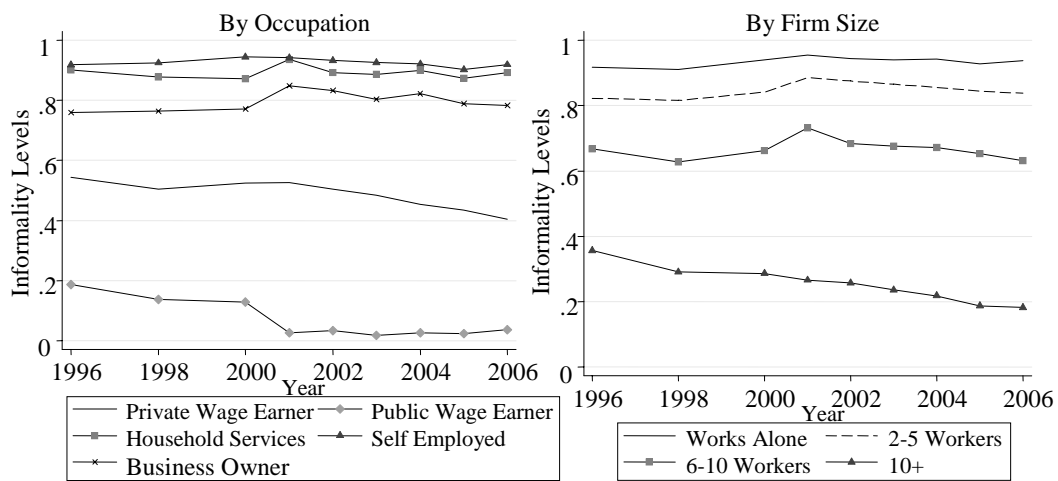**Figure 2. Coincidence of Informality Definitions, 2006**

Figure 2 has two main implications. First, the *Firm Size and Occupation* definition captures a sizeable portion of workers considered informal under *Pension*. Second, the difference between the two definitions is sizable as about one fifth of all workers are classified as formal or informal depending on the definition used.

Under both *Firm Size and Occupation* and *Pension*, 47% of workers are informal. Hence, even though the government's official definition does not include any criteria regarding social security coverage, it captures the bulk of the phenomenon indirectly. This is because non-compliance with social-security regulations is a small-firm

phenomenon that varies across occupations (as portrayed in Figure 3). Differences in *Pension* are staggering: around 30% of individuals working in firms with more than 10 employees are informal compared to over 90% of those working alone. This is mainly explained by the fact that compliance costs are more difficult to cover for small firms, for which is also easier to stay below the government's radar. Differences in *Pension* across occupations are also important; about 80% of self employed and household services (who are informal according to the *Firm Size and Occupation* definition) do not contribute to Pensions. On the other end of the spectrum, few government employees are informal according to *Pension*. The magnitude of the differences in firm size are similar to than those across occupations.
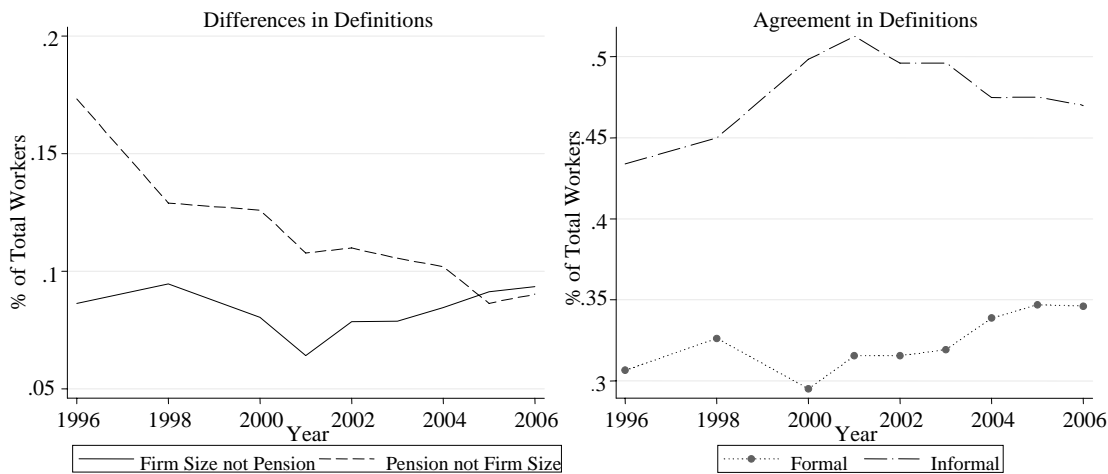
Figure 3. Informality Under *Pension* Across Occupations and Firm Size

Informality levels in 2006 measured by *Firm Size and Occupation* and *Pension* are very similar. However as mentioned above, the classification differences between the two measures for the same year are substantial. Around 18% of workers are formal under one definition and informal under the other. Figure 4 shows the evolution of the coincidence between the two definitions, that is, the information contained in the Venn Diagram over time. The left hand side panel of Figure 4 shows the evolution of the classification differences between 1998 and 2006. Notice that the percentage of workers classified as informal under *Pension* but as formal under *Firm Size and Occupation* (Pension not Firm Size in the graph) has been decreasing for the period of study from 13% in 2001 to 9% in 2006. Workers classified as informal using *Firm Size and Occupation*, but formal using *Pension* (Firm Size not Pension in the graph), have fluctuated between 7% and 9%.

On the other hand, the right hand side panel of Figure 4 shows the percentage of workers who are either informal or formal under both definitions. The percentage of workers classified as informal under both definitions ranges between 45% and 50% while the coincidence in formality varies between 30% and 35%.

Figure 4. Comparison between *Firm Size and Occupation* and *Pension* 2000-2006

Who are the misclassified workers? Workers who are informal under *Firm Size and Occupation* but are formal under *Pension* can be grouped in two categories. On the one hand, they are relatively educated, older and wealthier. On the other, they are often unpaid family aids and household workers. Workers who are considered informal under *Pension* but are formal under *Firm Size and Occupation* are relatively younger, more educated, richer and are more often either private wage earners or self-employed (see Table A1 in the Appendix).

2.4 Informality and the Business Cycle

The period under study includes both expansions and recessions, structural reforms of the labor market and significant variation in non-wage costs and the minimum wage. Therefore, it is interesting to study the effects of each of them on informality. Let us begin by calculating the correlation coefficients between the size of the informal sector (across alternative definitions) and the business cycle for the period 1984-2006. If informality is a disadvantage sector of a segmented labor market detached from formal activity, it should be countercyclical since it expands during downturns to absorb displaced workers from the formal sector. If, on the other hand, the size of the informal sector is procyclical, this is suggestive of a micro-entrepreneurial sector, linked to the formal sector through the provision of low cost goods and services.

Table 1 shows that informality, except for the case when it is measured by *Pension*[4], is positively and significantly correlated with unemployment. This implies that the size of the informal sector moves in opposite direction to the business cycle, suggesting segmentation in the labor market. While informality measured by *Firm Size and Occupation* displays a correlation of +0.61, the correlation is substantially higher when informality is measured through *Health* or *Health and Pension* (ranging between +0.91 and +0.97)[5].

Table 1. Correlation between Informality Definitions and the Business Cycle

	Firm Size and Occupation	**Pension**	**Health Contribution**	**Health and Pension**
Unemployment	0.61*	0,57	0.91*	0.97*
p-value	2,0%	10,4%	1,1%	0,1%

* Significant at 95% confidence levels.

Flórez (2002) divided the Colombian informal sector into three subgroups, according to their goals and observable characteristics. *Subsistence*, a group of workers who are forced to be informal as their last and only possibility to earn a living: the self-employed, unpaid family aids and household services; *Lower Costs*, workers who have an informal contract in order to lower the cost for the firm; and *Business Owners*, the owners of small firms who want to accumulate capital taking advantage of the greater flexibility and lowers costs in the informal sector[6]. For the period between 1986 and 2000, Flórez (2002) finds that the first subsector is negatively correlated with the business cycle, and therefore implies exclusion. The last two are positively correlated with economic growth, which implies that they are voluntarily –and perhaps temporarily- opting out of formality (i.e. exit).

