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Labor Market Rigidities and Informality in Colombia

Informality has been at the center of the economic debate in Colombia as a result of 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 health, unemployment, and old age insurance, 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 nonwage costs and a high minimum wage relative to the economy's level of productivity. Nonwage costs are costs faced by the employer and include health and pension contributions, payroll taxes, and transportation (commuting) subsidies.[1] These labor market rigidities imply that the formal sector, where workers and employers comply with regulations, is less able to adjust to the business cycle than the informal sector. Hence, economic policy originally designed to protect workers might actually be worsening employment conditions by increasing informality.

This paper brings new elements to the study 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 nonwage costs and the minimum wage. By generating individual or city-level variation, we are able to disentangle the effects of nonwage costs, the minimum wage, and the business cycle on informality. We begin our analysis by considering alternative definitions of informality, two of which we adopt (primarily driven by data availability): the definition used by Colombia's National Administrative Department of Statistics (DANE, for its initials in Spanish), which is based on firm size and occupation, and a definition based on contribution to health insurance (as a proxy for compliance with labor market regulations).

With regard to the empirical analysis, we first 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 nonwage costs and the minimum wage are highly correlated with informal sector growth. Next, we look at the transitions between sectors. On the one hand, we measure the transition flows between the formal and informal sectors using transition matrices. These describe, for example, the proportion of job destruction in the formal sector that is absorbed by the informal sector. On the other hand, we estimate the effect of labor market rigidities on the likelihood of switching sectors (controlling for idiosyncratic characteristics and macroeconomic conditions), to determine their role in the decision to make the transition. We find that labor market rigidities are important drivers of the transition into informality, particularly for low-skilled workers. However, further research is needed to understand the channels through which labor market rigidities affect the transition into the formal sector, in particular for workers with high educational attainment.

One strand of the literature associates informality with labor market rigidities in Colombia. Núñez finds a positive relation between informality and income taxes on labor revenue for the period 1988–98.[2] Sánchez, Duque, and Ruíz find that increases in labor market rigidities increase informality, unemployment, and its duration, based on aggregate data.[3] Using a firm panel from the industrial sector, Kugler and Kugler find that a 10 percent increase in payroll taxes decreases formal employment between 4 and 5 percent.[4] Santa María, García, and Mujica use individual data from Colombia's household survey; they find that the subsidized regime, financed through nonwage costs,

2. Núñez (2002).
3. Sánchez, Duque, and Ruíz (2009).
4. Kugler and Kugler (2009).

has increased the incentives to become informal, thus acting as a subsidy to informality.[5] Our results suggest that an increase of 10 percentage points in nonwage costs is associated with an increase of 5 to 8 percentage points in the size of the informal sector. Some authors characterize informal workers and study informality from a segmentation perspective. Flórez finds that some informal workers are excluded from the formal sector, while others opt out.[6] Perry and others document two coexistent phenomena in the Latin American region: exclusion from the formal sector as a result of labor market segmentation; and exit from the formal sector as some workers find better conditions in informality.[7] They show that whereas the self-employed choose to be so in many Latin American countries, a sizeable fraction of the Colombian self-employed seem to be excluded from the formal sector.[8] Bernal reports that one-half of informal workers would accept a formal job for a wage equal to or lower than the one they currently make.[9] Along these lines, our results support the idea that low-skilled informal workers are being excluded from the formal sector and suggest that high-skilled workers may also have exit motives.

The paper is divided into five sections. The following section compares and documents the evolution of informality across alternative definitions, and the paper then describes the evolution of labor market rigidities. Subsequent sections estimate the effect of nonwage costs and the minimum wage on the size of the informal sector and the probability of switching sectors and wages. The final section concludes.

The Evolution of Informality

This section describes the different definitions of informality that we consider and analyzes the extent to which they coincide. We also explore the effect of the business cycle and relative wages on informality. Our study uses data from the Colombian Household Survey, a repeated cross-section carried out by Colombia's National Administrative Department of Statistics (DANE), for the period 1984–2006. The survey collects information on demographic

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5. Santa María, García, and Mujica (2009).
6. Flórez (2002).
7. Perry and others (2007).
8. See, for example, Cunningham and Maloney (2001) for the case of Mexico.
9. Bernal (2009).

and socioeconomic characteristics of the population, such as gender, age, marital status, and educational attainment, together with labor market characteristics for the population aged twelve or more including occupation, job type, income, and industrial sector.

Based on data availability, our analysis focuses on Colombia's eleven main cities between 1984 and 2000 and the thirteen main cities for the period 2001–06. In particular, we use the household survey's informality module, which allows for several empirical definitions of informality as described in the next subsection. This module is available every two years before 2001 and yearly thereafter. We use observations with a complete set of covariates and restrict the sample to workers between fifteen and seventy years of age, who report working between sixteen and eighty-four hours per week. The size of the weighted samples ranged from 1.7 million workers in 1984 to about 6.5 million in 2006.

Informality Definitions

The literature includes a number of alternative definitions of informality, usually dictated by data availability. This section characterizes the evolution of informality using all definitions available from the Colombian Household Survey, and it explores the extent to which definitions involving compliance (or noncompliance) with labor market regulations coincide with DANE's official definition related to firm size and occupation.

DANE defines informal workers as those who work in firms with ten or fewer employees; are unpaid family aids and housekeepers; are self-employed (except for independent professionals and technicians); or are business owners of firms with ten employees or fewer. In what follows, we refer to this definition as *Firm Size and Occupation,* since it is largely driven by these two dimensions. This definition has been criticized in the literature for not measuring the phenomenon directly.[10] That is, it does not explicitly include any criteria related to labor market regulations even though the negative aspects of informality have to do with lack of compliance.

We also consider three definitions related to social protection contribution that capture whether workers pay for access to the benefits associated with formal employment. The first social protection definition has to do with old-age insurance: we define informal workers as those who do not make pension contributions (and we call this definition *Pension*). The next informality cri-

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10. See, for example, Flórez (2002).

F I G U R E 1 .   The Evolution of Informality by Alternative Definitions

Informality rate (percent)   Unemployment rate (percent)
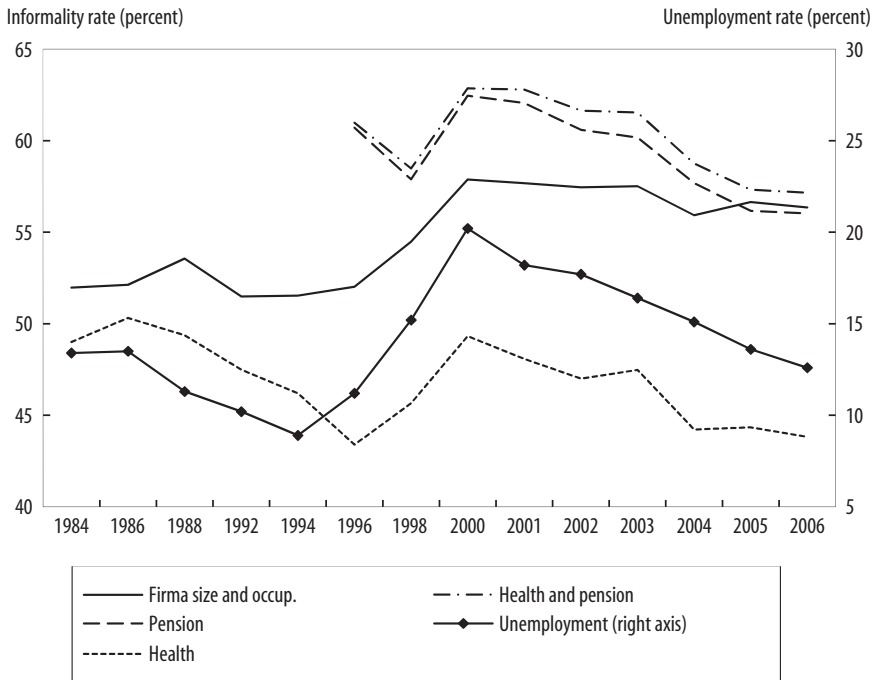
terion is the lack of health insurance contributions (termed *Health* below).[11] Finally, we consider the *Health and Pension* criterion that defines workers as formal if they contribute to both health insurance and a pension fund and informal otherwise. This is the most comprehensive criterion and thus implies the highest levels of informality.

