Credit, Labor Informality and Firm Performance in Colombia

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Abstract[1]

This paper explores the links between labor formality, access to credit and firm performance in Colombia using Annual Manufacturing Survey data for the period 2000-2009. A significant though small relationship is found between access to credit and informality. The results suggest that a 10 percent increase in the ratio of credit to sectoral output increases labor formality between 0.76 and 1.14 percentage points. This effect vanishes as a firm's financial constraint increases. The paper also reports a strong correlation between labor formality and firm performance measured as output and employment growth. A one percentage point increase in labor formality is associated with an 8.5 percent increase in output and an 11 percent increase in employment growth.

JEL classifications: E26, G21, O4, O16
Key Words: Credit markets, Financial constraints, Informality, Colombia

1. Introduction

There is considerable consensus in the finance and development literature that financial development fosters economic growth (Levine, 1997; Beck, Levine, and Loayza, 2000). This argument is based on the idea that well-functioning financial markets allow firms to undertake investments and through them realize productivity gains that would not be possible when there is high dependence on external finance (Rajan and Zingales, 1998). There is also significant consensus that informality of firms and of employment arrangements, understood as the lack of compliance with taxes and regulations, restricts growth, because informality is associated with allocative inefficiencies that lead to under-investment and to lower total factor productivity (Farrell, 2006; Perry et al., 2007; Levy, 2008; La Porta and Shleifer, 2008; D'Erasmo and Moscoso Boedo, 2009; Hsieh and Klenow, 2009). Moreover, because informality shrinks the national tax base, it often induces higher compensatory taxes to be levied on formal businesses that, in turn, reinforce the incentives to be informal, multiplying the adverse effects of informality on economy-wide productivity and growth.

Studies exploring the links between the functioning of formal credit markets and labor formalization are scarce. A notable exception is Catão, Pagés and Rosales (2009). Using microeconomic data from Brazil, these authors explore whether and to what extent requirements to access formal credit markets can explain aggregate variations in formal versus informal employment relative to other driving forces of formality, such as overall economic growth and tighter enforcement of labor and tax regulations. They also examine whether this "credit channel" works mainly through its effect within size categories and/or by shifting the composition of employment between firm sizes. In their empirical analysis they define formal employment as "those jobs in compliance with registration regulations and social security contributions." Using sector-level formality measures from household surveys data, data on banking credit and measures of sector-level financial dependence calculated as in Rajan and Zingales (1998), Catão et al. find that formalization rates increase with financial deepening, especially in sectors where firms are typically more dependent on external finance. They also find that financial deepening significantly explains shifts in formalization rates within each firm size category, but not so much shifts in formalization between firm sizes.

This paper builds on the research put forth by Catão et al. using firm-level data from the Colombian manufacturing sector to examine the relation between banking credit and labor

formalization. In our empirical analysis we use firm-level measures of financial constraints, in combination with information about banking credit at the sector level, and a firm-level measure of labor informality based on payroll taxes compliance as in Meléndez and Pagés (2011).[2]

Our results suggest that, while banking credit availability at the sector-level is positively associated with higher formality of employment arrangements at the firm level, this result is reversed for the more financially constrained firms (firms that depend more on their internal resources to finance their investments despite the sector-level availability of credit). We also find that higher payroll tax compliance is positively associated with higher output, higher output growth, and higher total factor productivity growth. Our results on the relation between labor formality and firm size measured by assets, and that between labor formality and employment growth, are inconclusive.

The paper is organized as follows. After this introduction, Section 2 presents the data we use in estimation and provides descriptive statistics. Section 3 describes the models we use to undertake the estimation, Section 4 discusses the econometric results, and Section 5 concludes.

2. Data Sources and Descriptive Statistics

The primary data source used in this research is the Annual Manufacturing Survey (AMS) conducted by the national statistical agency, DANE. Our research focuses on the manufacturing sector due to the richness of the available data for this sector, and the fact that businesses can be tracked over time.

The AMS collects annual information on all manufacturing establishments with 10 or more employees, or annual output above 500 minimum monthly wages. Establishments are assigned IDs that are stable over time, allowing the construction of a panel, and the firm to which each establishment belongs is also assigned a fixed ID, so that the information can be aggregated at the firm level. The information we use for this paper covers 2000-2009.

The AMS contains information on sales; production; use of labor, capital, and materials; labor costs; and details on location, sector of activity and other firm characteristics. It does not, however, collect information about firms' use of banking credit (or any other type of credit). For the purpose of this paper we combine the AMS data with ISIC 4-digit sector-level information

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[2] A sector-level labor informality measure from household surveys is available and can be used as an alternative to our firm-level informality measure for robustness checks in a future draft.

on credit operations intermediated by formal (i.e., supervised) financial institutions over 2000-2009.[3] These data come from the Financial Superintendency (Superfinanciera), which oversees the activities of all formal financial intermediaries. As part of this task, it is informed of all financial transactions by its supervised institutions. The database we use contains information on credit balances outstanding (per ISIC 4-digit sector) per year.

Finally, using firm identifiers we combine the AMS data with data from the national customs registry in order to properly identify firms that participate in international markets as exporters. We use this information to control for this type of activity in our econometric estimations.