We perform this exercise for the period between 1984 and 2006 and find that all three subsectors are negatively correlated to economic growth. We also include calculations for *Health*, for comparability purposes because *Pension* is only available for the period 1996-2006. Moreover, we replicate the analysis for two separate subperiods. Table 2 shows that for the period 1984-2000 the signs of the correlations are consistent with Flórez (2002), although insignificant. However, for the remainder of the period, the correlation coefficient for all subsectors is negative and signficant[7]. Thus, workers with an informal contract and entrepreneurs, who used to opt out of formality, seem to be now *excluded* from it.

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[4] When we exclude the year 1996 from the calculation, the correlation coefficient of Pension is highly and statiostically significant: +0.87.
[5] We get very similar results when estimating the correlations with GDP growth.
[6] The owners of big firms have extremely low levels of informality measured by social protection.
[7] The same results hold if we choose the cutoff year to be between 1996 and 2002. Again, our results are robust if we use GDP growth to proxy for the cycle.

Table 2- Correlations between Informality under Health and the Business Cycle by subsector

1984-1998				
	Subsistence	Lower Costs	Business Owners	Total Health
Uneployment	0,70	-0,31	-0,59	0,20
p-value	8,1%	50%	16%	66%
2000-2006				
	Subsistence	Lower Costs	Business Owners	Total Health
Uneployment	0.90*	0.86*	0.84*	0.88*
p-value	0,6%	1,2%	1,7%	0,8%

These findings open an interesting question in regards to changes in the Colombian labor market that could have tilted the balance between the exit and exclusion components. Thus, the remainder of the paper explores some elements in this direction by estimating the effects of labor market rigidities on informality.

3. Labor Market Rigidities and Informality

The Colombian labor market is characterized by having high NWC and wage inflexibility associated with the minimum wage (Bernal et al., 2009). Such rigidities are thought to contribute to the high unemployment and informality rates prevalent in the economy mainly due to the lack of adaptability of the formal sector to the business cycle. The coexistence of high levels of NWC and minimum wage reinforce each other's negative effects.

An increase in NWC makes labor relatively more expensive as compared to capital for employers. Hence employers can either shift the production away from labor, destroying formal working posts, or try to pass the additional cost to employees via lower wages. However, the nominal downward rigidity imposed by a high and binding minimum wage, implies that formal employers cannot always completely pass on NWC to workers via prices and may also adjust through quantities by destroying formal jobs. Ultimately, this generates a higher destruction rate of formal jobs that pushes more workers into either the informal sector or unemployment[8].

Increases of the minimum wage beyond increases in price levels and productivity can also generate job destruction directly. If the minimum wage increases in real terms, formal sector firms destroy working posts whose productivity levels lie between the old and new minimum wage to comply with labor market regulations.

Let us describe, in turn, the evolution of NWC and the minimum wage over the period of study. Colombia faced very profound reforms, as did other countries in the region, in

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[8] For a simple formalization of the theoretical effects of payroll taxes on formal employment, see Kugler and Kugler (2009).

the early 1990s. In particular, Law 100 of 1993 structurally reformed the Colombian social security system, both in health and pensions. Two regimes were created in health insurance: contributive (an employment-based mandatory insurance system) and subsidized. Before 1993, health contributions amounted to 6% of the wage, while after the reform contributions[9] increased to 12%. Pension contributions rose from 8% to 13.5% of the wage after the reform (Flórez, 2002, and Santa María et al. 2009). Therefore, Law 100 increased non wage costs by 11.5 percentage points.

In addition to the steep increase in NWC, Bernal et al., (2009) suggest that three aspects of the current design of the Colombian social protection system, embeded in Law 100 of 1993, generate informality. First, since social security benefits are multi-dimensional, workers who prefer partial coverage over full coverage may opt out of the whole package and hence become informal. Second, there is a percentage of the population for whom the quality of the services offered in the contributive and subsidized regimes are comparable. Since the subsidized regime is free of charge, it is efficient for eligible workers in this population to remain in the subsidized regime. One of the claimed recent successes of Colombian public policy is precisely the increase in coverage of the subsidized regime. Third, the current design does not allow for an easy transit between the formal and informal sectors. Thus, workers in the subsidized regime are reluctant to accept a formal job and enter the contributive regime, since re-entering the subsidized regime is time-consuming. Finally, workers who are thus eligible for the subsidized regime (classified as poor) are also eligible for an array of social programs. Therefore, by accepting a formal job, the worker and his family gain access to the contributive health insurance regime, but loose the other benefits.

Let us now turn to the evolution of the minimum wage. First, the minimum wage in Colombia is high. Over time increases in the minimum wage should take into account not only changes in the price level, to maintain its purchasing power, but also increases in productivity. Therefore, a good way to characterize its evolution in time is to take the ratio between the minimum and the median wage. This measure trivially controls for the effect of inflation. Since the median wage is a measure of the average productivity of the labor force, by measuring the minimum as a proportion of the median, we also account for increases in productivity. We will refer to this measure as the *min-median ratio* in what follows. In a cross-country comparison, Maloney and Nuñez (2004) find that the Colombian minimum wage -as measured by the *min-median ratio*- is among the highest in Latin America.

Second, the minimum wage in Colombia is binding. As shown in Kristensen and Cunningham (2006), rises in the minimum wage increase the relative cost of labor and given the presence of downward wage rigidities, the formal sector is unable to adjust via

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[9] For wage-earners, the worker and employer share the burden, 4% and 8%, respectively, and the self-employed have to contribute the full amount. Nearly 10 percentage points of the contribution finance the worker's insurance and the remainder contributes to the health access of the poor and unemployed in the subsidized regime.

prices and is forced to do so via quantities. The same logic applies during periods of economic downturn: wages cannot be adjusted downwards generating higher formal job destruction rates. Therefore, the evolution of the minimum wage is expected to affect the relative sizes of the formal and informal sectors.

In addition, Maloney and Núñez (2004) suggest that the minimum wage indexes the whole wage distribution, since increases in the minimum wage are adopted as a benchmark for wage increases along the distribution. The effect is stronger for wages close to the minimum and decreases for higher wages in the distribution. Also, a sizeable fraction of the workforce earns less than the minimum, especially in the informal sector. Hence, not only does the existence of a minimum wage generate wage inflexibilities -especially around the minimum, but the *evolution* of the minimum wage can have important effects on the labor market's behavior.

The *min-median ratio* remained relatively stable around 85% from the mid 1980s to the early 1990s, decreased to 70% in the mid 1990s, escalated to over 90% by 2000 and remained at this level until the end of the analysis period. This secular increase was the result of an inflation forecast error combined with legislation by the Constitutional Court. Increases in the minimum wage for the following year in Colombia are negotiated by the end of the previous year, and guided by the projected inflation rate plus calculated increases in productivity. In December 1998 the expected inflation for year 1999 was in the range of 15% to 17%, and the negotiated increase in the minimum wage was 16%. However, during the course of the year the country fell into the deepest recession since the 1930s and the realized inflation rate for year 1999 was 9%. Therefore, the minimum wage increased 7% in real terms. The following year, the Constitutional Court ruled that minimum wage increases could never be below the observed inflation rate of the previous year[10]. The combination of these decisions implied that the minimum wage has been effectively maintained at a very high level since.

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[10] Constitutionality Sentence Nº 815/99, October 20 1999. "El Gobierno, en la hipótesis de la norma, debe ponderar los factores contenidos en ella, pero que, en todo caso el reajuste salarial que decrete nunca podrá ser inferior al porcentaje del IPC del año que expira. Y ello por cuanto el Gobierno está obligado a velar por que el salario mantenga su poder adquisitivo, de tal forma que garantice el mínimo vital y móvil a los trabajadores y a quienes de ellos dependen. De lo contrario, vulnera el artículo 53 de la Constitución."