Figure 1 presents the evolution of the informality rate for the period 1984–2006 across these alternative definitions.[12] According to *Firm Size and Occupation,* informality was stable at around 52 percent from 1984 to 1996,

11. Informality behaves very differently when measured by health access instead of health contribution, mainly because of the expansion of the subsidized regime that provides free health insurance to the poor. 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 or family insurance or who work but are covered by the subsidized regime as informal.

12. The time series for each definition is presented according to data availability.

grew steadily between 1996 and 2001 to 56 percent, and remained at this level until the end of the period. This increase is sizable and is at the 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* decreased between 1984 and 1996, then increased from 44 percent to 49 percent between 1996 and 2000, and finally decreased between 2001 and 2006. Informality is higher if measured through pension contributions as compared to health contributions, suggesting either that workers value health more than old-age insurance or that they have informal old-age insurance mechanisms such as family or friends. Informality measured by *Health and Pension* closely follows the *Pension* criterion. The dotted line, measured on the right axis, is the urban unemployment rate. The informality definitions that have to do with compliance seem to follow the cycle more closely than the *Firm Size and Occupation* definition. However, according to all definitions, informality increased in the second half of the 1990s and peaked around 2000, after the deep economic recession of the late 1990s.

To What Extent do Alternative Definitions of Informality Coincide?

Despite the difference in levels, the evolution of informality measured by *Pension* and *Health* is very similar. When we take a closer look at the composition of these groups, we find that 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.* Hence, given that *Health* captures the relevant dynamics of informality measured by compliance and is available for a longer period than *Pension,* we use it as the benchmark definition for compliance with labor market regulations in the remainder of the paper.

The levels of informality suggested by *Health* are lower than those measured by *Firm Size and Occupation.* Moreover, their trends are not identical over time. This raises the question of whether these alternative definitions are classifying the same workers as informal. To address this issue, we first present a Venn diagram portraying the extent to which these definitions coincide using data from 2006 (figure 2).[13] The diagram has three main implications. First, the majority of informal workers under *Firm Size and Occupation* or

13. Henley, Arabsheibani, and Carneiro (2006) present a similar analysis for the Brazilian case.

F I G U R E 2 . Concurrence of Informality Definitions, 2006
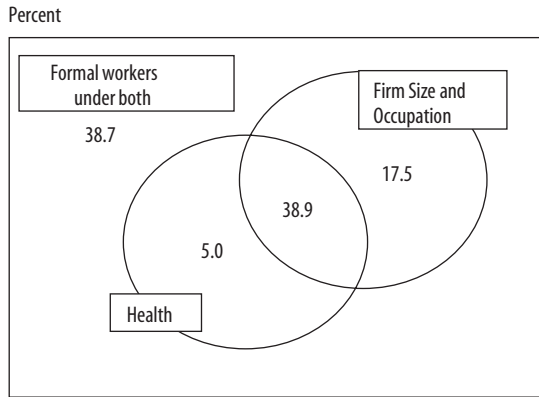
Percent

Health (38.9 percent of total workers) are informal under both definitions. This is because noncompliance with social security regulations is a small-firm phenomenon. Second, the *Firm Size and Occupation* definition captures the bulk of workers considered informal under *Health* (90 percent of health informality), despite the fact that it does not include any criteria regarding social security compliance. Third, the difference between the two definitions is still sizable, as about one-fourth of all workers is classified as formal or informal depending on the definition used.

Differences in informality levels across firm size and occupations measured by *Health* are staggering, as displayed in figure 3. Less than 20 percent of individuals working in firms with more than ten employees are informal, compared with over 80 percent of those working alone. This reflects the fact that not only do small firms have a harder time covering compliance costs than large firms, but they also find it is easier to stay below the government's radar. Differences in informality measured by *Health* across occupations are also important: about 85 percent of the self-employed and household service workers (who are informal according to the *Firm Size and Occupation* definition) do not contribute to health insurance, whereas few government employees are informal.

As mentioned above, the classification differences between *Firm Size and Occupation* and *Health* are substantial. Figure 4 shows the evolution of the concurrence between the two definitions, that is, the information contained in the Venn diagram over time. Panel A of the figure shows the evolution of the classification differences between 1984 and 2006. The percentage of workers

F I G U R E 3 .   **Informality under *Health* across Occupations and Firm Size**

A. Informality levels by occupation
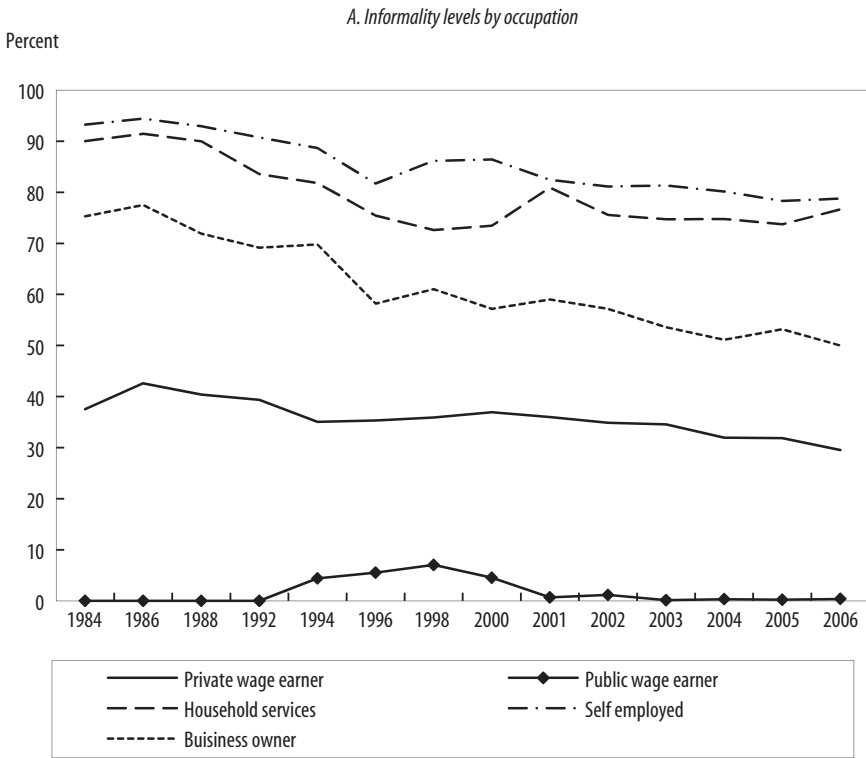
Percent

classified as informal under *Health* and as formal under *Firm Size and Occupation* were fairly stable for the period of study at around 7 percent. Workers classified as informal using *Firm Size and Occupation* but formal using *Health* increased from 10 percent in 1984 to 17 percent in 2006. This may be related to increasing enforcement efforts in regard to health insurance contributions. Panel B of figure 4 shows the percentage of workers who are either informal or formal under both definitions. The shares range between 36 percent and 42 percent.[14]

14. Workers who are classified as informal under *Firm Size and Occupation* but as formal under *Health* can be grouped in two categories: those who are relatively well educated, older, and wealthier and those who are unpaid family aids, business owners, or household workers. Workers who are considered informal under *Health* but formal under *Firm Size and Occupation* are relatively younger, less educated, and wealthier (see table A1 in the appendix for details).

