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MSMEs and the Cost of Using Capital

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Abstract

Micro-business populate most of the demography of firms in developing countries. However very often these firms are discouraged to hire skilled workers and to accumulate capital, and therefore to be productive. The lack of incentives to accumulate capital occurs not only because interest rates are decreasing in capital, but also because they are subject to tax deductions that cannot be used by firms too small to be subject to taxes. This paper estimates a general equilibrium model that includes an endogenous extensive and intensive margin of informality, a tax structure that considers waivers to small firms and deductions to larger firms, capital and a cost of using it that follows a logistic function behavior, resembling what is found in the data. The model is calibrated for the case of the manufacturing sector in Colombia. Simulations suggest that policies oriented to increase the use of capital in one group, without any more policies to reduce the average cost of using capital, imply an increase of the cost of using capital for other groups. Therefore, policies to reduce the informal distortion of using capital can increase formal firm's productivity but reducing the size of the formal sector, thus harming overall productivity. On the other hand, policies oriented to reduce the size distortion of using capital can increase formality maintaining output and productivity relatively stable, because both tails of the productivity distribution are equally affected.

Keywords: Informality, Microbusiness, Business Informality, Cost of Using Capital, Interest Rates, Microcredit.

JEL codes: C68, D24, D58, J46, L26, L60

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1 Introduction and literature review

Capital accumulation is crucial to promote long-term growth. However, factors such as information failures and informality create a distortion that impacts access to capital among small and/or informal firms. Therefore, analyzing capital accumulation in a setup of informality and other distortions inherent to small firms is crucial for developing countries. Although there are several theoretical frameworks studying the causes and consequences of informality, they usually do not consider capital accumulation. In contrast, there are some studies concentrated on capital accumulation, mainly in larger firms, that do not take into account informality.

One of the papers that better reproduces the main characteristics of informality in Latin America from the point of view of firms is [Ulysea \(2018\)](#). This model, estimated for the case of Brazil, considers the intensive and extensive margin of informality as decisions taken by the firm after performing a cost-benefit exercise. [Alvarez and Ruane \(2019\)](#) estimated a similar model for the case of Mexico, but allowing some idiosyncratic shocks that are different for formal and informal firms, and finally, [Fernández \(2023a\)](#) also estimated a similar model for the case of Colombia, but considering the impact of profit taxes waivers for small firms, and labor cost deductions for larger firms. Most of this type of models do not include capital, which might affect inferences about the relevance of informality to shape public policy impacts.

However, there is some existing literature on capital costs and informality that assumes an extra cost of capital adjustment in the informal sector. For instance, [D’Erasmus and Boedo \(2012\)](#) developed a framework in which they estimate the impact of informality on consumption and wealth for different levels of development of the credit market, understood as the ability to use collateral to access credit. Similarly, [Loayza \(2016\)](#) highlights the problem of improper allocation generated by a distortion in relative costs: formal firms face higher labor costs, while informal firms face higher capital costs and lower productivity. [Chisari, Romero, and Martínez \(2016\)](#), through a general equilibrium model calibrated for Argentina, which includes a fixed extra financing cost for informal firms, estimated the gains in productivity that allow firms to become formal and access capital markets. [De Paula and Scheinkman \(2011\)](#) found that the Brazilian informal sector faces a 1.3 higher cost of funds than the formal sector, plus a higher enforcement. Therefore, according to the authors, there is a discontinuity in the level of capital and labor employed at a fixed level of productivity. Consistently, a program oriented to reduce the capital cost of small, mostly informal firms, might increase the use of capital in small firms and their income level. [Erosa, Fuster, and Martínez \(2023\)](#), in their model calibrated for Brazil, find that financial frictions operate as a cost to high productivity firms, which reinforced with the possibility of operating informally, create an advantage to low productivity entrepreneurs.

For the case of Colombia, [Hamann-Salcedo and Mejía \(2013\)](#) developed an endogenous informality model in which formal firms are allowed to be financed at the international interest rate, while the informal sector only has the ability to obtain limited domestic credit. [Granda and Hamann \(2015\)](#) replicate well the Colombian economy and the savings patterns of workers and firms by assuming interest rate differentials and labor and capital segmentation.

In order to partially fill the identified gap in the literature, the research question of this paper is

how firms' decisions and outputs are affected by distortions in accessing to capital and the impact of removing those distortions. The paper advances on the same line as [Erosa et al. \(2023\)](#), but in this case the distortion takes two forms: One related to size, because small firms tend to be riskier, suffer information failures, and do not get tax incentives if they are below the exempt-tax bracket. The other distortion is related to informality since the business informality condition implies that often firms avoid getting in contact with financing institutions, and if they contact them, they cannot use their capital as collateral, increasing the cost of using capital. In addition, information failure tends to be larger in informal firms due to lack of documentation.

Accordingly, the main contribution of this paper is to develop a model with three main features. The first adopts the basic structure of [Ulyseea \(2018\)](#) that includes an extensive and intensive informality margin, small and large firms, and skilled and unskilled workers. The second incorporates the same tax structure of [Fernández \(2023a\)](#), which considers tax waivers to small firms and tax deductions oriented to larger firms. The third involves capital, and a cost of capital use, modeled by using a logistic function, following [Veyrune, Della Valle, and Guo \(2018\)](#). The use of this type of function allows to estimate interest rates in a dual-economic environment without going back to the type of models that assume different production functions for each sector.