2.1 Labor Informality

The availability of detailed information in the AMS about labor use by type of worker (production versus non-production workers), and by type of work contract (permanent versus temporary), and associated labor costs also disaggregated by type (salary and mandatory bonuses payments, social security payroll taxes (for health, pension and work injury benefits coverage) and other payroll taxes,[4] allows us to calculate effective payroll tax rates and compare them to the legal payroll tax rates to assess firm compliance with labor regulations, as in Meléndez and Pagés (2011). Because salaries and mandatory bonus payments cannot be separated in the data, these authors compute modified effective payroll tax rates calculated on the basis of these augmented salaries rather than strictly on salaries (from which nominal payroll taxes are defined). To preserve comparability, they also produce "adjusted" legal payroll tax rates, using a multiplier that modifies the legal rates to obtain the rates that would result if these were applied not only to salaries but also to mandatory bonuses to calculate payroll contributions (legal payroll tax rates are multiplied by $(1/(1+X\%))$ where $X\%$ is the non-salary fraction of the payroll). We adopt this approach to produce our firm-level formality measure: the ratio of the firm's payroll tax rate effectively paid to the prevailing legal payroll tax rate. Table 1 presents

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[3] While loan information is systematically recorded only since 2004, we also chose to use the information for the previous years. Credit availability between 2000 and 2003 may be over or underestimated. Our main results hold when the sample is restricted to 2004-2009. These results are available upon request.

[4] In Colombia payroll taxes finance health coverage for sickness and maternity; pensions for old age; work injury benefits (ARP, for its acronym in Spanish); monetary subsidies and in-kind transfers to low-income workers' families (through Cajas de Compensación Familiar, CCFs) and to low-income children (through Instituto de Bienestar Familiar, ICBF); and training activities for workers of contributing employers (through SENA).

payroll tax rates adjusted as described above for data comparability. We use these adjusted tax rates to determine whether a firm complies with payroll contribution obligations.

Notice that an effective payroll tax rate below the legal rate may reflect either straight lack of compliance with legal obligations or elusion of obligations through a particular contract mix choice, which would not be illegal but turns out to be just as harmful to labor conditions.[5]

Table 2 presents manufacturing firms in the AMS by employment size category and by payroll taxes compliance status. Because legal payroll contributions present some variation across sectors of activities, this table lists as non-compliant only firms reporting payroll contributions below the lowest possible payroll tax rate (to which we refer as the legal lower bound).[6] Micro firms listed in this table are firms with less than 10 employees that are placed in the AMS database because of their output level (hence, not strictly micro-firms by all definitions). This table shows that *formally registered* firms are not always formal when it comes to their employment arrangements. Moreover, the share of firms reporting payroll tax rates below the legal lower bound is highest among larger firms (firms of 200 or more employees).

These results may seem counterintuitive if compared to labor formality statistics from household surveys. We want to underscore that they are not comparable. First, firms in the AMS are, as stated, formally registered firms; second they are small, medium or large by their employment size, their output size or both (i.e., informal micro-firms, where most informal labor is concentrated, are not part of the universe covered by the AMS); and third, what we are able to measure is their extent of compliance with labor regulations, so our measure of labor formality is a firm-level measure. It does not tell us how many workers in manufacturing are informal.

Table 3 shows firms reporting payroll tax rates below the legal lower bound by manufacturing subsector. Food, beverages and tobacco and Textiles, wearing apparel and leather account for the largest shares of firms in this category (19 percent and 20 percent, respectively, in 2009), and Non-metallic mineral products appears to have the highest share of compliers. Overall, this table shows both wide variations across sectors and significant persistence over time in the shares of firms that pay contributions below the legal lower bound.

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[5] We are not able to tell from the data which explanation prevails. A more thorough discussion of this issue is found in Meléndez and Pagés (2011).

[6] The payroll tax to finance work injury benefits varies across sectors of activity and can be as high as 8.5 percent. Because we do not know the exact rate corresponding to each firm, we assume a firm paying the lowest of these rates is complying with its payroll tax obligations.

2.2 Financial Constraints

The AMS also allows us to construct a simple measure of financial constraints by computing the correlation coefficient between each firm's investment and its cash flow[7] for the years between 2000 and 2009 in which the firm is active. This measure of financial constraints is based on the work of Calomiris and Hubbard (1995) and Hubbard (1998) among others, and it rests on the notion that firms that do not have access to financial markets need to rely on their cash flow to finance investment needs. The higher the correlation between investment and cash flow, the tighter the constraint. We divide firms into three groups according to their relative position in the distribution of these correlation coefficients. Firms in the lower third of the distribution are assumed to be financially unconstrained, and firms in the top third are assumed to be financially constrained. Firms in the intermediate segment of the distribution are assumed to be probably financially constrained. By definition this is a relative measure of financial constraints resting on the idea that firms that are more dependent on their cash flow to finance their investments face higher credit constraints. Figures 1 to 3 show that financially unconstrained firms, not surprisingly, account for higher shares of output, fixed assets and employment. Also, at least until 2007, unconstrained firms grew at a higher rate in terms of output than constrained firms; unconstrained firms additionally accumulated fixed assets while constrained firms appear to have disinvested. The differences are not as marked with respect to employment. All series show deterioration during the 2008 and 2009 global financial crisis.

2.3 Banking Credit

Table 4 shows the evolution of the stock of banking credit to businesses over time, distinguishing commercial credit from microcredit. The upper panel reports the value and number of credits going to all productive sectors, and the lower panel focuses on credit disbursed to the manufacturing sector. We see credit increasing both in value and numbers of loans over time, with the manufacturing sector participating with an average share of 19.8 percent of credit value and 6.0 percent of number of loans between 2000 and 2009, and with slightly lower average shares (17.2 percent and 5.4 percent, respectively) between 2005 and 2009.

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[7] Cash flow is proxied using operating profits constructed, in turn, as the difference between income associated with the firm's activity and operating expenses (labor costs, inputs and energy costs, sales and management expenses).

Table 5 shows banking credit going to manufacturing firms, by subsector of activity. Banking credit is unequally distributed across sectors, with Food, beverages and tobacco capturing the largest share, followed by Chemicals, and chemical, petroleum, coal, rubber and plastic products. Also, sector shares of banking credit are relatively stable over time.