FIGURE 3. Informality under *Health* across Occupations and Firm Size (*Continued*)

B. Informality levels by firm size
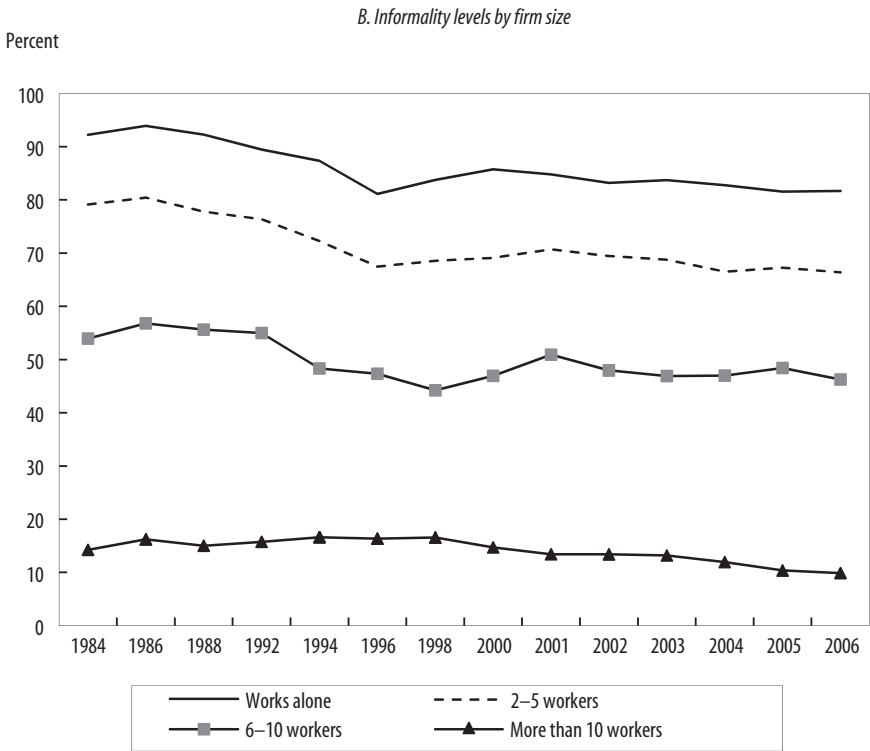
Informality and the Business Cycle

The period under study includes both expansions and recessions, structural reforms in the labor market, and significant variation in nonwage costs and the minimum wage. To study the effects of these movements on informality, we begin by looking at the correlation between the size of the informal sector (across alternative definitions) and the business cycle for the period 1984–2006. If informality is a disadvantaged sector of a segmented labor market detached from formal activity, it should be countercyclical, expanding during downturns to absorb displaced workers from the formal sector. If, on the other hand, the size of the informal sector is procyclical, this would be suggestive of a micro-entrepreneurial sector, linked to the formal sector through the provision of low-cost goods and services. Our estimates show

F I G U R E 4 .   **Comparison between *Firm Size and Occupation* and *Health***

A. Differences in definitions

Percent of total workers

Firm size, not health

Health, not firm size

B. Agreement in definitions

Percent of total workers
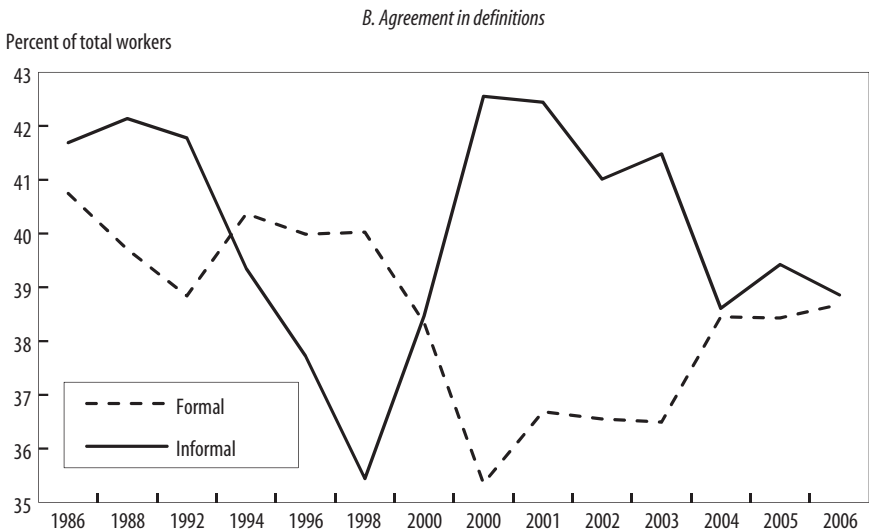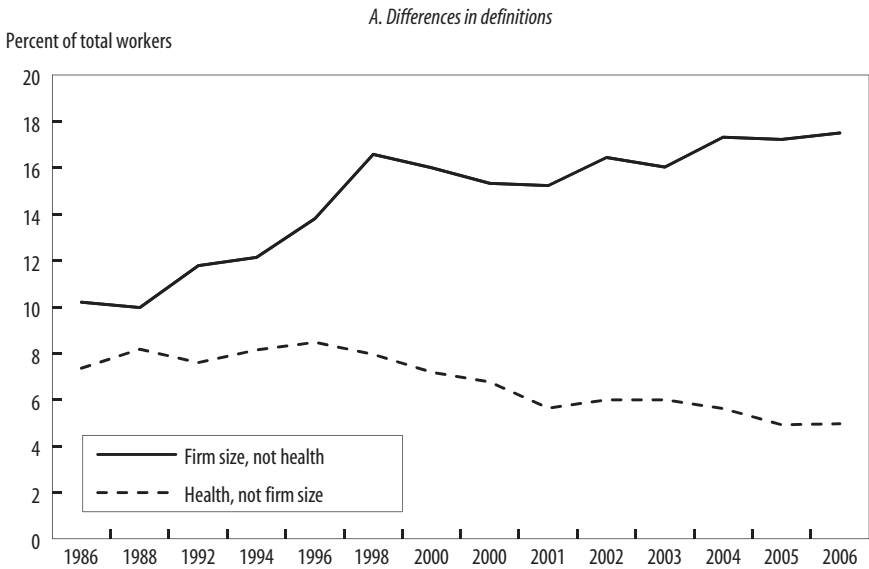
Formal

Informal

that informality is positively correlated with unemployment, regardless of the definition. Although we have few observations, the correlation is statistically significant (and substantially higher) when measured by *Firm Size and Occupation* or by *Health and Pension*. This implies that the size of the informal sector moves in the opposite direction of the business cycle, suggesting segmentation in the labor market.[15]

Relative Wages: Returns to the Formal and Informal Sectors

The formal and informal sectors differ substantially in their associated levels of earnings.[16] In this regard, the informal sector is not attractive. As portrayed in figure 5 (panel A), informal workers earn, on average, 40–60 percent of what their formal peers earn, regardless of the definition of informality. Informal wages improved relative to formal wages until 1994, but then deteriorated significantly up to the early 2000s—a time when both nonwage costs and the minimum wage increased substantially and the country faced the deepest recession in recent history. Informal wages recovered starting in 2002, but even after several years of high economic growth, informal workers' relative earnings in 2006 were still lower than in the 1980s.
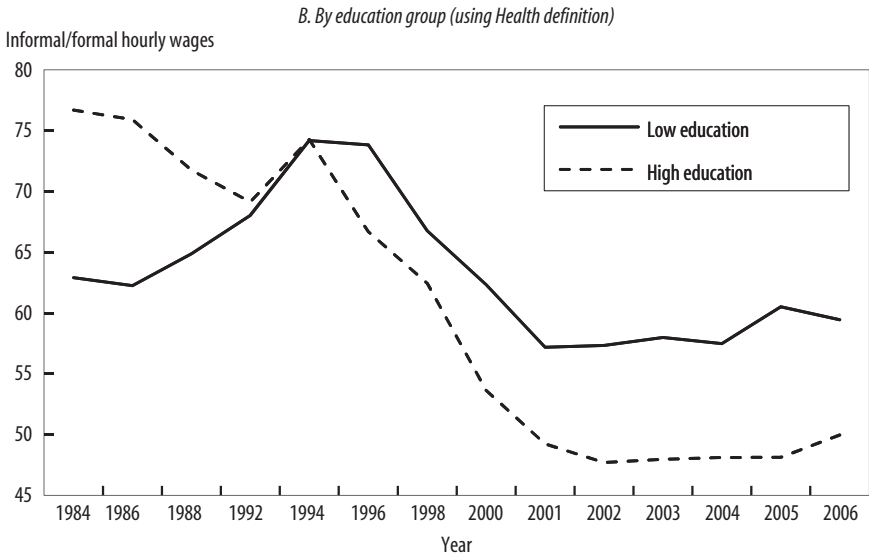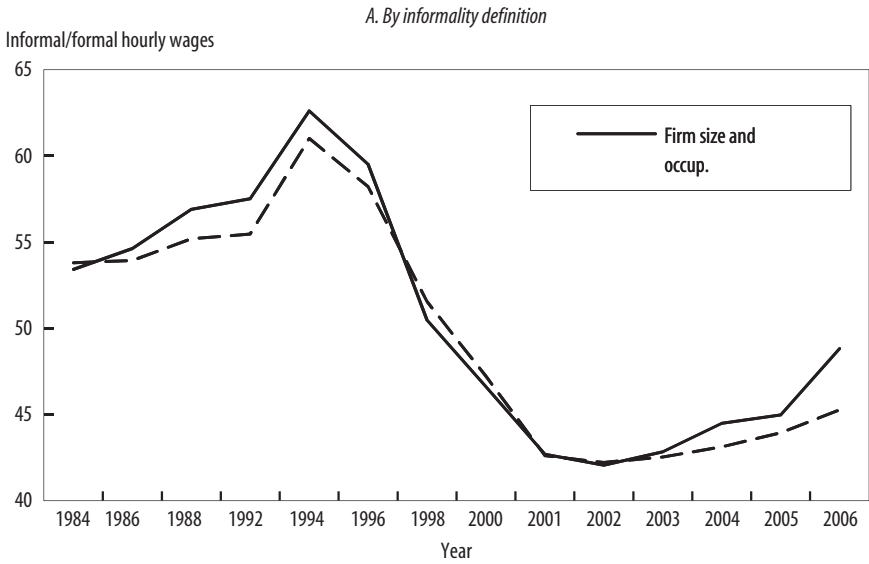
Relative returns also differ markedly across education groups (see figure 5, panel B), but the trends for each group are similar to the trend observed for the total.[17] Using the *Health* definition, informal high-skilled workers (those with completed secondary education or more) were relatively better off than their low-skilled peers at the beginning of the period. In the second half of the