The model is calibrated for the case of the manufacturing sector in Colombia. Simulations suggest that policies to redistribute capital across informal and formal firms might lower the overall cost of accessing capital, but generate a negative impact on overall productivity and informality. On the other hand, policies oriented to reduce the size distortion of using capital can increase formality maintaining output and productivity relatively stable, because both informal small firms and larger formal firms get affected.

The rest of this paper proceeds as follows: Section 2 presents the data sources and main facts for the case of Colombia, Section 3 illustrates the structure of the model, Section 4 is concentrated on calibration issues, Section 5 shows the results of policy simulations, and Section 6 concludes.

2 Data sources and facts. The case of Colombia

Microbusiness in Colombia accounts for approximately 93% of business, 30% of workers, and 8.3% of the value added in urban Colombia, excluding agriculture, government and self-employment ([Fernández, 2023b](#)). Some of this behavior could be encouraged by the tax system. 77% of these companies earn less than COP\$46 million (US\$14,000 per year at 2019 prices) the lower limit for paying profit taxes in the country (EEG,2019). As explained by [Fernández \(2023a\)](#), firms with income below this threshold have strong incentives to not hire workers formally, and in consequence find harder to hire skilled workers. This paper explains how these firms are also discouraged from accumulating capital. Therefore, Colombia's business demography ends up concentrated in very small unproductive firms because of the lack of incentives to use capital and/or hire skilled workers.

This section describes the data sources used to calibrate the model for the case of Colombia and provides some general characteristics of Colombian firm structure including labor and capital distributions of formal and informal firms, as well as some international comparisons. This overview

is key to understanding the basic assumptions of the model and its policy implications.

The EEG (2019), the main source of data in this document, is a database that compiles different company-level surveys in Colombia (Fernández, 2023b). The scope of the analysis is restricted to the manufacturing industry, due to the lack of information on capital use in other sectors. The manufacturing sector in EEG (2019) is compiled in the following way: 1- Firms with more than one worker (excluding self-employment) and less than ten workers are represented by the EMICRON, which is an employer-employee database linked to the household sector¹; 2- Formal firms with more than 10 workers are collected from the EAM (2019) a manufacturing firm level census; 3- Informal firms with more than 10 workers are estimated by using the household survey (GEIH) questions directed to entrepreneurs, and by assuming that each entrepreneur represents one firm. The GEIH is a cross-sectional survey in which variables are representative at a monthly or quarterly level.

As shown in Table 1, after excluding self-employment, there are 104 thousand firms (7,770 observations)² of which 75 thousand are registered in the Chamber of Commerce. This amount can be compared with the total number of registered firms compiled by the Dane: 82 thousand (DEE, 2023), showing a raw representativeness of 91%.

Similarly, EEG (2020) accounts for 900,000 workers in the manufacturing sector 57% to the 1591 thousand manufacturing sector entrepreneurs estimated by the GEIH (excluding self-employment). More details about this database can be found in Fernández (2023b).

Table 1. Representativeness of data source (thousands)

	# Firms		# Workers
EMICRON	97	EMICRON	323
EAM	6	EAM	558
GEIH	1.4	GEIH	19
TOTAL EEG	104	TOTAL EEG	901
EEG Formal	50		
DEST	82	GEIH (no self)	1591
EEG Formal / DEST	0.61	EEG / GEIH	0.57

Source: Own calculations based on DEST (2023), GEIH, EEG.

One of the main characteristics of the firm structure of the manufacturing sector in Colombia is the large number of small companies. Within the manufacturing sector, even after excluding self-employment, 91% of the firms have equal or less than 10 workers, 5.4% between 10 and 50 workers, and 2.6% more than 50 workers.

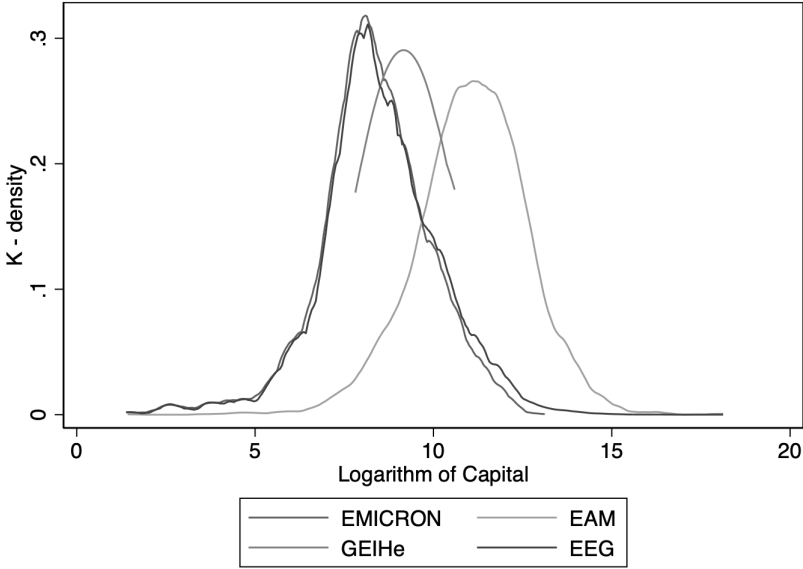
The capital stock in EMICRON and EAM is collected through the question that asks en-

¹In line with the ILO criteria, this survey restricts the definition of firm to those with power of disposal over the production means.

²97 thousand were collected from EMICRON (1581 observations), 6 thousand from the EAM and 1.4 thousand from the GEIH

trepreneurs to value the total assets used under the productive processes. The capital stock in informal firms with more than 10 workers and missing values (1.3% of the EEG) are imputed using the random forest technique to estimate the logarithm of the capital/labor relationship. Figure 1 shows the result of the imputation. As it can be shown, the imputed capital-to-labor ratio of informal firms with more than 10 workers lies between the distribution of the same relationship for micro-business and formal firms with more than 10 workers. This imputation does not significantly change the overall distribution of firms.