3. Empirical Approach

3.1 Credit and Informality

To explore the relation between formal credit markets and labor formalization, we estimate the following baseline equation:

$$I_{ijt} = \propto + \beta_1 C_{j(t-1)} + \beta_2 Corr_{ij} + \beta_3 \left(Corr_{ij} \times C_{j(t-1)} \right) - T_t + u_{ijt} \quad (1)$$

where I_{ijt} is the ratio of the effective payroll tax rate paid by firm i, in sector j, at time t to the legal lower bound payroll tax rate (our measure of labor informality); $C_{j(t-1)}$ is sector j's ratio of banking credit outstanding to output (our measure of banking credit availability); $Corr_{ij}$ is firm i's correlation of cash flow[8] and investment (our measure of financial constraint); and T_t are year dummies to control for the macroeconomic cycle among other time-specific factors.

Because our labor formality measure is bounded between 0 and 1 (being equal to 1 for firms that pay exactly the legal payroll tax rate[9]) this equation is estimated using a Tobit model. We are not able to include firm-level fixed effects regardless of the panel shape of our data due to the lack of within-firm variation in our credit measure.

To ensure that our results are not biased due to omitted variables, we estimate modified versions of this basic regression including different sets of controls. First, we include alternative measures of the relative importance of white-collar employment: the ratio of professional to non-professional workers, and the ratio of professional to total labor costs. We expect a higher share of more educated workers will be reflected in higher labor formality. Second, we include the share of sector output over total manufacturing output, lagged, for sectors defined at the 4-digit level, to control for the relative size of the sector. Third, we gradually include location dummies at the metropolitan area level; ISIC 3-digit sector dummies; firm-size employment category

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[8] Proxied by the firm's operating profits.
[9] Because we are comparing the legal *lower* bound payroll tax rate to the effectively paid, on occasion the resulting ratio is higher than one. When this occurs, we set it equal to one, since it reflects compliance with the legal obligation.

dummies; dummy variables indicating, whether the firm is an exporter, and the firm's age (in logs).

We also estimate a version of the same equation (and its variations) using as the dependent variable a binary variable that takes the value of one when our labor informality measure equals one, and the value of zero otherwise. This Probit model explains the probability that a firm chooses to be informal in terms of its employment arrangements.

3.2 Informality and Firm Performance

A second set of exercises explores the relation between the degree of formality of labor arrangements and firm performance. The baseline equation used for estimation in this case is:

$$X_{ijt} = \alpha_i + \beta_1 I_{ij(t-1)} + T_t + u_{ijt} \quad (2)$$

where X_{ijt} is a measure of performance of firm i at time t; α_i are firm-level fixed effects to control for the potential estimation biases due to unobserved firm characteristics that are invariant over time; I_{ijt} is the ratio of the effective payroll tax rate paid by firm i at time t to the legal lower bound payroll tax rate (our measure of labor formality); and T_t are year dummies to control for the macroeconomic cycle.

As before, to check the robustness of our results we estimate modified versions of this basic regression including different sets of controls. We gradually include location dummies at the metropolitan area level; the share of sector output over total manufacturing output, lagged, for sectors defined at the 4-digit level; a dummy variable indicating whether the firm is an exporter; ISIC 3-digit sector dummies; the firm age (in logs); and our alternative measures of the relative importance of white-collar employment.

4. Results

4.1 Credit and Informality

Tables 7 and 8 present the results of the Tobit regressions. There is a small positive relationship between credit availability and formality in Colombia (the ratio of the effective to legal payroll tax rates increases between 1.14 and 0.76 percentage points—depending on the set of controls included in the regression—when the credit to output sector ratio increases by 0.1). Being financially constrained has no significant effect on labor formality. However, more financially

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constrained firms in sectors where credit is more abundant are less formal than the average firm.[10] Being financially constrained in a sector where (some) firms have been successful in obtaining external financing implies competing from a disadvantaged position. This may, in turn, increase the opportunity cost of engaging in formal employment arrangements. These results, though small, are robust across model specifications. The inclusion of additional controls produces slightly lower coefficients but otherwise leaves the results unchanged.[11]

Results of the Probit models to explain the probability of being formal go in the same direction as the previous results (see Tables 9 and 10). The probability increases between 3 and 4 percentage points—the smaller marginal effect corresponding to the model version including the largest set of controls—when the sector-level credit to output ratio increases by 10 percentage points, and the probability is between 5 and 6 percentage points lower for financially constrained firms in the sector where credit is larger. The inclusion of controls reduces the size of the marginal effects but does not affect their sign or increase their significance.

4.2 Informality and Firm Performance

We tried several firm performance measures as dependent variables in these panel regression models and report those for which the coefficients on our variable of interest, the labor informality measure, are significant. Tables 11 and 12 report the estimation results for two dependent variables: i) output and ii) employment growth. Labor formality is significantly and positively correlated with these two variables: a 1.0 percentage point increase in labor formality is associated with an 8.5 percent increase in output and an 11 percent increase in employment growth. These results refer to the coefficients obtained in the model specifications including the larger set of controls. We do not obtain significant effects on firm size measured by employment, output growth, TFP[12] or TFP growth using this model specification.

It is important to note that these results should be strictly interpreted as correlations. Higher formality has a significant association with different measures of firm performance, but

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[10] Note that our credit variable is different from that of Catão et al. in the sense that it is not a countrywide measure of financial development but a measure of the banking credit actually flowing to the sector of activity to which the firm belongs.

[11] We are showing the sets of regressions that already include several controls. We included them gradually, and our results are robust in versions that include smaller sets of control variables.