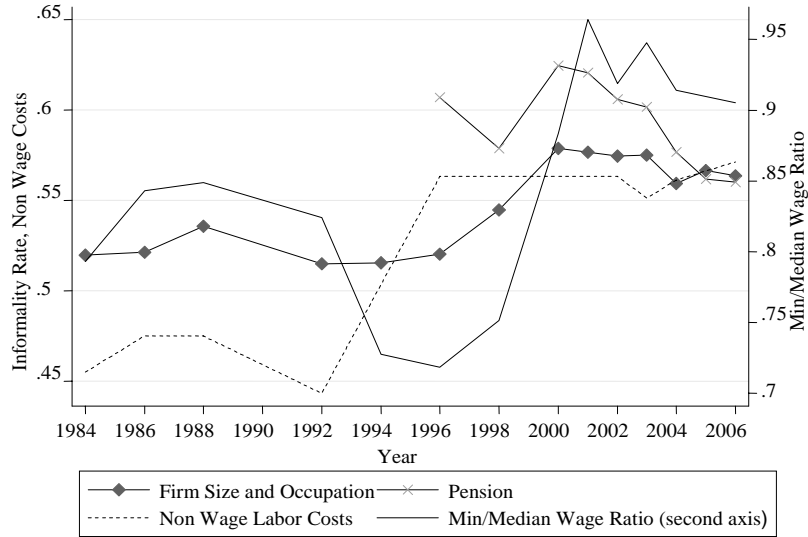**Figure 5. Informality and Labor Market Rigidities**

Figure 5 displays the informality rates under *Firms Size and Occupation* as well as under *Pension*, alongside the *min-median ratio* and NWCs. As described above, both the NWC and the min-median ratio display secular increases during the period of study. The major increase in NWC was due to Law 100 of 1993, which substantially increased the payroll taxes. The min-median fluctuated 0.53 and 0.45 until 1998. In 1999 it jumped to over 0.90 and remained at this level until 2006. Graphically, the increase in NWC precedes the increase in informality, while the increase in the min-median ratio follows it.

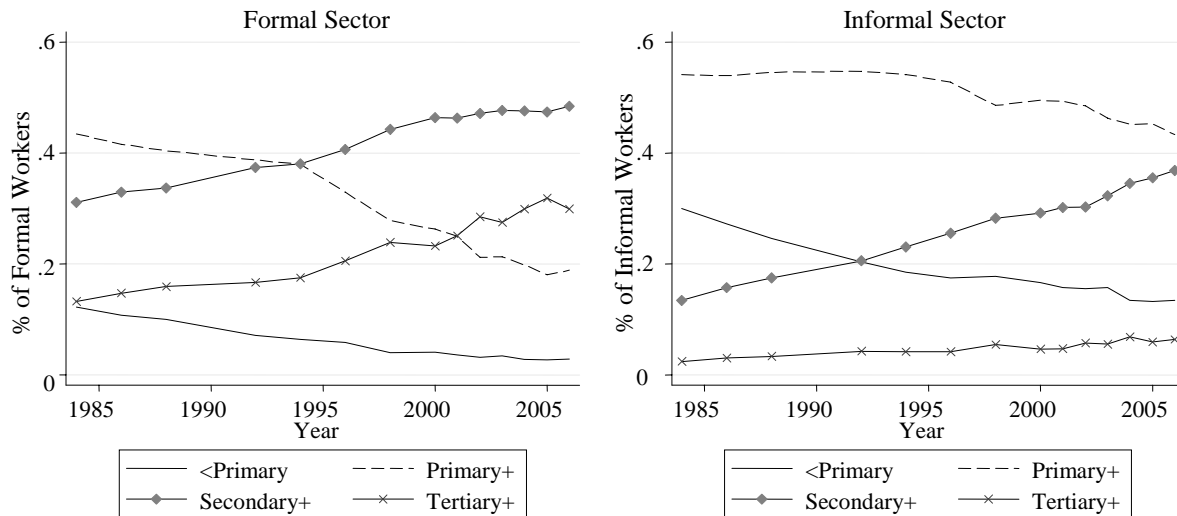## 4. Characterizing the Formal and Informal Sectors

To characterize the formal and informal sectors we use two informality definitions, as suggested by the results presented in Section 2. On the one hand, we adopt the official definition used by DANE for which we have information for the whole period of study: *Firm Size and Occupation*. On the other, we use *Pension* to measure the phenomenon directly. We characterize the differences between these sectors in terms of education levels, age, occupations, industry sector, gender and city. In most dimensions, there are no major differences, and thus we document in this section the results for *Firm Size and Occupation* and attach those for *Pension* in the Appendix. Only when there are significant differences across these definitions we present both. We also characterize differences in earnings between formal and informal workers.

4.1 Education

We start by discussing the education composition of workers in both sectors. The education level categories are based on the number of completed years of education and

the reported completed levels of schooling. *<Primary* includes workers with less than five year of education. Those between five and ten years belong to *Primary+*. *Secondary+* corresponds to individuals who have between eleven and fifteen years of education. Finally those who completed more than sixteen years are in *Tertiary+*. Education is a good predictor of whether a worker is in the formal or informal sector. Clearly, formal workers are on average more educated than informal ones. As shown in Figure 6, in 2006 about 80% of informal sector belonged to the two lowest education categories, that is, had completed primary or less; while the remainder had completed at least secondary education. In the formal sector, on the contrary, 20% of workers belong to the lowest education categories, and 80% to the two highest categories. Most workers with a college degree work in the formal sector.

Figure 6. Informality under *Firm Size and Occupation* by Education Level
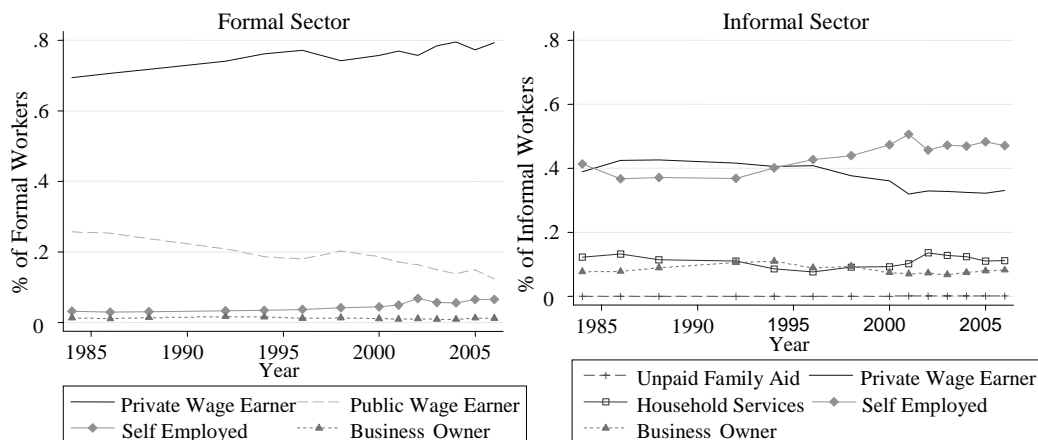

4.2 Occupation

Using household survey data we can identify six different occupations: private and public wage earners, unpaid family aid, household services, self-employed and business owners. The latter are self-employed who employ others. Informality rates vary greatly across occupations. Because the *Firm Size and Occupation* definition is largely driven by the occupational category, all household workers are informal and all public workers are formal. Figure 7 shows that private and public wage earners account for over 90% of the formal sector. In the informal sector, the main occupations are private wage earner and self-employed, each accounting for about 40% of informal workers until the mid 1990s. Staring 1994, the balance between private wage earners and self employed in the informal sector changes; the proportion of self-employed has increased to nearly 50%

while the proportion of private wage earners has decreased to around 33%. Note that most business owners are informal.