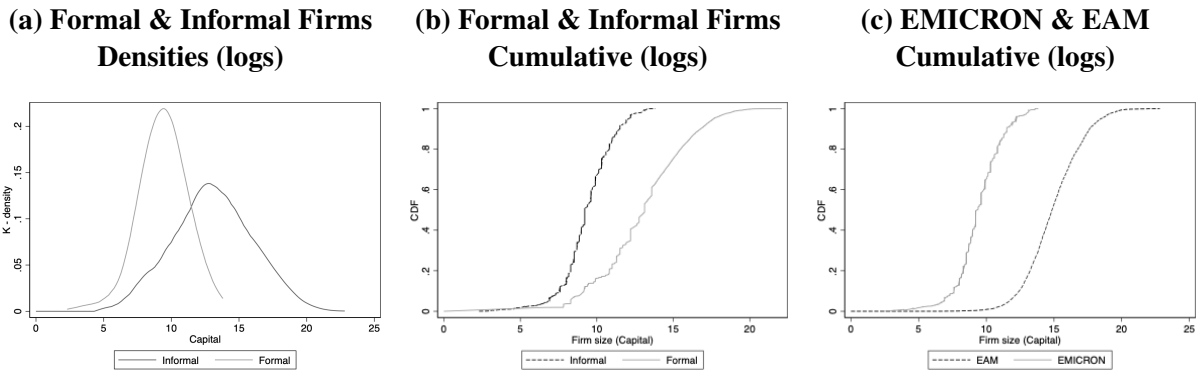
Figure 1. Logarithm of capital to labor ratio



Source: EEG (2019).

The capital stock distributions, shown in Figure 2, evidence some “missing middle” behavior in the case of Colombia, particularly among informal firms. This behavior is observed even if the survey is restricted to EMICRON. Figure 2a shows the density distribution of the capital logarithm for formal and informal firms, Figure 2b shows the respective cumulative distribution and Figure 2c shows the cumulative distribution of EMICRON and EAM. The differences between Figure 2b and Figure 2c suggest that the difference observed between informal and formal firms is not due to the source of the observations.

Figure 2. Capital stock distributions



Source: EEG (2019).

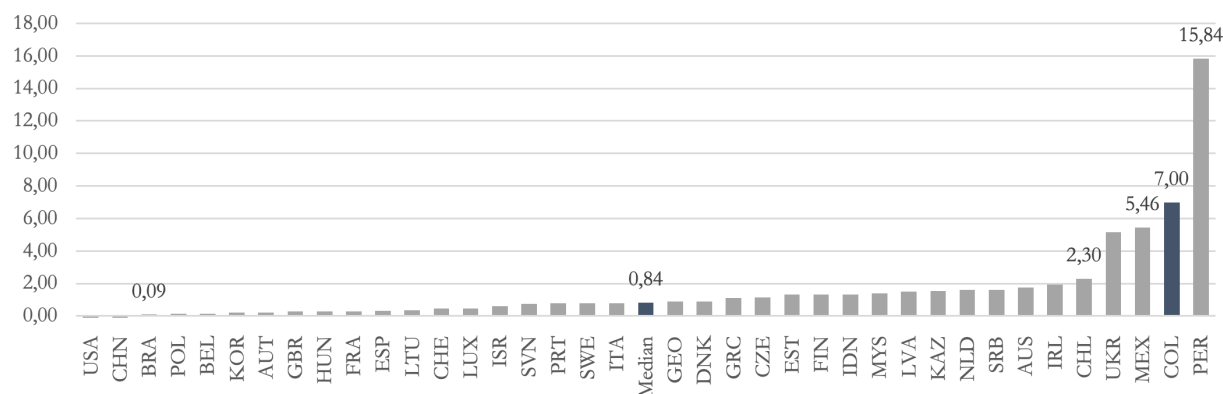
Differences in capital costs are widely known in developing countries, where small and particularly small informal firms have last-resort access to the black-market finance sector. According to EMICRON, most Colombian microbusinesses recognize that they get funds whenever they ask for them. However, 14% of the informal firms get their credits through informal means (friends 6%, black market 9%), and even 8% of the formal micro business get their access to credit among informal markets (friends 7%, black market 1%). The interest rates in the black market can be several times higher than the formal market interest rates³.

The lack of incentives faced by microbusiness to accumulate capital takes two forms: the first one is related to size. Interest rates tend to decrease in capital, since capital guarantees credits. In line with this, there is a spread between the interest rates charged to SMEs and larger firms, which is particularly large in Colombia (7 pp per year vs. a median of 0.84 in the OECD countries), as seen in Figure 3.

On top of this, Colombia has an additional spread for MSMEs that, according to the OECD (2020) averaged 9pp between 2010 and 2018, as shown in Figure 4. This spread covers both formal and informal microbusiness, that tend to show higher costs for informal informal business, as it is more risky to lend to informal firms due to lack of documentation.