15. We get very similar results when we estimate the correlations with gross domestic product (GDP) growth.

16. There are two 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 or informal sector given data availability, so the results may be biased. Second, given the data structure, there is no way to disentangle the returns to the labor and capital components of self-employment and business ownership. Therefore, the returns reported by these categories may overstate earnings as a return for their work.

17. Workers with less than eleven years of schooling are classified as low skilled, while workers with eleven or more completed years of schooling are classified as high skilled. On average, 8.7 percent of the Colombian workforce has completed tertiary education. Table A2 in the appendix displays the sample sizes and distributions across sectors of these two education groups. This classification splits the Colombian workforce roughly in half: 53 percent of workers are low skilled, and 47 percent high skilled. When we compare the composition of the formal and informal sectors, roughly one out of every three informal workers is high skilled, whereas two out of every three formal workers are high skilled.

F I G U R E 5 . **Trends in the Relative Mean Wages of the Informal to Formal Sectors**

A. By informality definition

Informal/formal hourly wages

B. By education group (using Health definition)

Informal/formal hourly wages

1990s, the relative wages of the high-skilled group decreased more than those of low-skilled individuals. The results are similar when we use the *Firm Size and Occupation* definition.

Labor Market Rigidities and Informality

The Colombian labor market is characterized by relatively high nonwage costs and wage inflexibility associated with the minimum wage.[18] Such rigidities are thought to contribute to the high unemployment and informality rates prevalent in the economy, mainly by limiting the formal sector's ability to adapt to economic cycles. The coexistence of high levels of nonwage costs and a binding minimum wage reinforce each other's negative effects.

The literature includes extensive studies of the effect of payroll taxes and the minimum wage on the labor market. An increase in nonwage costs makes labor relatively more expensive than capital. Hence, employers can either shift production away from labor, destroying formal jobs, or try to pass through 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 nonwage costs to workers via prices, which generates further job destruction and pushes more workers into either informality or unemployment. Increases of the minimum wage beyond price and productivity growth can also generate job destruction directly. If the minimum wage rises in real terms, firms destroy formal jobs whose productivity levels lie between the old and new minimum wage level.

Gruber shows that payroll taxes reduce labor demand and wages in equilibrium.[19] Kugler and Kugler introduce nonwage costs and a minimum wage into the Stiglitz-Shapiro model of efficiency wages; they find that nonwage costs decrease formal employment when taxes are not completely shifted to workers via lower wages.[20] This is always the case when the minimum wage is binding. Albrecht, Navarro, and Vroman, in an extension of the Mortensen-Pissarides search and matching model, find that rises in nonwage costs increase the size of the informal sector.[21] Fortin, Marceau, and Savard suggest that

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18. Bernal and others (2009).
19. Gruber (1997).
20. Kugler and Kugler (2009).
21. Albrecht, Navarro, and Vroman (2009).

higher taxes on labor and a higher minimum wage increase the number of firms operating in the informal sector, decreasing the demand of informal labor at the expense of decreasing vacancies for formal workers.[22] Kristensen and Cunningham show that rises in the minimum wage increase the relative cost of labor, which, given the presence of downward wage rigidities, makes the formal sector unable to adjust via prices and forces it to do so via quantities.[23] Card and Krueger review the literature on minimum wages and suggest that an increase in the minimum wage increases wages and reduces employment in the covered (formal) sector.[24] The effect in the uncovered (informal) sector depends on the model of labor supply chosen, but it is either negative or ambiguous on wages and either positive or ambiguous on employment.

Colombia implemented very profound labor reforms in the early 1990s, as did other countries in Latin America. In particular, Law 100 of 1993 structurally reformed the Colombian social security system, both in health insurance and pensions. Two regimes were created in health insurance: contributive (namely, an employment-based mandatory insurance system) and subsidized. Before 1993, health insurance contributions amounted to 8 percent of wages, and the reform raised contributions to 12 percent.[25] Similarly, pension contributions rose from 8 percent to 13.5 percent of wages in a three-year period.[26] Law 100 thus increased nonwage costs by 9.5 percentage points.

In addition to the steep increase in nonwage costs, Bernal and others suggest that four aspects of the current design of the Colombian social protection system, embedded in Law 100 of 1993, generate informality.[27] First, since social security benefits are multidimensional, 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 under the contributive and subsidized regimes is comparable. Since the subsidized regime is free of charge, it is optimal for eligible workers in this population to remain in the subsidized regime, which

22. Fortin, Marceau, and Savard (1997).
23. Kristensen and Cunningham (2006).
24. Card and Krueger (1995).
25. In the case of wage-earners the worker and employer share the burden (4 percent and 8 percent, 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.
26. Flórez (2002); Santa María, García, and Mujica (2009). Contributions for workers earning more than four times the minimum wage rose from 8 percent to 14.5 percent.
27. Bernal and others (2009).

implies passing up formal jobs.[28] Third, the current design does not allow for an easy transition between regimes. Thus, workers in the subsidized regime may be reluctant to accept a formal job and enter the contributive regime, since reentering the subsidized regime is time consuming. Finally, workers who are eligible for the subsidized regime (that is, who are classified as poor) are also eligible for an array of social programs. By accepting a formal job, these workers and their families gain access to the contributive health insurance regime but may potentially loose other benefits.

The minimum wage in Colombia is high. A cross-country comparison reveals that the Colombian minimum wage is the highest in Latin America, as measured by the ratio of the minimum wage to the median wage.[29] In addition, the minimum wage in Colombia is binding, and it indexes the whole wage distribution, since increases in the minimum wage are adopted as a benchmark for wage increases in the whole economy.[30] The effect is strongest for wages close to the minimum, and it decreases for higher wages in the distribution. 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 level generate wage inflexibilities, especially around the minimum, but its evolution can have important effects on the dynamics of the labor market.

In this paper, nonwage costs include severance payments, health and pension contributions, payroll taxes, two annual bonuses, vacation payments, and a transportation (commuting) subsidy.[31] The latter is fixed by law at the beginning of each year and applies exclusively to workers earning less than two times the minimum wage. In our calculation of nonwage costs, this

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28. One of the proclaimed recent successes of Colombian public policy is precisely the increase in coverage of the subsidized regime.

29. Maloney and Nuñez (2004). Since changes in the minimum wage should take into account changes in both purchasing power and labor productivity, a good way to characterize its evolution over time is to use the ratio between the minimum wage and the median wage as a proxy for productivity. This measure trivially controls for inflation.