Figure 7. Informality rate under *Firm Size and Occupation* by Occupation

Our results about the occupation, education and age composition of the formal and informal sectors suggest that some well educated and experienced workers, as well as most business owners are in the informal sector. This fact suggests that at least a small group of individuals might chose informality since it is in their best interest to operate within this sector; which is what the World Bank (2007) calls *exit*[11].
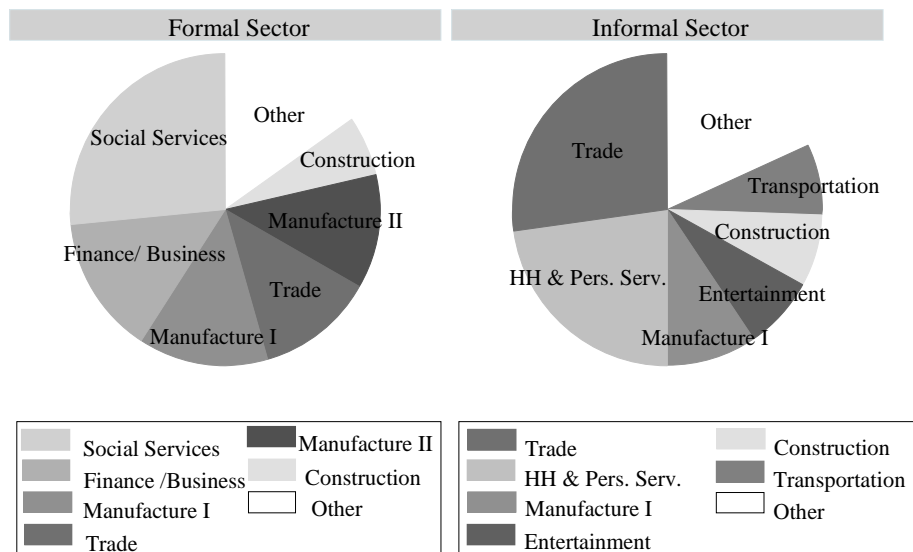
4.3 Economic Sector

The informality rate varies across economic sectors as well. Using the available 2-digit economic sector information, we build 10 sector categories: Primary sector (agriculture, farming and extracting activities), Manufacture I (food, beverages, textiles, clothing and shoes), Manufacture II (intermediate goods), Manufacture III (furniture and capital goods), Construction (construction and distribution of gas, water, electricity), Trade (wholesale and retail trade), Entertainment (hotels, restaurants, bars and other entertainment services), Transportation, Financial, Real Estate and Business Services (finance, insurance, business, telecommunications, courier, information technology, equipment rental, real estate), and Other Services (education, health, security).

Because there have been no major changes of the composition in economic activity of There have been no major changes in the composition by economic activity of the formal and informal sectors. Thus, in Figure 8 we present the average participation over the period of study. Industry sectors are more evenly represented in the formal sector

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[11] In fact, according to this report Colombia appears to be an atypical case in Latin America, given that most individuals operating in the informal sector seem to be driven by exclusion rather than exit. The descriptive analysis of this section agrees with the results on self-employment by Mondragón-Vélez and Peña (2010) in this regard.

led by Social Services, Finance and Business Services, Manufacturing and Trade, accounting for around 80% of formal workers. Note that the first three economic sectors can be associated with higher education requirements. Almost half of informal workers operate in Trade or Household & Personal Services; both of these activities have a high presence of self-employment and in general don't necessarily require high levels of education.

Figure 8. Informality under *Firm Size and Occupation* by Economic Sector

4.4 Age, Gender and City

The informality profile by age describes a U-shape: informality is higher for younger and older workers, and lower for prime-aged individuals. However it is unclear whether older workers are more likely to be informal because of life cycle decisions, or because they are more often business owners or self employed. There are also differences in the informality rate by gender (Table 3). Given that there are no major changes in time, we present the average gender composition of the formal and informal sectors for the period of study. As shown in Figure 3 under *Firm Size and Occupation* there are no major differences in the gender compositions of the two sectors: women account for 42.6% of formal and 44.3% of informal workers. However, when we consider informality as measured by *Pension* we find that a higher proportion of informal workers are women, 58.6%, as compared to formal ones, 47.6%. Therefore, women contribute to pensions less than men, which is paradoxical since the life expectancy of women in the country is higher than that of men.

Table 3- Informality under *Firm Size and Occupation*, by gender

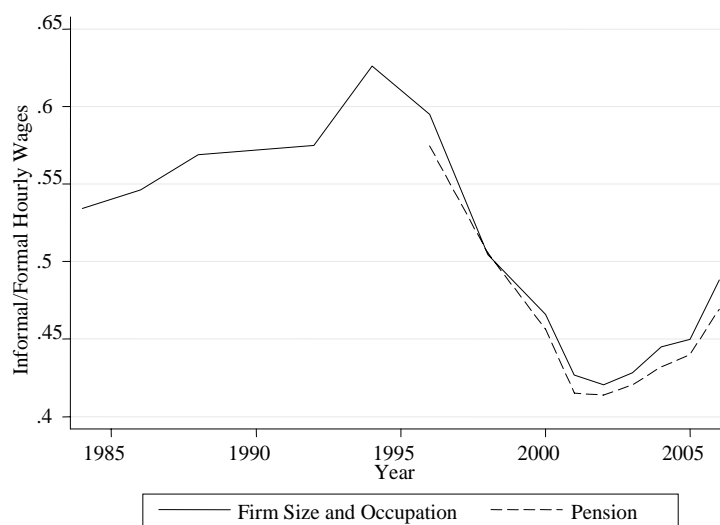|	Firm Size and Occup.		Pension	
Sector	Men	Women	Men	Women
Informal	55,7%	44,3%	41,4%	58,6%
Formal	57,4%	42,6%	52,4%	47,6%

Informality levels vary across cities in time. The results by city (not reported), broadly speaking, suggest that Cúcuta and Montería have the highest levels of informality under *Firm Size and Occupation*, with observed rates of over 70%. As expected, the biggest cities -Bogotá and Medellín, report the lowest levels of informality.

4.5 Returns

A central dimension in which the formal and informal sectors differ is their associated levels of earnings. There are, however, some necessary caveats to the analysis of returns to the two sectors. First, as discussed in the literature, some workers voluntarily transit into the informal sector, while others simply cannot get a job in the formal sector. The former effect implies that the selection of agents into sectors is not random. There is currently no good way of adjusting for selection into the formal / informal sector given data availability, and the results may thus be biased. Second, given the data structure there is no way to disentangle the returns to the labor and capital components in self-employment and business ownership. Therefore, the returns reported by these categories may overstate earnings as a return for their work.