[12] We obtain firm-level TFP as a residual from a standard production function using estimates of factor elasticities from Eslava et al. (2006); those estimates are obtained using instrumental variables methods and the AMS data for 1982-1998.

causality can go in either direction. On the one hand, higher labor formality may be associated with hiring the most capable work force. This in turn will have a positive impact on any measure of firm performance. On the other hand, as firm performance improves, firms may find it easier to deal with any type of constraint that may limit its ability to cover all possible wage and non-wage related costs associated with formality. Additionally, as firms expand the likelihood of securing markets in the medium and long run increases their incentives to hire less flexible labor. Firms that perform below par may find it risky to engage in formal labor contracts and may prefer to hire informal labor to gain flexibility as a buffer against a potential contraction. In this sense, as firms improve their performance formality may increase as well, and vice versa.[13]

5. Conclusions

In this paper we explore the links between labor formalization and access to credit at the firm level, and between labor formalization and firm performance. We find that access to credit increases labor formalization in firms that, for tax purposes, are already formal. This effect vanishes in firms that face stronger credit constraints. There are two channels that may explain this finding. On the one hand, access to credit may allow firms to grow faster or improve their productivity, secure their markets, and through this channel generate the necessary incentives to hire a more formal work force. Weaker firms may hedge the risk of a contraction by hiring a more informal and more flexible work force. In this respect, credit may have an indirect effect on formality. On the other hand, credit may also have a direct effect on hiring a more formal (and more expensive) workforce in the form of credit to finance working capital.

We also find a strong correlation between firm performance and informality. As noted above we cannot disentangle the causal nature of this relationship. Nonetheless it is interesting to note that there is a sizeable correlation between output growth, employment growth and labor formality.

The main caveat of this research is that due to data limitations we focus on a specific set of firms that are themselves highly formal. All of the firms in our sample are formal in the sense that they are registered taxpaying firms. Our exercises explore different levels of labor formality

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[13] In a non-reported set of exercises, available on request, we carry out GMM dynamic panel estimations trying to address the endogeneity problem described above. We were not able to address this problem properly and could not find specifications that would be sufficiently reasonable to report in this paper.

within this group. It is possible that obtaining a sample that permits contrasting registered with non-registered firms may challenge these results.

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Annex: Tables and Figures

Table 1. Payroll Tax Rates in Colombia,
Adjusted for Data Comparability, 2000-2009

Year	Employer contributions				
	SS minimim payroll tax[1]	SS maximum payroll tax[2]	Other payroll taxes[3]	Total payroll tax (lower bound)	Total payroll tax (upper bound)
2000	15.3	22.0	7.4	22.7	29.4
2001	15.3	22.0	7.4	22.7	29.4
2002	15.3	22.0	7.4	22.7	29.4
2003	15.3	22.0	7.4	22.7	29.4
2004	15.9	22.6	7.4	23.3	30.0
2005	16.2	23.0	7.4	23.6	30.3
2006	16.5	23.3	7.4	23.9	30.7
2007	17.0	23.7	7.4	24.3	31.1
2008	17.3	24.0	7.4	24.6	31.4
2009	17.3	24.0	7.4	24.6	31.4

Source: Meléndez and Pagés (2011). [1] Calculated with minimum ARP tax. [2] Calculated with maximum ARP tax. [3] SENA, ICBF and CCFs.

Table 2. Manufacturing Firms Reporting Payroll Tax Rates below Lower Bound, by Size

Year	All	Large Firms	Medium Firms	Small Firms	Micro Firms	Firms reporting payroll tax rates below legal lower bound (% of firms in each category)				
						All	Large Firms	Medium Firms	Small Firms	Micro Firms
2000	5,592	513	1279	2620	1180	587	15.0%	9.5%	8.8%	13.4%
2001	5,372	509	1,271	2534	1058	530	15.5%	7.8%	8.6%	12.6%
2002	5,383	513	1,330	2553	987	554	14.0%	8.1%	9.1%	14.3%
2003	5,741	510	1,342	2809	1080	545	10.6%	6.7%	8.7%	14.5%
2004	5,825	507	1,344	2882	1092	617	15.0%	9.0%	9.1%	14.6%
2005	6,106	500	1,368	3026	1212	562	13.2%	8.6%	7.6%	12.4%
2006	6,083	494	1,342	3041	1206	676	14.0%	11.5%	9.5%	13.4%
2007	6,056	482	1,336	3062	1176	706	19.3%	13.1%	9.6%	12.3%
2008	6,750	487	1,430	3366	1467	633	16.8%	10.9%	7.6%	9.5%
2009	7,840	476	1,482	4187	1695	644	14.3%	8.4%	7.3%	8.6%

Source: Annual Manufacturing Survey and authors' calculations.

Table 3. Manufacturing Firms Reporting Payroll Tax Rates below Lower Bound, by Sector

Year	All	Food, Beverages and Tobacco	Textile, Wearing Apparel and Leather	Wood and Wood Products, Including Furniture	Paper and Paper Products, Printing and Publishing	Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products	Non-Metallic Mineral Products, except Products of Petroleum and Coal	Basic Metal Industries	Fabricated Metal Products, Machinery and Equipment	Other Manufacturing Industries
		Firms reporting payroll tax rates below legal lower bound (% of firms)								
2000	587	22.8%	20.1%	2.6%	9.4%	13.6%	1.4%	7.2%	10.1%	12.9%
2001	530	21.7%	17.0%	3.2%	9.4%	13.2%	0.9%	8.5%	10.0%	16.0%
2002	554	22.9%	19.5%	2.0%	7.9%	12.6%	0.7%	9.0%	10.5%	14.8%
2003	545	22.8%	18.0%	2.8%	9.9%	11.9%	0.9%	7.7%	11.0%	15.0%
2004	617	20.9%	19.8%	2.3%	9.1%	14.6%	0.3%	6.5%	11.2%	15.4%
2005	562	21.2%	20.8%	2.1%	9.8%	16.2%	0.7%	4.4%	11.9%	12.8%
2006	676	19.5%	20.7%	2.4%	9.3%	16.4%	1.2%	5.2%	11.1%	14.2%
2007	706	19.5%	23.2%	2.4%	7.4%	15.3%	1.1%	5.0%	11.6%	14.4%
2008	633	20.4%	22.0%	1.7%	9.8%	16.7%	1.1%	6.0%	9.0%	13.3%
2009	644	18.9%	19.7%	2.3%	8.9%	16.1%	1.9%	4.8%	13.4%	14.0%

Source: Annual Manufacturing Survey and authors' calculations.