30. Maloney and Núñez (2004).

31. Payroll taxes finance public social services, which are paid solely by the employer and are locally referred to as *parafiscales.* They are contributions to the following three organizations: the Instituto Colombiano de Bienestar Familiar (ICBF), which aims to protect children and improve the welfare of Colombian families; the Servicio Nacional de Aprendizaje (SENA), which invests in the social and technical development of Colombian workers through training programs; and Cajas de Compensación Familiar (CCF), whose main function is to redistribute a portion of the payroll of the covered work force through monetary subsidies and in-kind services to workers with the lowest wages.

transportation subsidy is included as a percentage of the minimum wage.[32] For example, in 1993, 45.8 percentage points of an employee's earnings corresponded to nonwage costs, of which 7.0 were health insurance, 8.0 were pension contributions, 9.3 were severance payments, 9.0 were payroll taxes, 4.2 were vacation payments, and 8.3 were two annual bonuses. In addition, the transportation subsidy accounted for 9.3 percent of the minimum wage.[33] Our measure of nonwage costs does not include severance payments for unfair dismissals (as in Cárdenas and Bernal), because data are not available for estimating the probability of being unfairly dismissed.[34] We also do not include the work uniform subsidies mandated by law, given the difficulty of determining their costs over time and applicability across sectors. Finally, the total nonwage costs we include in our calculations is a proxy for the percentage of the wage employers would have to pay, regardless of whether they actually pay them.

Figure 6 displays the informality rates under *Firm Size and Occupation* and *Health,* alongside the ratio of the minimum wage to the median wage (MinW) and nonwage costs. Both nonwage costs and MinW display secular increases during the period of study. The major increase in nonwage costs was due to Law 100 of 1993, which substantially increased payroll taxes. MinW remained relatively stable at around 85 percent from the mid-1980s to the early 1990s, decreased to 70 percent in the mid-1990s, escalated to over 90 percent 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.[35] This combination of fac-

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32. We compared different ways to include the transportation subsidy, and the results were robust to the different specifications tested. In particular, if the subsidy is included as the fixed amount mandated by law, it can become an unrealistically high percentage of the salary for those workers earning less than the minimum wage. As a robustness check, we repeated the estimations in the paper without the transportation subsidy in the nonwage costs measure, and the main results did not change.

33. For a detailed description of nonwage costs by year and income, see table A3 in the appendix.

34. Cárdenas and Bernal (2003).

35. Increases in the minimum wage for the coming year in Colombia are negotiated by the end of the current year, based on the projected inflation rate plus calculated increases in productivity. In December 1998, the expected inflation for 1999 was in the range of 15–17 percent, and the negotiated increase in the minimum wage was 16 percent. Over the course of the year, however, the country fell into the deepest recession since the 1930s, and the realized inflation rate for 1999 was 9 percent. Consequently, the minimum wage increased 7 percent 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 (Constitutional Court Sentence N° 815/99, 20 October 1999).

F I G U R E 6 . **Informality and Labor Market Rigidities**

Informality rate;
Nonwage costs

Min/median
wage ratio

Firm size and occup.
Health
Nonwage labor costs
Min/median wage ratio (right axis)
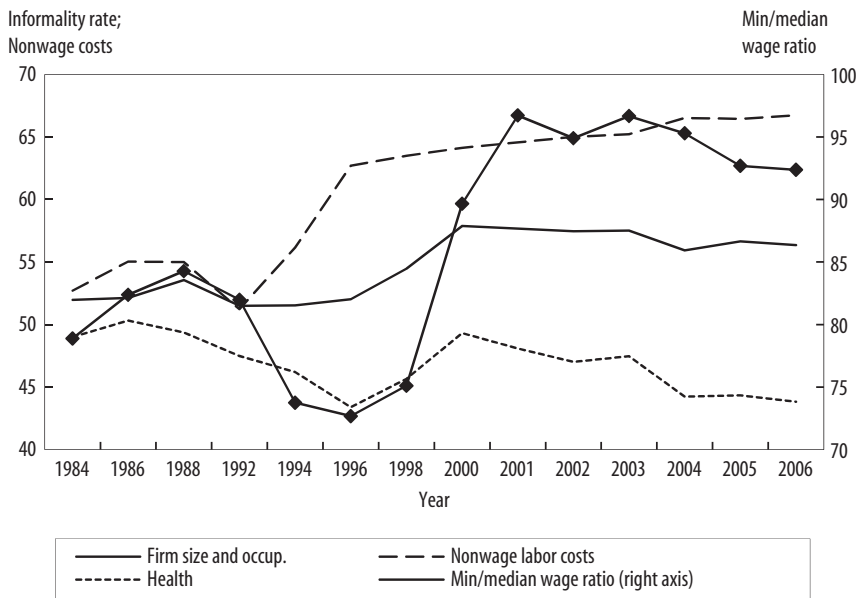
tors has kept the minimum wage at a very high level since that time. As shown in figure 6, the increase in nonwage costs preceded the increase in informality, while the increase in MinW coincided with it.

In sum, some analysts regard the increase in nonwage costs and the minimum wage as key drivers of the high levels of unemployment and informality in Colombia.[36] High nonwage costs increase the cost of formality for both firms and workers, generating incentives for workers to avoid compliance either voluntarily (through exit from the formal workforce, in response to labor supply behavior) or involuntarily (through exclusion from formal jobs, related to labor demand behavior). Increases in the minimum wage could imply higher informality via exclusion from the formal sector. The following sections explore the empirical validity of these hypotheses for Colombia over the past twenty years.

36. See, for instance, Bernal and others (2009).

The Size of the Informal Sector

We exploit the observed variation in MinW and nonwage costs over the period 1984–2006 to determine the effect on the size of the informal sector. In these estimations we use the two alternative definitions of informality discussed earlier (namely, *Firm Size and Occupation* and *Health*). We pool observations from all the quarters for which the informality module is available in the period of interest to estimate the effects of labor market rigidities on the probability of being informal, using a probit model and controlling for individual characteristics. We estimate the following model:

$$\text{INF}_{ict} = \beta_0 + \beta_1 \text{MinW}_{ct} + \beta_2 \text{NWC}_{it} + \beta_3 \text{Income\_pc}_{ict} + \beta_4 \mathbf{X}_{ict} + \varepsilon_{ict},$$

where INF_{ict} is a dummy variable that takes the value of one if individual i residing in city c at time t is classified as informal and zero otherwise, MinW_{ct} is the ratio of the (national) minimum wage to the median wage in city c at time t, and NWC_{it} is the level of nonwage costs as a percentage of the individual's salary.[37] NWC varies across individuals as well as over time. First, highly paid individuals have higher pension contributions (as a share of their wages) in order to finance part of the country's subsidized regime. For instance, workers earning more than four times the minimum wage have to contribute an additional percentage point of their monthly earnings to the pension fund, and workers earning more than sixteen times the minimum wage contribute up to two extra percentage points. Second, workers earning less than two times the minimum wage receive a transportation (commuting) subsidy that is about 10 percent of the minimum wage.[38] Income_pc_{ict} is real household income per capita, which is a proxy for the business cycle, and $\mathbf{X}_{ict}$ is a vector of individual controls that include age and age squared, educational attainment, gender, and marital status (defined as marriage or cohabitation), in addition to industrial sector and city dum-

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37. We performed a robustness exercise in which we used the real minimum wage by city, adjusting for differences in the evolution of inflation levels across cities. The results are qualitatively and quantitatively very similar. The estimated effects are higher when we eliminate the regional variation in MinW by using the national minimum-median ratio.

38. As discussed earlier, the main findings of the paper are robust to the inclusion or exclusion of transportation/commuting subsidies within nonwage costs.

T A B L E 1 . Estimated Effects on the Size of the Informal Sector, Total Sample[a]

	Definition of the informal sector		
Explanatory variable	Firm size and occupation	Health	Sample mean
Minimum wage /	0.117***	−0.007	0.866
median wage	(0.044)	(0.063)	
NWC	0.843***	0.448***	0.615
	(0.059)	(0.068)	
Income_pc	0.001	−0.021***	1.225
	(0.001)	(0.004)	
No. of observations	459,105		

***Statistically significant at the 1 percent level.

a. The dependent variable is a dummy variable that equals one if the individual is informal and zero otherwise. In columns one and two, we use the *Firm Size and Occupation* and *Health* informality definition, respectively. Robust standard errors are in parentheses.

mies.[39] The regressions were estimated using cluster-robust standard errors (clustered on year and city) to account for the fact that although our sample spans over twenty-two years, we only have observations in fourteen periods, while MinW varies across years and cities but not across individuals.