On average, however, the informal sector is not attractive in terms of the earnings. As portrayed in Figure 9, formal workers earn on average more than their informal peers; the results using *Firms Size and Occupation* and *Pension* are remarkably similar. However, due to a high variance, the effect is statistically insignificant. Informal wages improved relative to formal wages until 1994; the average informal wage increased from 0.54 formal wages to 0.63. There was a deterioration of relative wages between the mid 1990s and the early 2000s by around 0.15, a time where NWC increased by more than 10 percentage points and the minimum wage increased substantially. In addition, between 1999 and 2001 the country faced the worst recession in recent history. However, the steep deterioration of informal relative wages began in 1996, 3 years before the onset of the economic crisis. During the last four years of the period of study, informal wages suffered a recovery phase. Even after several years of high economic growth, informal workers in 2006 were worse, in relative terms, than at the beginning of the period.
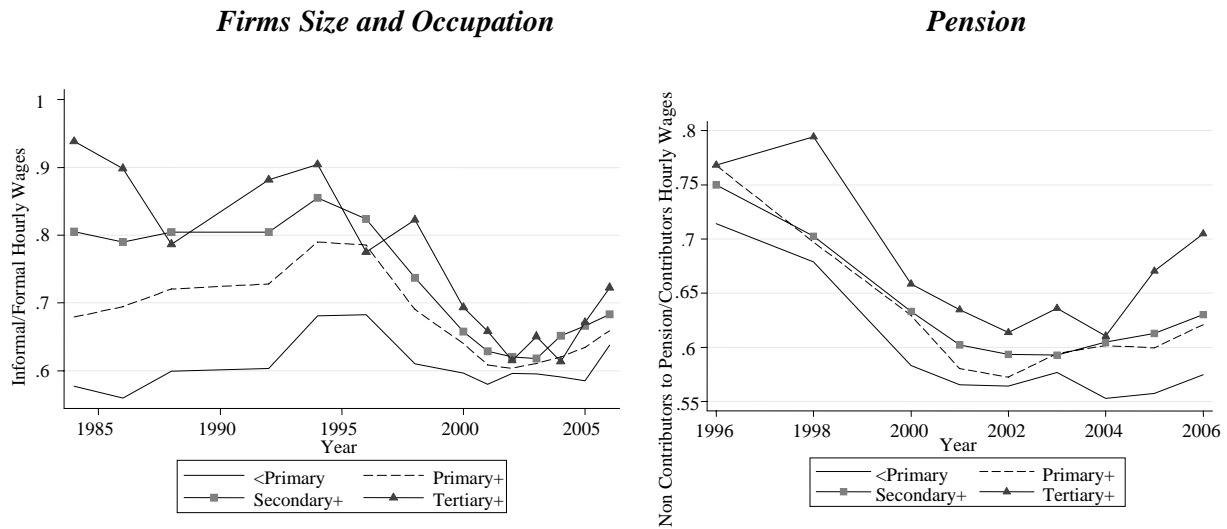
Figure 12. Trends in Relative Informal-Formal Wages, By *Firms Size and Occupation* and *Pension*

There are, however, sizeable differences in relative returns across education groups. Even though average wages are always lower in the informal sector, relative returns to the informal sector are generally better for high education workers than for low educated ones (Figure 13). Under *Firm Size and Occupation*, on the left panel of Figure 13, the dispersion of relative wages across education groups at the beginning of the period was quite high: it ranged between 0.94 for *Tertiary+* to 0.58 for *<Primary*. The dispersion remained stable until the mid 1990s, when it decreased substantially until 2002. The dispersion in relative wages at the end of the period was less than one third of what it was, ranging in the 2000s roughly between 0.6 and 0.7. The decrease in dispersion of relative wages across education levels coincides with the increase in NWC, the minimum wage and the economic crisis. Again, the decrease in dispersion begins *before* the crisis.
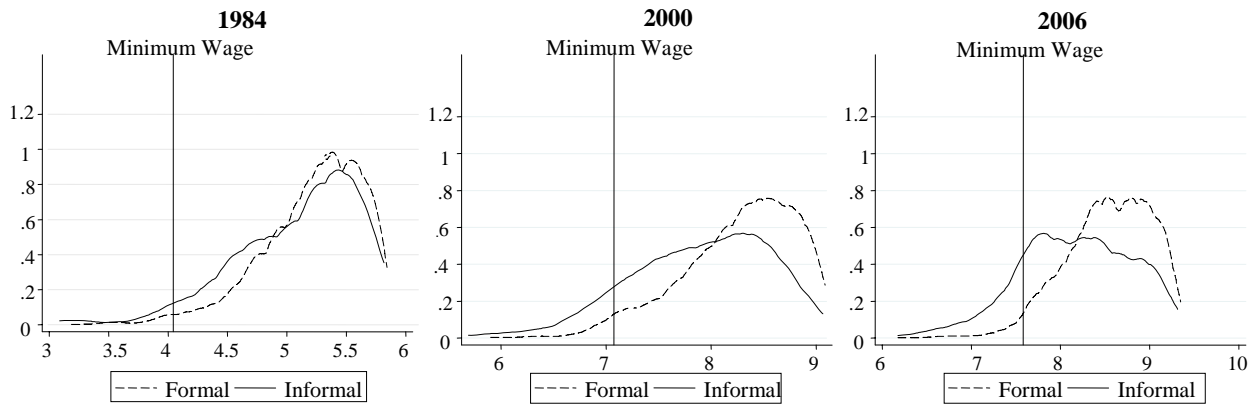
Measuring informality by *Pension*, on the right panel of Figure 13, relative returns are also better for more educated workers. However, the dispersion between high and low education workers is about 0.1, and remains relatively stable throughout the period of study. Each education group has a behavior similar to the aggregate (portrayed in Figure 12).

Figure 13. Trends in Relative Informal-Formal Wages by Education Groups

Firms Size and Occupation   *Pension*

Given the sizeable differences in the relative mean earnings across education groups using the *Firm Size and Occupation* definition, we present the hourly wage density distributions for workers with a college degree (Figure 14) and for workers with a high school degree (Figure 15). The vertical line represents the hourly minimum wage.

Figure 14. Hourly Wage Density Distributions College+, *Firm Size and Occupation*

The wage distributions for college educated workers were practically the same in the formal and informal sectors in 1984. In 2000 and 2006, however, the wages of informal workers decreased substantially when compared to those of formal workers. This is not only suggested by the graphs, but was confirmed through statistical analysis[12]. In

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[12] For 1984 we tested the null-hypothesis of equal distribution for formal and informal workers using the Smirnov-Kolmogorov test. The p-value was 0.00 confirming that the distributions were statistically equal.

addition, the minimum wage does not appear to be 'binding' in either distribution for this education group.

The case for lower education levels is different. Figure 15 shows the hourly wages distributions of workers with a high school degree[13]. First, the distribution of formal wages is statistically higher for the three years presented. Second, the minimum wage appears to be binding both in the formal and informal sectors in 1984. However, in 2000, the minimum wage loses its bite in the informal sector, because a large fraction of workers earn below the minimum, and it becomes more binding in the formal sector. For 2006 the binding effect of the minimum wage is qualitatively similar but stronger than in 2000.

Figure 15. Hourly Wage Density Distributions Secondary+, *Firm Size and Occupation*

5. The Size of the Informal Sector

The high levels, and steep increase in NWC, can contribute to the high levels of the unemployment rate and to the reported increase in informality by making labor relatively more expensive for employers. Also, because the Colombian minimum wage is binding and among the highest in Latin America, its increases can generate destruction of formal working posts, and thus increase informality rate. Since we have data on informality levels using the *Firm Size and Occupation* definition across twenty-two years, we can exploit the observed variations of NWC and the *min-median ratio* over the period to determine the effect of their evolution on the size of the informal

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The same test was performed for 2000 and 2006 for those years the distributions were statistically different.

[13] Results for workers with less than high school are qualitatively similar to those with completed high school.

sector[14]. Thus, using household survey data, we estimate the effect of the evolution of NWC and the *min-median ratio* on the probability of being informal between 1984 and 2006. We pool the observations from all the quarters for which the informality module is available and estimate the effect of labor market rigidities and individual characteristics on the probability of being informal using a probit model. We estimate the following equation:

$$Inf_{it} = \beta_0 + \beta_1 \min_t + \beta_2 NWC_t + \beta_3 X_{it} + \beta_4 Y_t + \varepsilon_t$$

Where, the dependent variable, Inf_i, is a dichotomous variable that takes the value of 1 if individual *i* is informal under *Firm Size and Occupation*. The explanatory variables are the *min-median ratio* by city[15], NWC as a percentage of the payroll; X_i is a vector of individual controls including age and its square, educational attainment, gender, marital status[16] and economic activity dummies[17]. Y_t is a vector of controls including city dummies, and regional GDP growth. The regressions were estimated using year clustered robust standard errors, to account for the fact that even though our time frame spans over 22 years, we only have observations in 14 periods and some of the controls from one year to the next but not across individuals at a specific point in time. For example, the level of NWC is the same for all the observations of a given year.

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[14] *Firm Size and Occupation* is the only informality definition we can use to estimate the effect of labor market rigidities on informality, because *Pension* is only available since 1996, and we would thus miss the bulk of the variation in NWC.

[15] When instead we use the *min-median ratio* for the whole country, the effects of the minimum wage are higher.