Figure 1. Output, by Level of Financial Constraint
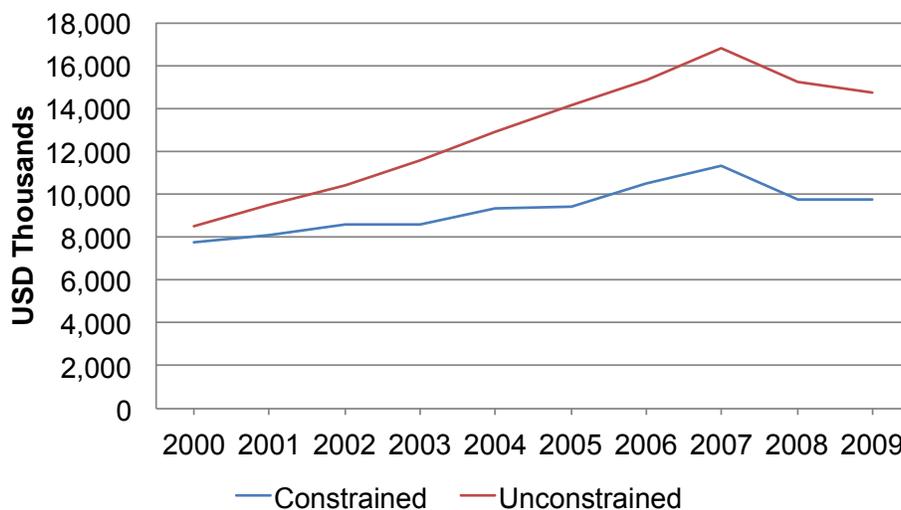
Source: Annual Manufacturing Survey and authors' calculations.

Figure 2. Fixed Assets, by Level of Financial Constraint
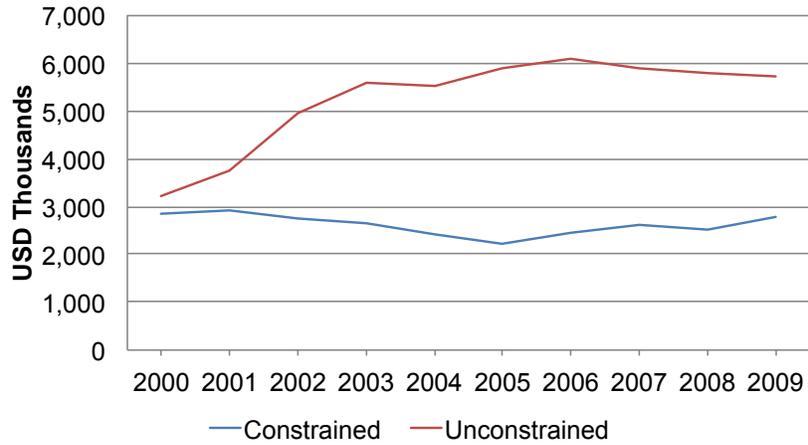
Source: Annual Manufacturing Survey and authors' calculations.

Figure 3. Employment, by Level of Financial Constraint
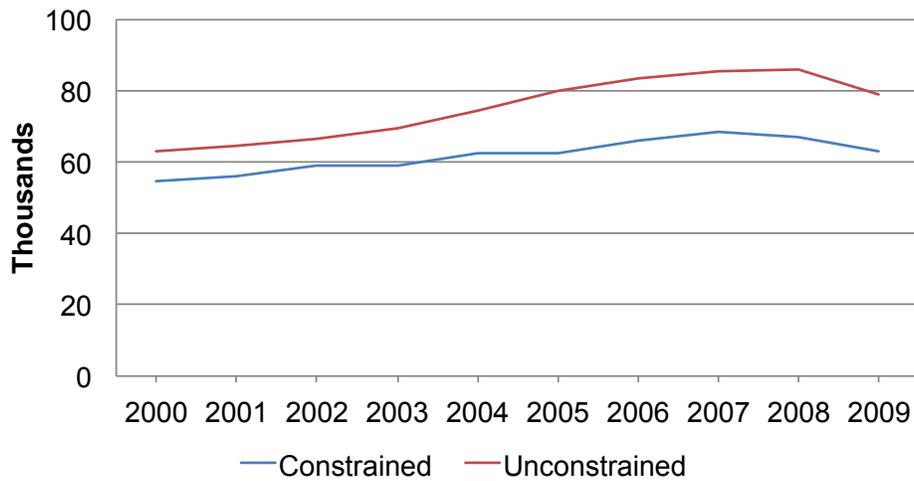
Source: Annual Manufacturing Survey and authors' calculations.