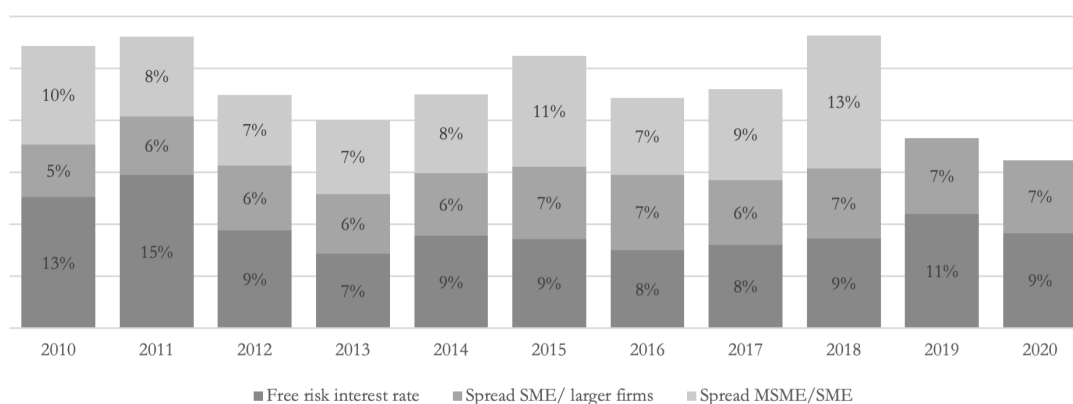
³Nevertheless, it is also possible that some informal small firms do not ask for means to finance capital because they do not need it, or they think that they do not need it. In fact, this is the main reason for 40% of employers. As explained above, this would imply a different production function for informal and formal firms. Another particularity is an important self-selection process in the sense that many employers do not ask for credit in formal markets because they think that they will not get access to it. Therefore, businesses might do better with capital, but they prefer to act as if they don't.

Figure 3. Interest rates spreads SMEs/larger firms in the OECD (2020)



Source: OECD (2022)

Figure 4. MSMEs/SMEs spread in Colombia



Source: Own calculations based on OECD (2020) and OECD (2022)

3 The model structure

The main challenge of this paper was to estimate a model that accounts for different distributions of capital among formal and informal firms, without going back to the type of model that assumes different production functions for each sector, and therefore dualism.

The model also adopts the same tax structure of Fernández (2023a) with waivers and deductions, which resembles that of many developing countries. This specification is key, as it shapes the use of capital and labor in small and large firms. In fact, as shown in Fernández (2022), firms that pay taxes have high incentives to hire formal workers, since they can tax-deduct interest payments and all the formal labor costs, including wages and social security; meanwhile, small firms do not have access to those incentives since they do not pay taxes. The tax structure also affects capital

accumulation.

The model also includes the main features of [Ulyssea \(2018\)](#) such as an intensive and extensive margin of informality, small and large firms, and skilled and unskilled workers. The inclusion of intensive and extensive margins is important since both types of informality do not always react in the same direction. The same is true for large and small firms, because the former pay taxes but have incentives to hire formally and to accumulate capital, which is not the case of small firms; and for skilled and unskilled workers, since large firms need a larger number of qualified workers.

In the model, formal and informal firms face the same production function that uses a Cobb-Douglas specification to mix labor and capital. In turn, labor is a CES's mix of skilled and unskilled labor. Formal firms pay taxes if they are above the tax threshold, and social security for those workers that are hired formally, or a cost associated to the inherent risk of informal hires, otherwise. Meanwhile, informal firms do not pay taxes or social security but face a cost associated with the risk of operating informally. Both cost of informality in the intensive and extensive margin are increasing in capital, so larger firms tend to run and hire formally. The model also considers a cost of using capital that is increasing in capital and faces a surcharge if the firms operate informally. More specifically, the structure of the model is the following:

Production function. The basic model assumes one good, the same production function with decreasing returns, and the same prices for formal and informal firms (normalized to 1). This feature is key to avoid assuming a complete dual market. Formal firms are subject to taxes if their gross income is above the respective thresholds.

$$y_S(\theta) = (1 + \tau_y)(1 + \tau_{VAT})\theta L_S^\alpha K_S^\beta,$$

with $(\alpha + \beta) < 1$ and $s = I, F$

$$\tau_y = 0 \text{ if } \theta L_S^\alpha K_S^\beta < Y_Y \text{ or } S = I, \tau_{VAT} = 0 \text{ if } \theta L_S^\alpha K_S^\beta < Y_{VAT} \text{ or } S = I$$

where I refers to informal and F refers to formal in terms of the extensive margin, y_S is the income of the formal/informal sector, θ denotes ex-ante-productivity, τ_y and τ_{VAT} income tax and VAT, and Y_Y and Y_{VAT} the respective thresholds.

Fix and extensive margin costs. Firms face fix costs of production, larger on informal firms ($FC_F > FC_I$) that are tax-deductible. Additionally, informal firms face enforcement costs based on the probability and cost of being caught by the authorities that is proportional to labor costs, since larger firms are easier to be detected. Parameters b_I and d represent how strong enforcement is and how much it changes with size.

$$T(L_I) = \left(1 + \frac{L_I^d}{b_I}\right)$$

Cost of using capital. Capital costs face two frictions: one related to size and another related to informality. In order to model interest rate, a logistic function is introduced. This allows the cost of capital use to decrease in the amount of capital, in line with [Estrada and Hernández Rubio](#)

(2019), Chowdhury (2009), and Rebolledo Abanto and Soto Chavéz (2004), but allows an upper and a lower bound following Veyrune et al. (2018). The function can be written as follows:

$$c_{KS} = \left(i + \gamma_I + \frac{\gamma_{MS}}{1 + e^{(a_S K_S + c_S)}} \right), \text{ with } S = I, F$$

Where i is the free risk interest rate, γ_I is the spread face by informality, γ_{MS} is the spread face by micro-business, and a_S, c_S are the shape and location parameters of the logistic function, respectively. Capital costs are assumed to be tax-deductible.