[16] Marital status is captured through a dummy that equals one if the individual is either married or cohabiting and zero if they're single, separated, divorced or widowed.

[17] The omitted categories for educational attainment and economic activity are less than primary and primary respectively. City dummies are also included but not reported.

Table 3. Probability of Being Informal under *Firm Size and Occupation*, Marginal Effects

VARIABLES	Probability of Being Informal			
	(1)	(2)	(3)	(4)
Min/median(city)	0.248***	0.241***	0.240***	0.184***
	(0.055)	(0.054)	(0.048)	(0.063)
Non wage costs	0.782***	0.633***	0.770***	-0.002
	(0.099)	(0.118)	(0.077)	(0.372)
Regional growth	0.103	-1.709**	0.033	
	(0.103)	(0.817)	(0.122)	
Male	-0.044***	-0.044***	-0.044***	-0.046***
	(0.003)	(0.003)	(0.003)	(0.002)
Married	-0.017***	-0.017***	-0.017***	-0.012***
	(0.003)	(0.003)	(0.003)	(0.003)
Complete primary	-0.093***	-0.093***	-0.093***	-0.102***
	(0.006)	(0.006)	(0.006)	(0.011)
Complete secondary	-0.273***	-0.274***	-0.274***	-0.299***
	(0.009)	(0.009)	(0.009)	(0.006)
Complete tertiary	-0.411***	-0.411***	-0.411***	-0.466***
	(0.019)	(0.019)	(0.019)	(0.015)
Age	-0.013***	-0.013***	-0.013***	-0.011***
	(0.001)	(0.001)	(0.001)	(0.001)
Age squared	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Min/median(city)X(Regional Growth)		-0.312		
		(0.462)		
(Non wage costs)X(Regional growth)		3.928**		
		(1.734)		
Min/median(city)X(Good Times)			-0.002	
			(0.038)	
(Non wage costs)X(Good Times)			0.029	
			(0.058)	
Collections				-0.931
				(3.313)
Min/median(city)X(Collections)				-0.069
				(0.093)
(Non wage costs)X(Collections)				1.709
				(5.822)
Observations	68.800.000	68.800.000	68.800.000	32.300.000

Robust standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The first column in Table 3 presents the estimations of our benchmark estimation. Labor market rigidities have sizeable effects on the probability of being informal; the coefficients on both NWC and *min-median ratio* are statistically significant. An increase in 10 percentage points (pp in what follows) in NWC, which amounts to the

steep increase observed between 1992 and 1996, is associated with an increase in the probability of being informal of about 7.8pp. To put this result in perspective, Kugler and Kugler (2009) estimate that such an increase in NWC decreases formal employment between 4 and 5%. The *min-median ratio* increased 20pp between 1996 and 2001. Our results suggest that a rise of 20pp in the *min-median ratio* generates an increase of 5pp in the likelihood of being informal.

Interestingly, although the informality rate is similar between men and women, after controlling for many relevant variables, women are more likely to be informal. People with higher education levels are less likely to be informal: compared with someone who did not finish primary, people with completed primary, secondary and tertiary are 0.09, 0,27 and 0,41 less likely to be informal, respectively. Older people are less likely to be informal. Someone at the mean of the age distribution is between 30 and 34 years old. An additional year decreases the probability of being informal in 0.01. The positive sign of the square of age is related to the U-shape of informality by age.

The business cycle as measured by regional GDP growth is not statistically significant. This may have to do with the choice of informality definition. Several alternative variables were included in the estimation to capture the cycle, including aggregate GDP growth and unemployment, and city-level unemployment. None of them were significant[18], and the magnitude and significance of the variables of interest did not change under the different specifications. We also included an interaction between NWC and the *min-median ratio*; it was not statistically significant, and is therefore not reported.

In the second column of Table 3 we introduce an interaction of regional GDP growth with NWC and the min-median ratio, to capture the fact that they affects the formal sector's ability to adjust to economic fluctuations. The interaction of growth and NWC is positive and significant, which goes against what we expected: NWC increase the probability of being informal more during expansions than in recessions. The total effect of GDP growth, after calculating the appropriate standard error, is again insignificant. The interaction between the minimum wage and GDP growth is not significant. Column 3 again tries to capture the formal sector's inability to adjust to the cycle because of labor market rigidities, by introducing the interaction between a 'good times' dummy, which equals one during periods of economic growth, with NWC and the min-median ratio. None of the interactions are significant in this case.

The final estimation presented in Table 3 is performed using city-level industry and trade tax revenue to control for the cycle. Because the data are only available starting 1998, the period covered by this estimation is 1998-2006. The minimum wage is significant, but the coefficient is slightly lower than in the previous estimations.

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[18] As an additional robustness check, we repeated the estimation changing the informality definition to health contributions and the business cycle again appeared insignificant.

However, NWCs are no longer significant, because the main changes in NWC happen before 1998, and thus in this period there is not enough variation.

6. Transitions between sectors

In this section we study the flows of agents within the labor force across different sectors and states. First, we measure the flows between the informal sector and the formal sector using transition matrices for each of the available cross-sections during the period 1986 to 2006. Then, we characterize each of the flows involving entry or exit of the informal sector by estimating transition probabilities as functions of demographics, occupation-specific and other idiosyncratic labor-history characteristics.

Since our database is composed of repeated cross-sections, we build the transitions within 12-month periods using retrospective questions. We observe the sector to which a worker belongs at the time of the survey. For workers who have been on the same job for over a year, we defined the previous sector to be the same as the current sector. For those who switched, we reconstructed the sector of the previous job according to the *Firm Size and Occupation* definition[19]. For the whole period of study we are able to study the transitions between the formal and informal sector since retrospective questions were available for employed workers. Starting 2001, the information on the previous job started to be available for the unemployed. Therefore, we are able to analyze for the 2001-2006 period, in addition, the transitions between the formal and informal sector and unemployment.

For the *Pension* definition we observe the sector to which the worker belongs at the time of the survey, but there is no retrospective information on whether the worker contributes to pensions on his previous job. Therefore, in the section, we will only perform the analysis using *Firm Size and Occupation.*

6.1 Measuring the Flows: Transition Matrices between Sectors

Table 4 displays the average flows between the formal and informal sectors. Since we observe workers with a 12 month difference, some of the workers reported to be formal and 'transition' into formality, may have switched jobs but remained in the same sector, or may have remained in the same job they were at. The left panel presents the flows as a proportion of the sector they belonged to in the previous period and the right panel does so as a proportion of the labor force. Therefore, it tells us the relative size of each group as a proportion of workers.

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[19] Retrospective questions suffer from measurement error. For example, the reconstructed unemployment rate of the previous year is lower than the observed unemployment rate at that time, for every year; the unemployment rate is underestimated by the retrospective questions.