Table 4. Banking Credit to Businesses

	Year	All loans		Commercial credit		Microcredit	
		Total loan value (USD thousand)	Number of loans	Total loan value (USD thousand)	Number of loans	Total loan value (USD thousand)	Number of loans
All businesses	2000	22,817,741	251,723	22,817,741	251,723	-	-
	2001	22,377,525	168,346	22,377,525	168,346	-	-
	2002	26,422,341	404,539	26,166,738	268,891	255,603	135,648
	2003	27,216,436	446,026	26,887,784	265,192	328,652	180,834
	2004	32,295,157	594,764	31,782,163	335,030	512,994	259,734
	2005	34,018,035	783,230	33,284,597	399,343	733,437	383,887
	2006	41,062,919	998,936	40,116,440	474,466	946,479	524,470
	2007	48,858,494	1,187,361	3,954,540	570,602	1,056,359	616,759
	2008	54,917,416	1,464,844	53,379,652	578,361	1,537,763	886,483
	2009	54,254,678	1,557,526	52,409,054	539,569	1,845,623	1,017,957
	Year	All loans		Commercial credit		Microcredit	
		Total loan value (USD thousand)	Number of loans	Total loan value (USD thousand)	Number of loans	Total loan value (USD thousand)	Number of loans
Manufacturing	2000	5,017,896	9,053	5,017,895.77	9,053	-	-
	2001	5,053,203	10,121	5,053,202.63	10,121	-	-
	2002	5,991,049	25,279	5,986,161.59	23,480	4,887	1,799
	2003	6,231,437	28,884	6,225,456.07	26,490	5,981	2,394
	2004	7,068,090	39,968	7,058,454.46	36,050	9,635	3,918
	2005	6,951,355	46,827	6,938,267.21	41,571	13,088	5,256
	2006	8,063,412	55,510	8,051,667.04	49,838	11,745	5,672
	2007	9,095,380	66,285	9,085,826.11	61,288	9,554	4,997
	2008	11,248,972	69,250	11,227,485.12	61,966	21,486	7,284
	2009	9,607,441	62,544	9,579,256.36	53,879	28,185	8,665

Source: Superintendencia Financiera and authors' calculations.

Table 5. Banking Credit to Manufacturing Businesses, by Sector of Activity

		MANUFACTURING SECTOR												
Year	All comercial credit in USD million	Food, Beverages and Tobacco			Textile, Wearing Apparel and Leather			Wood and Wood Products, Including Furniture			Paper and Paper Products, Printing and Publishing		
		%	Number of loans	Average loan size (USD thousands)	%	Number of loans	Average loan size (USD thousands)	%	Number of loans	Average loan size (USD thousands)	%	Number of loans	Average loan size (USD thousands)
2000	5,017,896	27.7%	1406	855	10.8%	2024	289	1.7%	164	519	13.0%	971	671
2001	5,053,203	27.8%	1834	704	12.1%	2370	250	1.5%	181	413	13.7%	1119	617
2002	5,991,049	29.5%	1989	659	12.5%	5859	241	1.1%	446	145	12.5%	2676	280
2003	6,231,437	27.8%	3905	425	14.4%	6573	120	1.1%	543	121	12.7%	2937	270
2004	7,068,090	27.2%	4478	367	15.9%	9299	130	1.0%	834	82	10.8%	3708	206
2005	6,951,355	24.5%	6240	293	16.6%	11031	115	0.8%	1095	50	9.7%	4126	163
2006	8,063,412	23.4%	7289	224	15.8%	13475	100	0.7%	1565	35	9.5%	4823	159
2007	9,095,380	24.1%	8785	203	15.9%	16998	89	0.7%	2052	33	9.4%	5779	147
2008	11,248,972	25.4%	10712	190	12.2%	16140	79	0.7%	2104	35	8.9%	5931	170
2009	9,607,441	25.6%	10656	263	11.8%	13208	83	0.6%	1771	35	8.7%	5336	156

		MANUFACTURING SECTOR												
Year	All comercial credit in USD million	Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products			Non-Metallic Mineral Products, except Products of Petroleum and Coal			Basic Metal Industries			Fabricated Metal Products, Machinery and Equipment		
		%	Number of loans	Average loan size (USD thousands)	%	Number of loans	Average loan size (USD thousands)	%	Number of loans	Average loan size (USD thousands)	%	Number of loans	Average loan size (USD thousands)
2000	5,017,896	21.8%	1702	406	7.5%	324	1,162	3.4%	215	796	5.0%	687	406
2001	5,053,203	21.8%	1931	387	5.3%	305	881	3.3%	255	655	5.1%	762	387
2002	5,991,049	22.5%	4309	177	5.3%	678	467	2.8%	519	327	4.6%	2047	177
2003	6,231,437	21.4%	4839	149	5.6%	758	461	3.0%	578	318	5.5%	2349	149
2004	7,068,090	21.0%	6208	143	5.3%	974	387	3.4%	798	303	4.7%	3209	143
2005	6,951,355	22.2%	6656	115	5.5%	1066	358	4.6%	952	340	6.3%	3729	115
2006	8,063,412	23.0%	7468	118	6.6%	1223	436	4.8%	1129	342	5.1%	4590	118
2007	9,095,380	21.9%	8659	112	6.2%	1535	368	5.5%	1394	360	5.6%	5618	112
2008	11,248,972	20.3%	9075	128	7.7%	1654	524	7.6%	1412	609	5.2%	6190	128
2009	9,607,441	21.0%	8145	122	9.1%	1544	566	7.7%	1254	589	8.1%	5729	122

Source: Superintendencia Financiera and authors' calculations.

Table 6. Summary Statistics

	Observations	Mean	Standard Deviation	Minimun	Maximun
Formality Variables					
Effective payroll tax rate / Legal payroll tax rate	52757	0.980	0.097	0	1
Dummy=1 if effective payroll tax rate is equal to legal payroll tax rate	52757	0.899	0.300	0	1
Perfomance Varibles					
Output (in logs)	53,369	14.526	1.688	7.475	22.032
Fixed Assets (in logs)	53,369	12.859	2.157	0	21.298
Employment (in logs)	53,369	3.583	1.177	0.693	8.372
Total Factor Productivity	53,369	2.440	0.650	-2.072	9.331
Credit Variables					
Credit / Total Output (t-1)	46,036	0.195	0.140	0	0.984
Correlation	53,369	0.036	0.512	-12.560	1.989
Correlation×(Credit/Output) (t-1)	46,036	0.007	0.102	-2.503	0.959
Sector Controls					
ISIC 3-digit sector share (t-1)	53,369	0.013	0.012	0	0.157
Firm Controls					
White Collar Employment / Total Employment	53,369	0.340	0.216	0	1
White Collar Wages / Total Wages	53,369	0.453	0.236	0	1
Firm age (in logs)	53,369	3.237	0.518	1.099	4.779
Firm size category	53,369	1.200	0.834	0	3
Dummy=1 if firm reports exports (t)	53,369	0.280	0.449	0	1