The estimated effects of NWC, MinW, and the business cycle on the size of the informal sector, measured through the workers' probability of being informal, are shown in table 1. The results suggest that labor market rigidities can have sizeable effects on the rate of informality, as the increases observed in NWC and MinW during the period of study are associated with a higher fraction of informal workers. For instance, an increase of 10 percentage points in nonwage costs is associated with an increase in the probability of being informal of 5 to 8 percentage points, depending on the definition of informality. To put this result in perspective, Kugler and Kugler estimate that a 10 percent increase in nonwage costs decreases formal employment by 4–5 percent.[40] Similarly, the results obtained when using the government's official definition of informality suggest that a rise of 20 percentage points in MinW (as occurred between 1996 and 2001) implies an

39. We use real household income per capita instead of regional GDP in order to generate variation across individuals. Our main findings are robust to changes in the business cycle proxy, for example by using real total household income, or to the exclusion of this variable from the estimation. When we use regional GDP, business cycle effects are in general not statistically significant. A better proxy for business cycle would be the growth of real household income per capita. However, because we are working with repeated cross-sections, it is impossible to build such a measure.

40. Kugler and Kugler (2009).

T A B L E 2 . Estimated Effects on the Size of the Informal Sector with Heterogeneous Effects by Skill Group[a]

	Definition of the informal sector		
Explanatory variable	Firm size and occupation	Health	Sample mean
Minimum wage / median wage	0.257***	0.175***	0.866
	(0.043)	(0.049)	
Minimum wage / median wage × high education	−0.268***	−0.352***	0.411
	(0.030)	(0.040)	
NWC	0.796***	0.178***	0.411
	(0.062)	(0.050)	
NWC × high education	0.065	0.587***	0.288
	(0.066)	(0.083)	
Income_pc	0.009	−0.202***	0.615
	(0.009)	(0.036)	
Income_pc × high education	−0.014	0.176***	0.207
	(0.009)	(0.036)	
No. of observations	459,105		

***Statistically significant at the 1 percent level.

a. The dependent variable is a dummy variable that equals one if the individual is informal and zero otherwise. In columns one and two, we use the *Firm Size and Occupation* and *Health* informality definition, respectively. The regressions incorporate the full set of controls, including any fixed effects. Robust standard errors are in parentheses.

increase of 2 percentage points in the informality rate.[41] The economic cycle coefficient, when significant, implies countercyclicality (though it generally has second-order effects).[42]

The magnitude and significance of the marginal effects of nonwage costs and the minimum wage on the total sample vary with the definition of informality. While effects are higher when informality is measured as *Firm Size and Occupation,* the coefficient of MinW is neither statistically nor economically significant when using *Health.* To address these robustness issues, we explore potential differences across education groups. Specifically, we study heterogeneous effects of the model on two different groups: low-skilled workers, which includes individuals with less than completed secondary education; and high-skilled workers, which includes workers with completed secondary education or more. The estimates in table 2 generally suggest sig-

41. To the best of our knowledge, there are no other estimations of the effect of the minimum wage on the size of the informal sector.

42. Regression estimates are only shown for the variables of interest; detailed and complete results for this estimation are available on request. The estimated coefficients for the control variables indicate that informality rates tend to be higher for women, young people, unmarried workers (though the effects are relatively small), and workers with low education. There is also significant variation across regions and economic sectors. Gender and marital status differences are not significant when using the *Health* definition of informality in the total sample.

TABLE 3. Estimated Effects for High-Skilled Workers

Explanatory variable	Firm size and occupation			Health		
	Coefficient	Chi²(1)	Prob>Chi²	Coefficient	Chi²(1)	Prob>Chi²
Minimum wage / median wage	−0.011	0.05	0.820	−0.177**	5.68	0.017
NWC	0.861***	170.43	0.000	0.765***	59.62	0.000
Income_pc	−0.005	1.07	0.300	−0.026***	6.83	0.009
No. of observations	459,105					

**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.

nificant differences in the effects of MinW and NWC on low- and high-skilled workers, which could be interpreted as a gradual segmentation of the labor force. First, higher MinW and NWC imply higher informality for those within the low-skilled group, regardless of the definition of informality. These results could be linked to the concept of exclusion: higher MinW and nonwage costs negatively affect the supply of formal jobs for low-skilled individuals, leaving them with the choice of informal paid jobs or involuntary self-employment.[43] Since the vast majority of informality is captured within this group, we consider these results the most relevant in regard to the effects of labor market rigidities on the size of the informal sector.

To facilitate the interpretation of the results, we isolate the net effect for the high-skilled group and its significance level (see table 3).[44] The effects of MinW and NWC on high-skilled workers are cleary different from the effects on low-skilled workers. Increases in MinW seem to decrease the probability of being informal for high-skilled workers, although the effect is only weakly significant under *Health* and not significant under *Firm Size and Occupation.* Given that the Colombian minimum wage is high and binding, rises in real terms turn out to be a regressive policy in terms of the size of the informal sector: it seems to protect high-skilled workers while pushing low-skilled workers into informality or unemployment.

Rises in nonwage costs, on the other hand, increase the probability of being informal for both low- and high-skilled workers. When informality is measured by *Firm Size and Occupation,* nonwage costs affect low- and high-skilled workers equally since the interaction coefficient between NWC and

43. See Perry and others (2007). This is consistent with the findings of Ardagna and Lusardi (2010) and Mondragón-Vélez and Peña (2010).
44. We used a chi-squared test to calculate the significance level and the delta method for the standard errors.
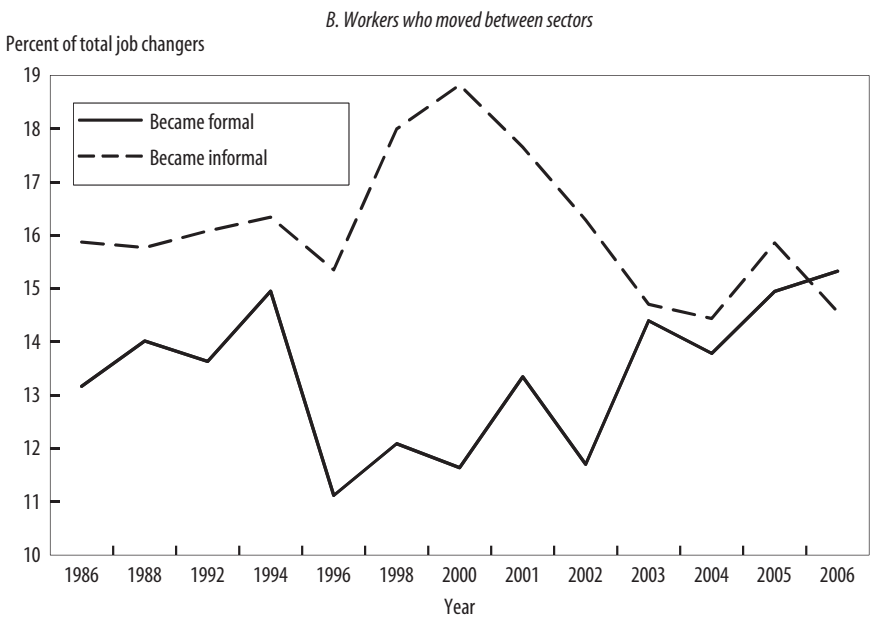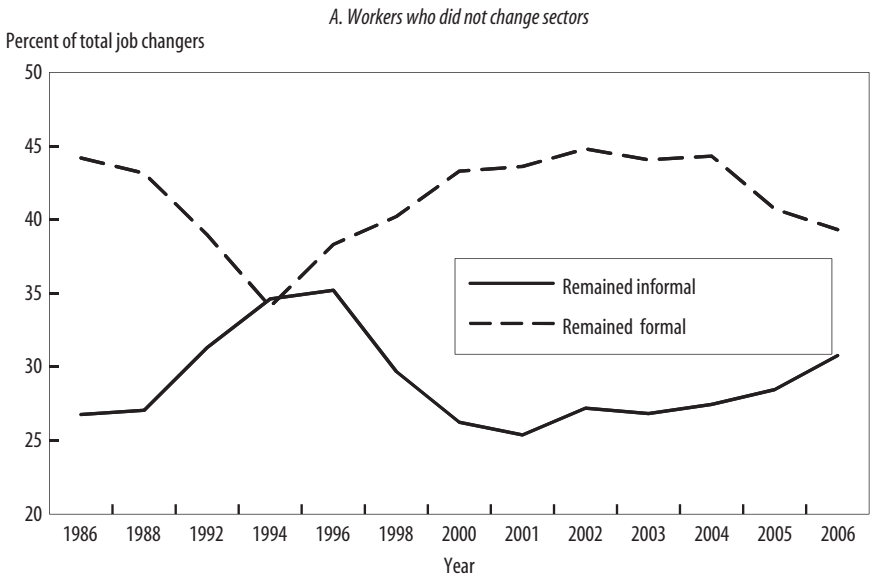
high-skilled workers is not significant (table 2). When we use *Health,* we see that nonwage costs affect the probability of being informal more for high-skilled individuals more than for low-skilled ones. Further research is needed to explain this phenomenon. Finally, when we use the *Health* definition, the effect of the business cycle is countercyclical for all workers, but the effect is stronger for low-skilled workers. When the economy is contracting, workers with a low education level are more likely to be informal, which suggests exclusion. Overall, these results suggest a strong link between informal low-skilled workers and exclusion.