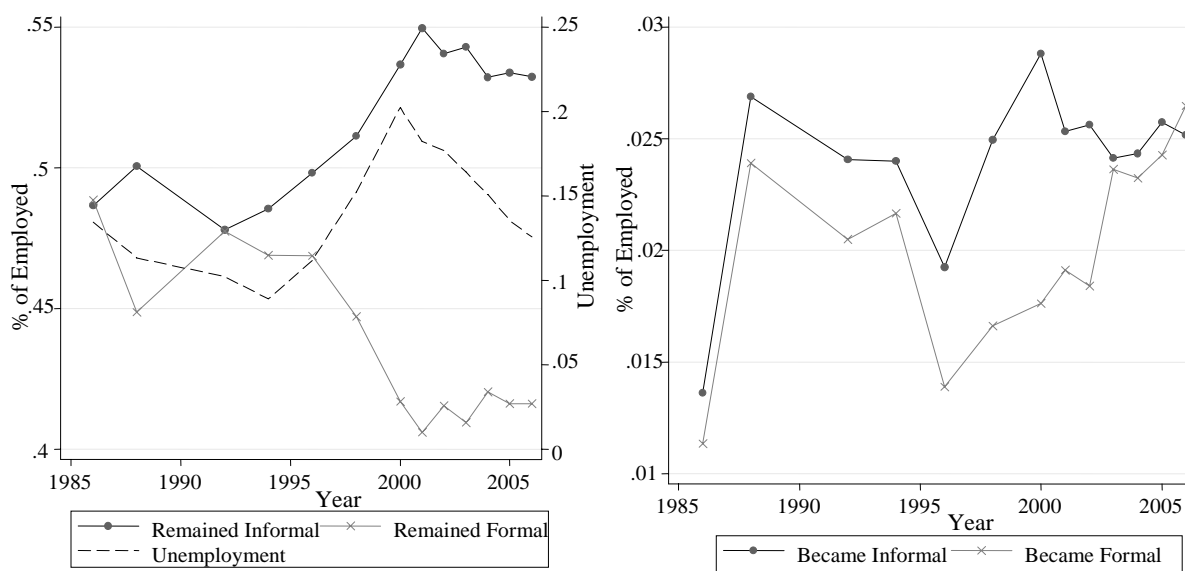## Table 4. Transition matrices, *Firm Size and Occupation*

1998

		june 1998						june 1998		
		Formal	Informal	Total				Formal	Informal	Total
june 1997	Formal	94.7%	5.3%	100%		june 1997	Formal	44.7%	2.5%	47.2%
	Informal	3.1%	96.9%	100%			Informal	1.7%	51.1%	52.8%
								46.4%	53.6%	

The left panel of Table 4 indicates that in 1997, 95% of those who were formal in their previous job remained formal and 5% became informal. On the other hand from those who were informal 97% remained informal and 3% became formal. The high values on the diagonal indicate high persistence in the same job or sector during last year, but the persistence is slightly higher in the informal sector. The right panel shows that 45% of workers in 1997 were formal and remained formal, 3% were formal and became informal, 2% were informal and became informal and the remaining 51% were informal and remained informal. The differences in the flows between workers entering the informal sector and those exiting from it are statistically significant for 1998.

The evolution of the transitions across time is plotted in Figure 16. The left panel shows that the persistence in the formal and informal sectors can be described in three stages. Between 1986 and 1994, the persistence in both sectors was relatively stable and of comparable size. Between 1994 and 2001 there was a change in the flow structure between sectors: informality became more of an absorbing state and formality less so. For the remainder of the period the persistence in each sector remained relatively constant, but now the persistence in the informal sector was substantially higher than in the formal sector. The right panel shows the transitions across sectors. That the expansion in informality under *Firm Size and Occupation*, was generated by a net inflow of workers into the informal sector, especially between 1994 and 2001. There was a big change between 1994 and 2001 both in terms of persistence of the sectors and in the flows between sectors, which coincides with the steep increase in NWC, *min-median ratio* and the crisis.

Figure 16. Transitions Across Time, *Firm Size and Occupation*

The unemployment rate is positively and significantly correlated with the percentage of formal workers that remained formal and negatively correlated with the informal workers who remained informal[20] –with coefficients of 0.8 and -0.7, respectively. However, it is not significantly correlated with the percentage of workers changing sector in any direction.

6.2 Measuring the Flows: Transition Matrices between Sectors and Unemployment

Starting 2001 retrospective questions are available for the unemployed, and thus we can calculate the more interesting transition flows between the formal and informal sectors *and* between sectors and unemployment[21]. Table 5 displays the average flows between the formal and informal sectors, and unemployment on the left, and on the right we have the relative size of each group within the economically active population for the year 2005. The results for the other years are very similar to the presented results.

Table 5. Transition Matrices Including Unemployment, *Firm Size and Occupation*
2005

		june 2005							june 2005			
		Formal	**Informal**	**Unempl.**	**Total**				**Formal**	**Informal**	**Unempl.**	**Total**
june 2004	**Formal**	85.0%	5.3%	9.7%	100%		*june 2004*	**Formal**	32.6%	2.0%	3.7%	38.3%
	Informal	3.9%	85.0%	11.2%	100%			**Informal**	1.9%	41.7%	5.5%	49.1%
	Unempl.	16.6%	23.6%	59.8%	100%			**Unempl.**	2.1%	3.0%	7.5%	12.6%
								Total	36.5%	46.7%	16.7%	

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[20] So are its forward and lag.
[21] In this analysis we exclude first-time job seekers. In addition, we cannot address the transitions with 'out of the labor force' because of information constraints.

Even after including unemployment in the analysis, the main message from Table 4 holds, namely, that there is high persistence in each sector. The left panel suggests that of those unemployed in 2005, 16% found a formal job, 24% found one in the informal sector and 60% remained unemployed. This is because the survey oversamples the long-term unemployed. When we include the unemployed in the transitions analysis, the size of the flows between sectors is put into perspective. In the right panel we see that the difference in the flows between sectors is unimportant between 2001 and 2006. The net flow from formality into informality is very small for the same period. The observed flows from unemployment into each sector are of the same order of magnitude as the flows between sectors: 2% to formality and 3% to informality. The flows into unemployment, however, are higher: 4% from the formal sector and 5.5% from informality.

6.3 On the probability of switching sectors

Let us now focus on workers who switch sectors in a 12 month period, since labor market rigidities can also important drivers of the transitions between sectors. We pool the observations for the period 1986-2006 to study the effect of labor market rigidities, the business cycle, individual characteristics, and the unemployment spell, on the probability of transiting between sectors. The regressions were estimated using probit models with year clustered robust standard errors. Model 1 describes the effect of the explanatory variables on the transition from formality -the dependent variable equals one if the person was formal 12 months ago and is now informal, and zero if he remained formal –regardless of whether there was a change of job or not. Model 2 describes those who switched from informality to formality.

The independent variables, common to both estimations, are the *min-median ratio* by city, NWC, regional GDP growth, age and its square, educational attainment, gender, marital status, economic activity and city dummies. We include a dummy that captures whether the worker changed the economic activity they worked in. We present only the significant variables.

Table 6. Probability of Switching Sectors under *Firm Size and Occupation*,
Marginal Effects

VARIABLES	(1) Become Informal	(2) Become Formal
Min/median(city)	0.048***	0.025***
	(0.013)	(0.007)
Non wage costs	0.209***	0.010
	(0.054)	(0.032)
Regional growth	-0.023	0.011
	(0.034)	(0.021)
Change Econ. Activity	-0.001	-0.011***
	(0.002)	(0.001)
Male	0.002	0.005***
	(0.002)	(0.001)
Complete primary	-0.014***	0.000
	(0.001)	(0.001)
Complete secondary	-0.037***	0.008***
	(0.002)	(0.002)
Complete tertiary	-0.037***	0.001
	(0.002)	(0.004)
Age	-0.004***	-0.002***
	(0.000)	(0.000)
Age squared	0.000***	0.000
	(0.000)	(0.000)
Observations	2.63e+07	3.06e+07

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
City and economic sector dummies were included

Table 6 shows that labor market rigidities are important drivers of the transition into informality. A rise of 10pp in NWC increases the probability of transiting into informality by 2pp, whereas a 20pp increase in the *min-median ratio* does so by 1pp. However, the estimated effects of labor market rigidities on the transition into the formal sector are not as expected. One would expect rises NWC and the *min-median ratio* to decrease the transition into formality. However, our results suggest that NWC are not significant in this transition and that rises in the *min-median ratio* have a small but significant *positive* effect on the probability of becoming formal: a 20pp increase in the min-median ratio is correlated with an increase in the probability of becoming formal by 0.5pp. We interpret these results as suggesting that rises in the *min-mean ratio* are correlated with higher rotation in the labor market, generating more transitions

in every direction; the increase in transitions into informality outweighs the effect on transitions into formality. However, further research is needed to understand the channels through which labor market rigidities affect the transition into the formal sector. Again, the economic cycle appear insignificant in both estimations, even though we performed several robustness check using alternative variables such as regional unemployment.