Table 7. Tobit Regressions to Explain Labor Formality

Dependent variable: Effective payroll tax rate/ Legal payroll tax rate	[1]	[2]	[3]	[4]	[5]	[6]
(Credit/Total Output) (t-1)	0.0909**	0.0984**	0.0957**	0.0922**	0.0988**	0.0963**
	[0.0265]	[0.0266]	[0.0263]	[0.0264]	[0.0265]	[0.0262]
Correlation	0.0221+	0.0227*	0.0231*	0.0220+	0.0226*	0.0230*
	[0.0115]	[0.0115]	[0.0114]	[0.0115]	[0.0114]	[0.0113]
Corr x (Credit/Total Output) (t-1)	-0.173**	-0.175**	-0.173**	-0.171**	-0.174**	-0.172**
	[0.0499]	[0.0499]	[0.0494]	[0.0498]	[0.0498]	[0.0493]
(White Collar Employment / Total Employment) (t-1)		0.0576**			0.0525**	
		[0.0167]			[0.0168]	
(White Collar Wages / Total Wages) (t-1)			0.0833**			0.0797**
			[0.0151]			[0.0152]
ISIC 3-digit sector share (t-1)				0.907**	0.788*	0.747*
				[0.311]	[0.312]	[0.309]
Constant	1.628**	1.604**	1.582**	1.614**	1.595**	1.572**
	[0.0155]	[0.0167]	[0.0168]	[0.0160]	[0.0170]	[0.0172]
Observations	45,480	45,480	45,442	45,480	45,480	45,442
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes

Table 8. Tobit Regressions to Explain Labor Formality, Robustness Exercises

Dependent variable: Effective payroll tax rate/ Legal payroll tax rate	[1]	[2]	[3]	[4]	[5]	[6]
(Credit/Total Output) (t-1)	0.0821**	0.0820**	0.0777*	0.0884**	0.0884**	0.0840**
	[0.0318]	[0.0318]	[0.0316]	[0.0319]	[0.0319]	[0.0317]
Correlation	0.0176	0.0176	0.0177	0.0172	0.0172	0.0174
	[0.0111]	[0.0111]	[0.0111]	[0.0111]	[0.0111]	[0.0110]
Corr x (Credit/Total Output) (t-1)	-0.175**	-0.175**	-0.173**	-0.174**	-0.174**	-0.172**
	[0.0486]	[0.0486]	[0.0482]	[0.0485]	[0.0485]	[0.0482]
(White Collar Employment /Total Employment) (t-1)		0.00427			0.00383	
		[0.0177]			[0.0177]	
(White Collar Wages /Total Wages) (t-1)			0.0297+			0.0297+
			[0.0162]			[0.0162]
ISIC 3-digit sector share (t-1)						
Constant	1.498**	1.496**	1.483**	1.472**	1.471**	1.459**
	[0.0224]	[0.0234]	[0.0233]	[0.0243]	[0.0253]	[0.0252]
Observations	45,480	45,480	45,442	45,480	45,480	45,442
Metropolitan area dummies	Yes	Yes	Yes	Yes	Yes	Yes
ISIC 3-digit sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm size category dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in brackets ** p<0.01, * p<0.05, + p<0.1

Table 9. Probit Models to Explain the Probability of Being Formal

Dependent variable: Dummy=1 if effective payroll tax rate is equal to legal payroll tax rate	[1]	[2]	[3]	[4]	[5]	[6]
(Credit/Total Output) (t-1)	0.040***	0.039***	0.039***	0.040***	0.040***	0.039***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Correlation	0.007	0.007	0.007*	0.007	0.007	0.007*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Corr x (Credit/Total Output) (t-1)	-0.055***	-0.055***	-0.055***	-0.055***	-0.055***	-0.055***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
(White Collar Employment / Total Employment) (t-1)		-0.000			-0.001	
		(0.006)			(0.006)	
(White Collar Wages / Total Wages) (t-1)			0.021			0.003
			(0.034)			(0.006)
ISIC 3-digit sector share (t-1)				0.068	0.069	0.064
				(0.119)	(0.120)	(0.120)
Observations	45,480	45,480	45,442	45,480	45,480	45,442
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in brackets ** p<0.01, * p<0.05, + p<0.1

Table 10. Probit Models to Explain the Probability of Being Formal, Robustness Exercises

Dependent variable: Dummy=1 if effective payroll tax rate is equal to legal payroll tax rate	[1]	[2]	[3]	[4]	[5]	[6]
(Credit/Total Output) (t-1)	0.033***	0.033***	0.032***	0.034***	0.034***	0.034***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Correlation	0.005	0.005	0.005	0.005	0.005	0.005
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Corr x (Credit/Total Output) (t-1)	-0.059***	-0.058***	-0.058***	-0.058***	-0.058***	-0.058***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
(White Collar Employment / Total Employment) (t-1)		-0.011			-0.011*	
		(0.007)			(0.007)	
(White Collar Wages / Total Wages) (t-1)			-0.007			-0.007
			(0.006)			(0.006)
ISIC 3-digit sector share (t-1)				0.330*	0.333*	0.326*
				(0.178)	(0.178)	(0.178)
Dummy=1 if firm reports exports (t)	0.000	0.001	0.001	0.001	0.001	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Firm age (in logs)	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	45,477	45,477	45,439	45,477	45,477	45,439
Metropolitan area dummies	Yes	Yes	Yes	Yes	Yes	Yes
ISIC 3 digit sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm size category dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in brackets ** p<0.01, * p<0.05, + p<0.1