Transitions between the Informal and Formal Sectors

In this section we study the flow of agents in the labor force between the formal and informal sectors. We started by developing transition matrices for each of the available cross-sections during the period 1986 to 2006 and then characterized each of the flows involving entry into or exit from the informal sector by estimating transition probabilities as a function of demographics, occupation-specific characteristics, and other idiosyncratic labor-history factors. Since our database is composed of repeated cross-sections, we build the transitions within twelve-month periods using retrospective questions. We observe the sector to which a worker belongs at the time of the survey; consider only workers who switched jobs in the previous year; and only use the *Firm Size and Occupation* definition, because retrospective information on contributions to health insurance is not available. Our results indicate that in 1998, for example, 62.3 percent of those who were formal in their previous job remained formal and 37.7 percent became informal. For workers whose previous job was in the informal sector, 80.3 percent remained informal while 19.7 percent moved into the formal sector. These values indicate some persistence across sectors. As a share of the workers who switched jobs the previous year, 29.7 percent of workers were formal and remained formal, 18.0 percent were formal and became informal, 12.1 percent were informal and became formal, and the remaining 40.2 percent 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 these transitions across time is plotted in figure 7. Panel A plots the share of workers who remained in either the formal or informal sector from one year to the next. The graph shows that persistence in the informal

F I G U R E 7 .   Transitions between the Formal and Informal Sectors over Time

A. Workers who did not change sectors

Percent of total job changers

Year

B. Workers who moved between sectors

Percent of total job changers

Year

sector decreased at the beginning and end of the period and increased between 1994 and 2001, while the opposite is true for persistence in the formal sector. Panel B, which illustrates the trend for workers who moved between sectors, suggests that the expansion in informality was generated by greater inflows of workers into the informal sector than outflows, starting in 1984. The differences in flows into and out of the informal sector were sizeable between 1996 and 2002, after the steep increase in nonwage costs and the minimum wage. By the end of the period, however, the flows into and out of informality became very similar, so the size of the informal sector stabilized.

We now study the effect of labor market rigidities and unemployment on the probability of moving into and out of the informal sector. We use an extended probit specification similar to the one described in the last section, which includes the unemployment spell and a dummy variable for whether individuals changed their economic activity as part of the covariates. The dependent variable in these regressions measures twelve-month transitions from the formal to the informal sector and vice versa, and we again include only those individuals who changed jobs in the past year.[45] The reported estimates thus measure the effects on the transition probability across the formal and informal sectors conditional on changing jobs. As before, these transitions can only be observed for the *Firm Size and Occupation* definition; regressions were estimated using cluster-robust standard errors (clustered on year and city); and results are only reported for the covariates of interest (namely, MinW, NWC, household income per capita as a proxy for the business cycle, the unemployment spell, and industrial sector change).[46]

The first column of table 4 shows the estimates for the transition probability into the informal sector. These results imply that labor market rigidities are important drivers of the transition into informality, consistent with the findings of the previous section regarding the size of the informal sector. A rise of 10 percentage points in nonwage costs increases the probability of transitioning into informality (given that the worker switched jobs) by 8.7 per-

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45. When we include workers who had been on the same job for over a year (by defining their previous sector to be the same as their current one), the magnitude of the coefficients of interest (MinW and NWC) falls dramatically, although the sign and significance of the probability of transitioning into informality do not change. For the estimation of the transition into formality, the significance of the effects changes, as well.

46. The remaining covariates have the expected sign and significance levels. The full set of results are available on request.

T A B L E   4 .   Probability of Transitioning between the Formal and Informal Sectors[a]

Explanatory variable	Formal to informal		Informal to formal	
	Transition probability	Sample mean	Transition probability	Sample mean
Minimum wage / median wage	0.292***	0.862	0.045	0.897
	(0.096)		(0.086)	
NWC	0.871***	0.626	−0.286***	0.645
	(0.127)		(0.085)	
Income_pc	0.005	0.315	0.006	0.210
	(0.017)		(0.018)	
Change in sector (dummy)	0.149***	0.795	0.067***	0.712
	(0.014)		(0.008)	
Unemployment spell	0.004	2.097	−0.003**	1.947
	(0.003)		(0.001)	
Summary statistic				
Pseudo *R* squared	0.14		0.18	
No. of observations:	20,430		31,880	

**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.
a. The dependent variable is a dummy variable that equals one if the individual transitioned between sectors in the last year, and zero otherwise. The informality definition used is *Firm Size and Occupation*. The regressions incorporate the full set of controls, including any fixed effects. Robust standard errors are in parentheses.

centage points, whereas a 20 percentage point increase in the ratio of the minimum wage to the median wage does so by 6 percentage points. Unemployment spell effects have the expected sign, but they are not significant.[47]

In regard to the transition into formality (third column of table 4), the effects of nonwage costs, the unemployment spell, and the business cycle have the expected signs (though with small economic significance for the last two). The probability of transitioning into formality decreases with higher nonwage costs or an unemployment spell, as expected. Again, the positive correlation of the transition into formality with changes in economic activity arises from the nature of informal activities and the processes of exclusion associated with them. While increases in MinW raise the probability of transiting into informality, the reverse is not true: MinW effects appear both economically and statistically insignificant in the transition into the formal sector.

47. The probability of transition into informality is expected to increase with higher nonwage costs or MinW as firms decrease the supply of formal jobs in response to larger hiring costs; decrease with the business cycle as the supply of formal job opportunities is pro-cyclical; and increase with the unemployment spell as the odds of getting a job in the formal sector are hurt by a long unemployment spell.

T A B L E 5 . Transition Probability between Sectors, by Skill Levels[a]

Explanatory variable	Formal to informal		Informal to formal	
	Transition probability	Sample mean	Transition probability	Sample mean
Minimum wage / median wage	0.470***	0.862	0.052	0.897
	(0.074)		(0.098)	
Minimum wage / median wage × high education	−0.327***	0.513	~0.021	0.278
	(0.079)		(0.068)	
NWC	0.567***	0.626	−0.393***	0.645
	(0.135)		(0.106)	
NWC × high education	0.557***	0.368	0.306**	0.201
	(0.190)		(0.154)	
Income_pc	0.017	0.315	−0.013	0.210
	(0.058)		(0.018)	
Income_pc × high education	~0.010	0.251	0.042	0.083
	(0.056)		(0.027)	
Change in sector (dummy)	0.153***	0.795	0.065***	0.712
	(0.017)		(0.010)	
Change in sector × high education	−0.009	0.455	0.005	0.225
	(0.030)		(0.018)	
Unemployment spell	0.009***	2.097	−0.004*	1.947
	(0.003)		(0.002)	
Unemployment spell × high education	−0.009***	1.170	0.002	0.610
	(0.003)		(0.003)	
Pseudo R squared	0.14		0.18	
No. of observations:	20,430		31,880	

*Statistically significant at the 10 percent level.
**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.
a. The dependent variable is a dummy variable that equals one if the individual transitioned between sectors in the last year, and zero otherwise. The informality definition used is *Firm Size and Occupation*. The regressions incorporate the full set of controls, including any fixed effects. Robust standard errors are in parentheses.

To explore behavioral differences and explain the asymmetric effect of MinW on the transition probabilities, we explore, as before, the robustness of these results across different education groups. Finally, changes in economic activity are positively correlated with both the transition into informality and the transition into formality. The former suggests that this decision is not necessarily related to a career path, and in line with exclusion.

The first column of table 5 shows that the effects on the transition into the informal sector for the total sample are mainly driven by the low-skilled group. The strongly positive and significant effects of MinW and nonwage costs on the probability of transitioning into informality are fully consistent with their effects on the size of the informal sector for this particular group.