Worker's qualification. Two levels of qualification (skilled (l_1) and unskilled (l_2)) are considered and mixed through a CES function, with parameter ρ and elasticity of substitution η_S in the following way:

$$L_S = \left(\eta_S l_1^\rho + (1 - \eta_S) l_2^\rho \right)^{\frac{1}{\rho}}, \quad S = I, F$$

Workers perform the same activities within the firm, subject to their level of qualification. They are hired according to their relative costs, but there is a critical threshold \tilde{l} below which only informal workers are hired.

Intensive margin costs. Formal firms can hire informally or formally. If they hire informally, they face an enforcement cost $T(l_{FI(1,2)}) = \left(1 + \frac{l_{FI(1,2)}^d}{b_{1,2}} \right)$, where $b_{1,2}$ is the parameter decreasing on enforcing, and d a parameter that indicates the intensity of the relationship. If they hire formally, they pay social security and a minimum wage $\max(w_{1,2}, w_{min})$, where $w_{1,2}$ is the equilibrium wage for formal and informal firms and w_{min} the minimum wage, but have access to a tax deduction on labor costs $(1 + \tau_w)(1 - \tau_y)$. The threshold below which firms hire only informal workers ($\tilde{l}_{1,2}$) is obtained by equalizing the marginal cost of hiring formally and informally.

$$w_{1,2} \left(1 + (d+1) \frac{l_{FI(1,2)}^d}{b_{1,2}} \right) = (1 + \tau_w)(1 - \tau_y) \max(w_{1,2}, w_{min})$$

$$\tilde{l}_{FI(1,2)} = \left[\frac{b_{1,2}}{(d+1)} \left\{ (1 + \tau_w)(1 - \tau_y) \frac{\max(w_{1,2}, w_{min})}{w_{1,2}} - 1 \right\} \right]^{\frac{1}{d}}$$

Maximization problems. Given that the threshold does not change with size, it is possible to reduce the number of variables by rearranging the maximization problem to four types of firms, as follows:

A. Informal firms

$$\begin{aligned} \max_{l_{i1}, l_{i2}} \pi_I &= \theta L_I^\alpha K_I^\beta - \left(1 + \frac{l_{I1}}{b_I}\right) w_1 l_{I1} - \left(1 + \frac{l_{I2}}{b_i}\right) w_2 l_{I2} - cK_I - FC_I \\ \text{s.t. } L_I &= \left(\eta_I l_{I1}^\rho + (1 - \eta_I) l_{I2}^\rho\right)^{\frac{1}{\rho}}, L_I > 0, \alpha + \beta < 1, w_1 > w_2 \end{aligned}$$

B. Formal firms that hire only informal ($l_1 < \tilde{l}_1$ & $l_2 < \tilde{l}_2$)

$$\begin{aligned} \max_{l_{f1}, l_{f2}} \pi_F &= (1 - \tau_y - \tau_{VAT}) \theta L_F^\alpha K_F^\beta - \left(1 + \frac{l_{FI1}}{b_1}\right) w_1 l_{FI1} - \left(1 + \frac{l_{FI2}}{b_2}\right) w_2 l_{FI2} - cK_F - FC_F \\ \text{s.t. } l_F &= \left(\eta_i l_{F1}^\rho + (1 - \eta_f) l_{F2}^\rho\right)^{\frac{1}{\rho}}, l_F > 0, \alpha + \beta < 1, w_1 > w_2 \text{ \& } b_2 > b_1 > 0 \end{aligned}$$

C. Formal firms that hire some formal skilled workers ($l_1 > \tilde{l}_1$ & $l_2 < \tilde{l}_2$)

$$\begin{aligned} \max_{l_{f1}, l_{f2}} \pi_F &= (1 - \tau_y - \tau_{VAT}) \theta L_F^\alpha K_F^\beta - \left(1 + \frac{\tilde{l}_1}{b_1}\right) w_1 \tilde{l}_1 - \left(1 + \frac{l_{FI2}}{b_2}\right) w_2 l_{FI2} \\ &\quad - (1 - \tau_w)(1 - \tau_y) w_1 l_{FF1} - cK_F - FC_F \\ \text{s.t. } l_F &= \left(\eta_i l_{F1}^\rho + (1 - \eta_f) l_{F2}^\rho\right)^{\frac{1}{\rho}}, l_F > 0, \alpha + \beta < 1, w_1 > w_2, b_2 > b_1 > 0, \\ l_{FFs} &= l_{Fs} - \tilde{l}_s, s = 1 \end{aligned}$$

D. Formal firms that hire some formal skilled and unskilled workers ($l_1 > \tilde{l}_1$ & $l_2 > \tilde{l}_2$)

$$\begin{aligned} \max_{l_{f1}, l_{f2}} \pi_F &= (1 - \tau_y - \tau_{VAT}) \theta L_F^\alpha K_F^\beta - \left(1 + \frac{\tilde{l}_1}{b_1}\right) w_1 \tilde{l}_1 - \left(1 + \frac{\tilde{l}_{FI2}}{b_2}\right) w_2 \tilde{l}_2 \\ &\quad - (1 - \tau_w)(1 - \tau_y)(w_1 l_{FF1} + \max(w_2, w_{min}) l_{FF2}) - cK_F - FC_F \\ \text{s.t. } l_F &= \left(\eta_i l_{F1}^\rho + (1 - \eta_f) l_{F2}^\rho\right)^{\frac{1}{\rho}}, l_F > 0, \alpha + \beta < 1, w_1 > w_2, b_2 > b_1 > 0, \\ l_{FFs} &= l_{Fs} - \tilde{l}_s, s = 1, 2 \end{aligned}$$

Entry and exit. M firms enter the market and observe ν (iid), which is a parameter that distorts the true productivity (θ), observed after entering the market. To enter the formal sector, firms must pay a fixed cost: $E_F > E_I$. If firms face unexpectedly low productivity, they exit the market before they start producing.