Table 11. Fixed Effects Panel Model to Explore Relation between Labor Formality and Output

Dependent variable: Output (in logs)	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
(Effective payroll tax rate/ Legal payroll tax rate) (t-1)	0.0831+	0.0804+	0.0807+	0.0759+	0.0760+	0.0745+	0.0854*	0.0851*
	[0.0425]	[0.0432]	[0.0433]	[0.0434]	[0.0434]	[0.0432]	[0.0427]	[0.0424]
ISIC 3 digit sector share (t-1)		4.423*	4.465*	8.797+	8.819+	8.860+	8.734+	8.836+
		[2.011]	[1.986]	[4.689]	[4.679]	[4.679]	[4.684]	[4.669]
Dummy=1 if firm reports exports (t)			0.0929**	0.0917**	0.0919**	0.0914**	0.0916**	0.0913**
			[0.0137]	[0.0140]	[0.0140]	[0.0141]	[0.0141]	[0.0141]
Firm age (in logs)						0.638**	0.635**	0.632**
						[0.210]	[0.209]	[0.210]
(White Collar Employment / Total Employment) (t-1)							-0.149**	
							[0.0385]	
(White Collar Wages / Total Wages) (t-1)								-0.127**
								[0.0306]
Constant	14.21**	14.15**	14.12**	13.92**	14.06**	11.98**	12.03**	12.02**
	[0.0396]	[0.0439]	[0.0428]	[0.156]	[0.334]	[0.758]	[0.754]	[0.759]
Observations	45,213	45,213	45,213	45,213	45,213	45,213	45,213	45,213
Adjusted R-squared	0.951	0.951	0.951	0.952	0.952	0.952	0.952	0.952
Metropolitan area dummies	No	No	No	No	No	Yes	Yes	Yes
ISIC 3 digit sector dummies	No	No	No	Yes	Yes	Yes	Yes	Yes
Firm-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in brackets ** p<0.01, * p<0.05, + p<0.1

Table 12. Fixed Effects Panel Model to Explore Relation between Labor Formality and Fixed Assets

Dependent variable: Fixed Assets (in logs)	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
(Effective payroll tax rate/ Legal payroll tax rate) (t-1)	0.179	0.178	0.178	0.180	0.179	0.179	0.182	0.180
	[0.114]	[0.114]	[0.113]	[0.114]	[0.114]	[0.114]	[0.115]	[0.115]
ISIC 3 digit sector share (t-1)		1.590	1.601	4.224	4.268	4.282	4.246	4.278
		[1.335]	[1.334]	[3.093]	[3.102]	[3.106]	[3.090]	[3.103]
Dummy=1 if firm reports exports (t)			0.0237*	0.0221*	0.0220*	0.0219*	0.0219*	0.0219*
			[0.00978]	[0.00999]	[0.00999]	[0.0100]	[0.0100]	[0.0100]
Firm age (in logs)						0.211	0.211	0.210
						[0.133]	[0.133]	[0.133]
(White Collar Employment / Total Employment) (t-1)							-0.0424	
							[0.0424]	
(White Collar Wages / Total Wages) (t-1)								-0.0232
								[0.0375]
Constant	12.56**	12.54**	12.54**	12.39**	12.63**	11.94**	11.96**	11.95**
	[0.118]	[0.124]	[0.125]	[0.315]	[0.355]	[0.574]	[0.571]	[0.573]
Observations	45,213	45,213	45,213	45,213	45,213	45,213	45,213	45,213
Adjusted R-squared	0.948	0.948	0.948	0.948	0.948	0.948	0.948	0.948
Metropolitan area dummies	No	No	No	No	No	Yes	Yes	Yes
ISIC 3 digit sector dummies	No	No	No	Yes	Yes	Yes	Yes	Yes
Firm-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in brackets ** p<0.01, * p<0.05, + p<0.1

Table 13. Fixed Effects Panel Model to Explore Relation between Labor Formality and Employment Growth

Dependent variable: % Δ Employment	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
(Effective payroll tax rate/ Legal payroll tax rate) (t-1)	0.118**	0.118**	0.118**	0.120**	0.121**	0.120**	0.114**	0.109**
	[0.0306]	[0.0306]	[0.0307]	[0.0305]	[0.0305]	[0.0306]	[0.0298]	[0.0296]
ISIC 3 digit sector share (t-1)		-1.105**	-1.098**	-1.836*	-1.869*	-1.856*	-1.782*	-1.830*
		[0.422]	[0.419]	[0.886]	[0.884]	[0.883]	[0.881]	[0.880]
Dummy=1 if firm reports exports (t)			0.0166**	0.0165**	0.0164**	0.0162**	0.0161**	0.0163**
			[0.00544]	[0.00547]	[0.00547]	[0.00552]	[0.00548]	[0.00547]
Firm age (in logs)						0.202*	0.203*	0.208*
						[0.0877]	[0.0872]	[0.0844]
(White Collar Employment / Total Employment) (t-1)							0.0877+	
							[0.0499]	
(White Collar Wages / Total Wages) (t-1)								0.136**
								[0.0341]
Constant	-0.0911**	-0.0776*	-0.0834*	-0.216**	-0.357*	-1.014**	-1.043**	-1.062**
	[0.0332]	[0.0342]	[0.0344]	[0.0826]	[0.148]	[0.328]	[0.328]	[0.319]
Observations	45,213	45,213	45,213	45,213	45,213	45,213	45,213	45,213
Adjusted R-squared	0.051	0.051	0.052	0.052	0.053	0.053	0.054	0.056
Metropolitan area dummies	No	No	No	No	No	Yes	Yes	Yes
ISIC 3 digit sector dummies	No	No	No	Yes	Yes	Yes	Yes	Yes
Firm-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in brackets ** p<0.01, * p<0.05, + p<0.1