T A B L E 6 .   Estimated Effects for High-Skilled Workers

Explanatory variable	Formal to informal			Informal to formal		
	Coefficient	Chi²(1)	Prob>Chi²	Coefficient	Chi²(1)	Prob>Chi²
Minimum wage / median wage	0.143	1.65	0.199	0.031	0.16	0.693
NWC	1.124***	46.29	0.000	−0.087	0.47	0.494
Income_pc	0.007	0.15	0.704	0.029	1.39	0.239
Change in sector (dummy)	0.144***	47.04	0.000	0.060***	31.89	0.000
Unemployment spell	0.000	0.01	0.930	−0.002	1.11	0.292
No. of observations	20,430			31,880		

***Statistically significant at the 1 percent level.

This constitutes additional support to the idea of a segmented labor market; workers are excluded from the formal sector as the effects of the minimum wage and nonwage costs work mainly through quantity adjustments in the demand for low-skilled labor. To facilitate the interpretation of the results in table 5, we highlight the net effects for the high-skilled group in table 6.[48] For high-skilled workers, the effect of increases in MinW (that is, the sum of the low-skilled group and the interaction coefficients) is not statistically significant. This implies that increases in MinW do not affect the probability of transitioning from the formal to the informal sector for this group. This result is in line with the findings from the last section. Higher nonwage costs increase the probability of transitioning from the formal to the informal sector for all workers, but especially for high-skilled ones.

Regarding the transition from the informal to the formal sector, increases in MinW are not statistically significant for any group. However, lower nonwage costs imply a higher transition into formality for the low-skilled group, as expected; this is linked to quantity adjustments via the demand for labor. The total effect for high-skilled individuals (that is, the sum of the low-skilled group and the interaction coefficients) is not statistically significant. Consistent with our findings in the last section, these estimations strongly support the exclusion of the low-skilled group. When looking at heterogeneous effects, changes in economic activity are again positively correlated with both the transition into informality and the transition into formality.

48. Again, the significance level was calculated using a Chi² test; the standard errors were computed using the delta method.

Conclusion

Informal workers are vulnerable, are frequently uncovered by social security, have relatively low education, and on average earn lower wages than formal workers. The secular increase in the size of the informal sector in Colombia is highly correlated with increasing labor market rigidities, namely, the minimum wage and nonwage costs. These increased rigidities have made the formal sector less able to adjust to economic cycles. The coexistence of high nonwage costs and a high minimum wage implies that the formal sector must adjust to the economic cycle through quantities rather than wages, cutting back on mostly low-skilled jobs and forcing those workers into the informal sector. Because the minimum wage is not binding in the informal sector, a high percentage of informal workers is paid below the minimum. As more low-skilled workers move into the informal sector, wages in that sector drop overall.

Rigidities also have consequences for the relative sizes of the formal and informal sector, which have ultimately triggered the documented increase in the latter. All in all, our results suggest that labor market rigidities affect low-skilled workers the most. Further research is needed to understand the channels through which labor market rigidities affect the transition into the formal sector and, in particular, the motivations of such transitions for informal workers with high educational attainment.

In terms of policy design, this paper provides useful evidence on the costs that labor market rigidities imply for vulnerable workers. These workers are precisely the targeted population that the wage policies aimed to protect in the first place, yet the unintended consequences have resulted in exclusion from the formal sector for many. However, our exposition of the costs associated with these rigidities needs to be balanced by an analysis of the benefits these instruments provide before policy recommendations can be formulated. Future research should include a comprehensive approach to address the complex social and economic challenges that informality represents across the developing world.

Appendix: Supplemental Tables

T A B L E   A 1 .   Characteristics of Misclassified Workers[a]

Variables	Informal under Firm Size and Occupation, but not Health	Informal under Health, but not Firm Size and Occupation
Complete primary education	0.253***	−0.087***
	(0.011)	(0.013)
Complete secondary or more	0.427***	−0.195***
	(0.012)	(0.015)
Complete tertiary or more	0.147***	0.133***
	(0.019)	(0.021)
Private wage earner	−0.340*	4.968***
	(0.201)	(0.086)
Public wage earner	Perfect predictor	4.124***
		(0.090)
Household worker	0.269	Perfect predictor
	(0.201)	
Self-employed	−0.421**	4.622***
	(0.201)	(0.086)
Business owner	0.190	4.444***
	(0.201)	(0.090)
Other occupation	−0.616***	5.159
	(0.219)	(0.000)
Age	0.010***	−0.011***
	(0.000)	(0.000)
Log(wage)	0.081***	0.036***
	(0.005)	(0.007)
Constant	−1.933***	−6.111***
	(0.202)	(0.097)
No. of observations	417,118	431,171

*Statistically significant at the 10 percent level.
**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.
a. The regressions omit the categories Less than primary education and Unpaid family aid. Robust standard errors are in parentheses.

T A B L E A 2 . **Sample Sizes and Distributions across Sectors, by Education Level**

	Education level		
Definition of informality and the worker's sector	Low education	High education	Total (entire distribution)
A. Number of workers			
Firm size and occupation			
Formal	71,922	135,222	207,144
Informal	170,130	81,831	251,961
Total	242,052	217,053	459,105
Health			
Formal	90,723	154,443	245,165
Informal	151,329	62,611	213,940
Total	242,052	217,053	459,105
B. Share by education level (percent)			
Firm size and occupation			
Formal	34.7	65.3	100.0
Informal	67.5	32.5	100.0
Total	52.7	47.3	100.0
Health			
Formal	37.0	63.0	100.0
Informal	70.7	29.3	100.0
Total	52.7	47.3	100.0
C. Share by sector (percent)			
Firm size and occupation			
Formal	29.7	62.3	45.1
Informal	70.3	37.7	54.9
Total	100.0	100.0	100.0
Health			
Formal	37.5	71.2	53.4
Informal	62.5	28.8	46.6
Total	100.0	100.0	100.0

T A B L E   A 3 . Nonwage Costs by Year and Income

Year	1–2 minimum wages + transportation subsidy	2–4 minimum wages	4–16 minimum wages	16–17 minimum wages	17–18 minimum wages	18–19 minimum wages	19–20 minimum wages	>20 minimum wages[a]
				Income (as a multiple of the minimum wage)				
1984	55.25	45.5	45.5	45.5	45.5	45.5	45.5	45.5
1985	Agreement 29 of 1985 increased pension contributions from 4.5 percent of wages to 6.5 percent.							
1986–88	57.31	47.5	47.5	47.5	47.5	47.5	47.5	47.5
1988	Act 89 of 1988 increased payroll taxes by 1.0 percentage point to finance childcare and family welfare programs, effective in 1989.							
1990	Act 50 of 1990 reduced double accounting of interest on severance payments, lowering nonwage costs 4.2 percentage points.							
1992	53.55	44.3	44.3	44.3	44.3	44.3	44.3	44.3
1993	Act 100 of 1993 increased pension contributions from 6.5 percent to 11.5 percent. It also increased health contribution by one percentage point (to 8 percent) to finance the solidarity component of the system.							
1994	59.12	50.3	51.3	51.3	51.3	51.3	51.3	51.3
1996	Per Act 100 of 1993, health contributions increased 4 percentage points (to 12 percent) and pension contributions increased two percentage points for people earning between one and four times the minimum wage and three percentage points for higher wages.							
1996–2002[b]	65.85	56.3	57.3	57.3	57.3	57.3	57.3	57.3
2002	Act 789 of 2002 reduced severance payments by one percentage point.							
2003	66.60	55.3	56.3	56.3	56.3	56.3	56.3	56.3
2003	Act 797 of 2003 added a cumulative 0.2 percentage point to each income bracket between 16 and 20 times the minimum wage effective in 2004, together with two increases of 0.5 percentage point each in pension contributions effective in 2005 and 2006.							
2004	67.92	56.3	57.3	57.5	57.7	57.9	58.1	58.3
2005	68.46	56.8	57.8	58.0	58.2	58.4	58.6	58.8
2006	68.99	57.3	58.3	58.5	58.7	58.9	59.1	59.3

a. The highest base for contributions to health and pension is 20 minimum wages.

b. Between 1996 and 2002, only the transportation subsidy changed. Therefore, nonwage costs for the 1–2 MinW bracket increased from 65.85 in 1996 to 67.30 in 2002, while they remained stable in all other categories.