Consumers. Representative household inelastically supplies L and derives utility solely from consuming the final good, $welfare = wL + \pi$ (profits) + T (taxes), assuming taxes are returned to consumers with an efficiency rate of 100%.

4 Calibration of the model

The model is calibrated through a two-stage minimum distance estimator (SMD) that uses the value of the structural parameters, the guess values of the estimated parameters, and the equations and functional forms of the model to generate moments of the distribution functions of some key variables of the economy. Moments of simulated data distributions are compared with the same moments obtained from the real data distributions, and the estimated parameters are adjusted until the model converges.

4.1 Structural and estimated parameters

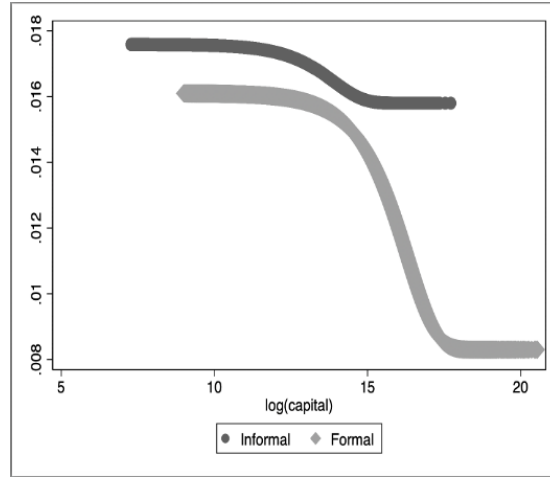
The structural variables of the economy and their respective sources are shown in Table 2. These parameters are very similar to the ones used in Fernández (2023a) but adjusted to the manufacturing sector. The cost of using capital for formal and informal firms is calibrated to fit capital, and according to Figure 5, this cost is always higher for informal firms, but decreases for capital in both formal and informal firms. Table 3 shows the estimated parameters that are in line with what was expected for the manufacturing sector⁴.

Table 2. Structural parameters

		Parameters	Source
w_1	Equilibrium wage of skilled workers	1232	GEIH
w_2	Equilibrium wage of unskilled informal workers	759	GEIH
i	Free risk interest rates (yearly)	10.4%	OECD
τ_w	Payroll/Payroll Contributions	0.47	Fernández & Mejía (2019)
τ_y	Income taxes	0.29	Statutory
V_0	Pareto parameter, ex ante productivity	7.00	Calibrated
k_f	Exit probability of formal firms	0.11	GEIH (firms)
$\frac{C_I}{w_2}$	Cost of operating in the informal sector / unskilled wage	0.2	Calibrated
$\tau_V AT$	VAT tax (net of income tax deduction)	0.145	Statutory
y_{ty}	Monthly threshold for paying income tax (40% deductions)	3833	Statutory
y_{tVAT}	Monthly threshold for paying VAT	8333	Statutory

⁴The source of the initial estimated parameters in the model is the following: cost of the intensive and extensive margin: Fernández (2022), but the final values are lowered since the specification of the cost function varies. Exit probability of firms: calculated as the change in the number of entrepreneurs minus the number of new entrepreneurs : GEIH (2018 and 2019). Cost of operating in the formal sector, Pareto shape parameter, cost of entering the formal and informal sector, Cobb-Douglas parameter, ex post productivity: Fernández (2021). CES shares and Beta: EEG(2019). However, all these parameters were modified to fit the data distributions

Figure 5. Cost of using capital



	Formal	Informal
i_{inf}	10%	21%
i_{sup}	22%	23%
a	$-1 \times e^{-6}$	$-1 \times e^{-8}$
c	-3	-5

Source: Own calculations.

Table 3. Estimated parameters

		Parameter
b_f	Intensive margin cost, skilled workers	10.8
b_f	Intensive margin cost, unskilled workers	12.6
b_i	Cost of extensive margin	1.6
k_f	Exit probability of formal firms	0.2
$\frac{C_F}{w_2}$	Cost of operating in the formal sector / unskilled wage	0.2
x_i	Pareto shape parameter	2.3
E_f	Cost of entering the formal sector	1271
E_i	Cost of entering the informal sector	1024
α	Cobb Douglas function parameter	0.4
σ	Productivity variance ex post	0.7
ρ	CES elasticity parameter	0.3
η_I	Skilled worker CES share. Informal firms	0.2
η_F	Skilled worker CES share. Formal firms	0.3
β	Beta	0.1

Source: Own estimations based on EEG (2019) and initial values based on Fernández (2021 and 2022), EEG(2019) and GEIH (2018 and 2019) and according footnote 3.