Some variables have the same sign in both regressions; they are related to the probability of changing of sector and not of entering a specific sector. For example, older individuals have a lower probability of changing of sector. A change in the economic activity increases the probability of switching sectors[22].

7. Conclusion

Informal workers are vulnerable, frequently uncovered by social security, with relatively low education and on average earn lower wages. The secular increase in the size of the informal sector is highly correlated with the increases in labor market rigidities, namely the minimum wage and NWC. The combination of increased labor market rigidities has made markets less able to adjust to the economic cycles. Informal workers are affected by the increase in rigidities because not only has the minimum stopped being binding in the informal sector, but also high percentage of informal workers earn below the minimum.

The coexistence of high NWC and minimum wage implies that the formal sector adjusts to the economic cycle through quantities -cutting back on jobs, while the informal sector does so through prices, i.e. decreasing the wages. Rigidities have also consequences on the relative sizes of the formal and informal sector, and have triggered the documented increase in the latter. All in all our results suggest that even though labor market rigidities affect formal sector workers, they have hurt informal workers the most.

Our results regarding the transitions between formal and informal sectors suggest that further research is needed to understand the channels through which labor market rigidities affect the transition into the formal sector.

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[22] Starting 2001 workers who changed jobs were prompted for the reason hey left the previous job. One of the possible answers was 'I found a better job' and another 'I was fired'. The first can de interpreted as the worker choosing to change jobs, while the second implies that the worker left the job involuntarily. We repeated the estimations for the period 2001-2006 and find that getting fired increases the probability of switching sectors, regardless of the direction of the flow. More interestingly, an individual leaving his job because he found a better one increases the probability of becoming formal and decreases the probability of becoming informal. The effects of other independent variables are very similar to the ones presented above.

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Appendix

Table A1. Missclassified workers

Characteristics of Misclassified Workers

	Informal under:	
VARIABLES	Firm Size and Occup. not Pension	Pension not Firm Size and Occup.
Complete primary	0.135***	-0.009***
	(0.001)	(0.001)
Complete secondary+	0.240***	-0.079***
	(0.001)	(0.001)
Complete tertiary+	-0.100***	-0.093***
	(0.001)	(0.001)
Private wage earner	-0.746***	5.372***
	(0.013)	(0.017)
Household worker	-0.121***	4.814***
	(0.013)	(0.017)
Self eployed	-0.903***	4.927***
	(0.013)	(0.017)
Business owner	-0.608***	4.546***
	(0.013)	(0.018)
Other Occupation	-0.848***	4.679***
	(0.015)	(0.019)
Age	0.008***	-0.009***
	(0.000)	(0.000)
Log(wage)	0.317***	0.304***
	(0.000)	(0.000)
Constant	-3.502***	-8.415***
	(0.013)	(0.018)
Observations	6.31e+07	6.47e+07

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Omitted categories are <Primary and Unpaid Family Aid

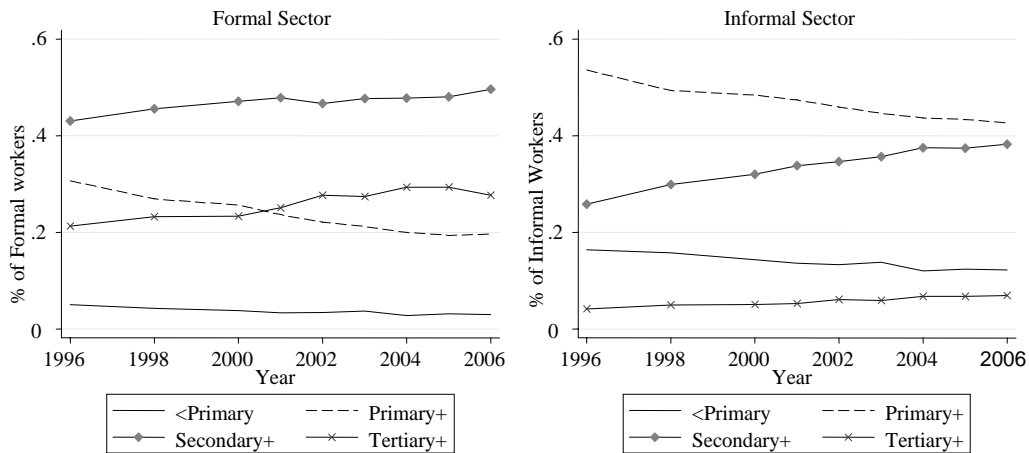## Figure A1. Informality under *Pension* by Education Level

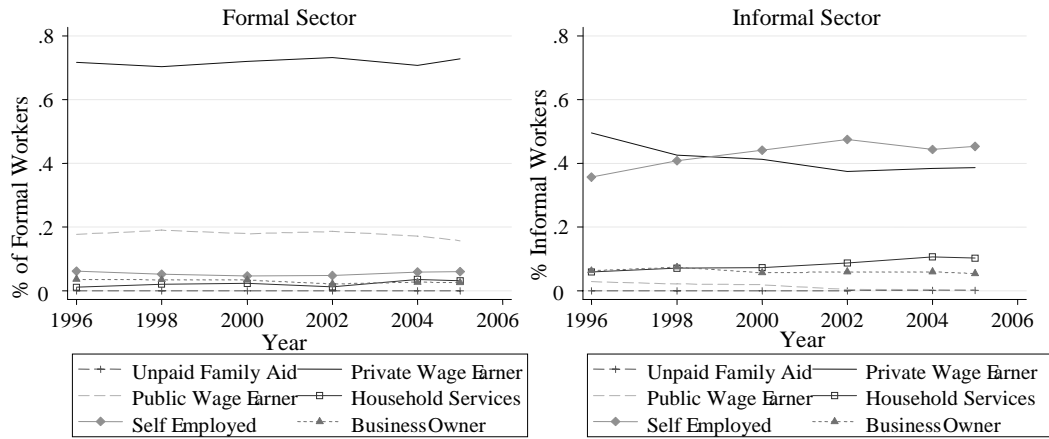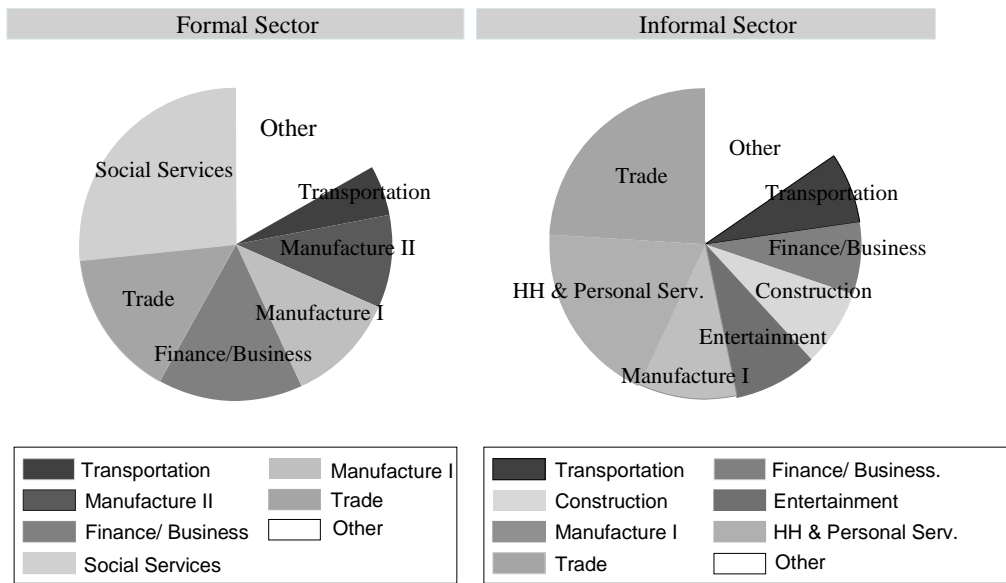# Figure A2. Informality rate under *Pension* by Occupation

Figure A3. Informality under *Pension* by Economic Sector

Graphs by Pension