Table 4 shows the model fit in terms of adjustment to some moments of the labor, capital, and

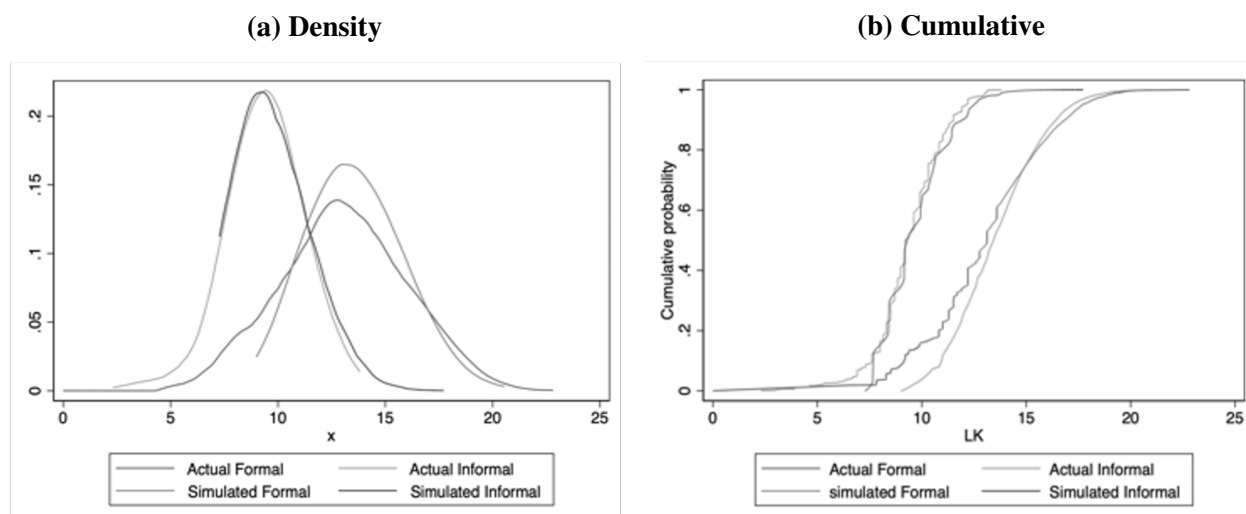
firm's distributions. As shown in this table, the model is accurate to estimate distributions in most variables, but tends to overestimate the intensive margin and underestimate the number of formal firms with less than 10 workers. Figure 6 shows the fit of the capital stock distributions for formal and informal firms.

Table 4. Model fit

	Actual	Simulated
Informal workers (%)	0.31	0.31
Unskilled	0.37	0.34
Skilled	0.12	0.14
% of informal firms on capital	0.02	0.04
% of microbusiness on capital	0.01	0.01
Ln KL formal firms	10.3	10.8
Ln KL informal firms	8.3	8.3
% informal firms	0.88	0.87
<10 workers	0.94	0.93
Intensive margin	0.31	0.39
Formal firms <10 workers	0.49	0.40
Formal firms 10-20 workers	0.13	0.12
Formal firms 20-40 workers	0.12	0.12
Formal firms 40+ workers	0.27	0.35

Source: Own estimations based on EEG (2019).

Figure 6. Distribution of capital fit



Source: EEG (2019).

5 Policy simulations

Two sets of policies oriented to increase access to capital were simulated: Eliminating the friction of the informal firm and reducing the friction of the small firm.

5.1 Eliminating the informal firm's friction in using capital

In this simulation, the same parameters for formal and informal logistic functions were used, as shown in Table 5. It means that informal firms will face a lower cost of using capital, but not as low as the free-risk interest rate. An important consideration in analyzing this scenario is how the interest rate reduction will be implemented. Indeed, it should be considered that the total amount of capital is fixed, and therefore, any attempt to reduce the cost of using capital for a group might mean an increase in the cost of capital for other groups. Not only that, but also this type of policy is often costly and implies an increase in taxes. Consequently, an alternative scenario is proposed, in which there is an increase in profit taxes, which encompasses the reduction of finance costs for informal firms.

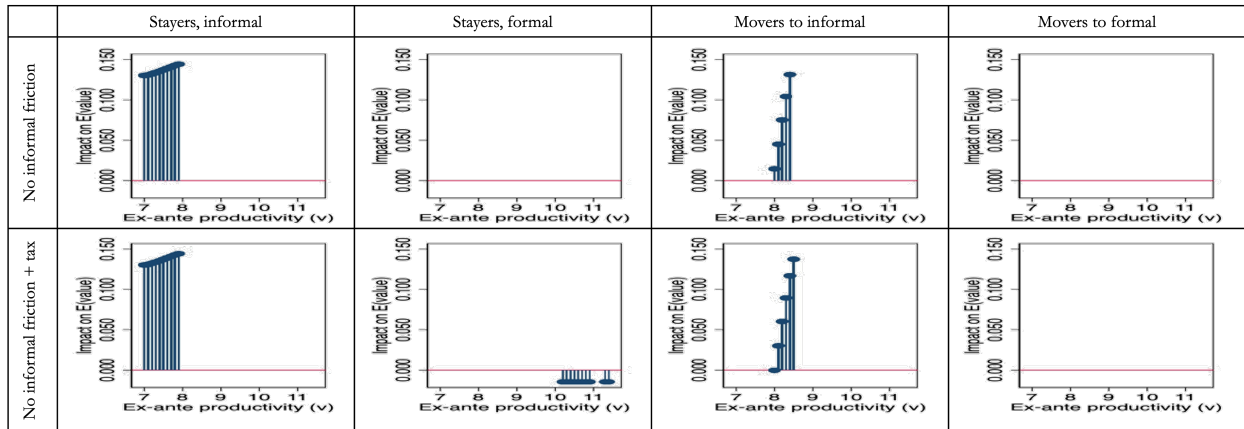
Table 5. Baseline and simulation parameters for informal firms

	Formal	Informal baseline	Informal simulation
i_l	10%	21%	10%
i_h	22%	23%	22%
a	$-1 \times e^{-6}$	$-1 \times e^{-8}$	$-1 \times e^{-6}$
c	-3	-5	-3

Source: Own estimations based on EEG (2019).

Figure 7 shows the initial impact of removing the distortion of the informal firm's interest rate on the present value of future profits according to their ex ante productivity and for the following groups of firms: i) firms that are informal in the baseline and policy scenarios or "stayers", informal, ii) firms that are formal in the baseline and policy scenarios or "stayers formal", iii) firms that are formal in the baseline and informal in the policy scenario or "movers to informal", and, iv) firms that are informal in the baseline and formal in the base scenarios "movers to formal". In the figures, the firms were sorted by their exogenous productivity. According to Figure 8, in the short run ($t=0$) and assuming no change in taxes, being informal becomes more productive (column 1), creating incentives for some formal firms to become informal (column 3), at a point where small formal firms disappear. If taxes are charged, these policies also harm larger formal firms (column 1 row 2).

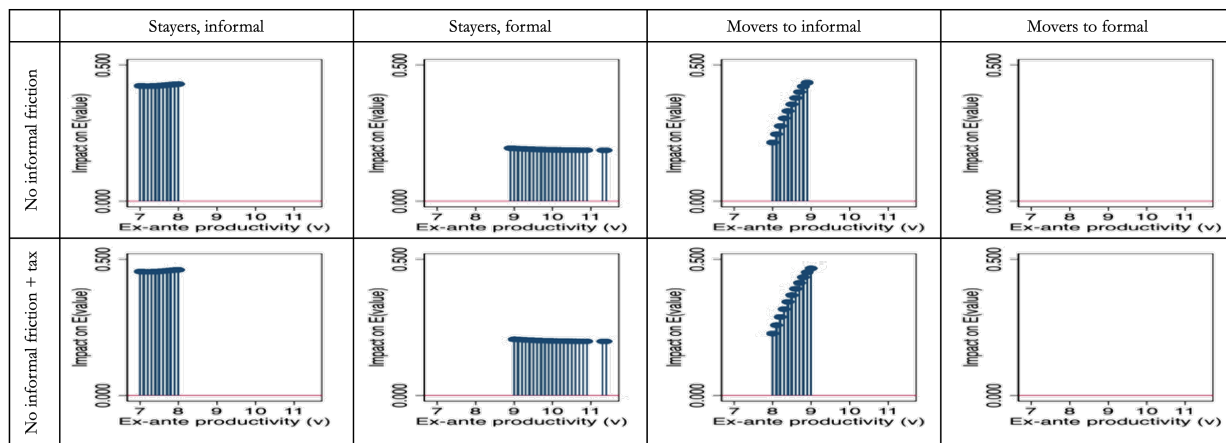
Figure 7. Micro effects of reducing the informal firms' distortion in accessing to capital (t=0)



Source: Simulated data based on EEG (2019)

In a more medium-term scenario (t=1), the risk-free interest rate decreases, since firms that move to the informal market use less capital being informal than being formal. In this scenario, even formal firms benefit due to the lower cost of capital use (column 2).

Figure 8. Micro effects of reducing the informal firms' distortion in accessing to capital (t=1)



Source: Simulated data based on EEG (2019)

Table 6 shows the overall macro-impact of removing the restriction of the informal firm on accessing capital. In the proposed scenario, the capital gets cheaper for informal businesses (from 1.8% to 1.2%), and they become more capital intensive (the capital share of informal firms increases from 4% to 26%). On the other hand, the formal sector is now concentrated in larger, more productive capital-intensive firms, and the share of formal microbusiness capital among total capital of formal firms tends to zero.

In this scenario, there is also an increase in business informality from 88% to 99%. In fact, small formal firms disappear, moving the economy towards dualism (small informal firms and

large formal firms). Consistently, the share of informal output increases from 20% to 60%. This shows the importance of including capital in the informality analysis.

The lower costs of formal firms (from 1.3% to 0.8%) encourage some formal firms to become informal, but also welcome the entry of a number of informal firms (informality increases from 88% to 99%). Informal firms show lower productivity and do not taxes, and therefore general productivity and tax indicators of the economy worsen (tax revenues decrease from 38% to 19%) . The income effect on informal GDP is positive, but the substitution effect is negative and larger, therefore, the output worsens.

Table 6. Macro effects of reducing the informal firm’s distortion in accessing to capital (t=1)

	Baseline	Capital	
		Friction informal	Friction informal + increase profit tax
Informal firms	87.5%	99.3%	99.5%
Informal GDP	20.2%	59.0%	63.3%
Mass of firms (millions)	1.38	1.36	1.36
Informal workers	29.0%	65.9%	69.36%
Skilled informal workers	13.3%	37.9%	41.83%
Unskilled informal workers	31.8%	70.9%	74.26%
Skilled wage	1,302	881	837
Unskilled wage	774	653	646
Interest rate	0.8%	0.6%	0.6%
Capital cost formal firms	1.3%	0.8%	0.7%
Capital cost informal firms	1.8%	1.1%	1.1%
Capital share of informal firms	0.04	0.26	0.29
Capital share of formal microfirms	0.01	0.00	0.00
ln (K/L) formal	10.87	11.35	11.42
ln (K/L) informal	8.29	8.97	9.02
TFP (%baseline)	9.92	9.73	9.70
Ollye & Parks	1.77	1.57	1.59
Output (mm)	165.22	144.36	142.63
Tax revenues	38.04%	19.42%	17.51%
Welfare	1348	1135	1133

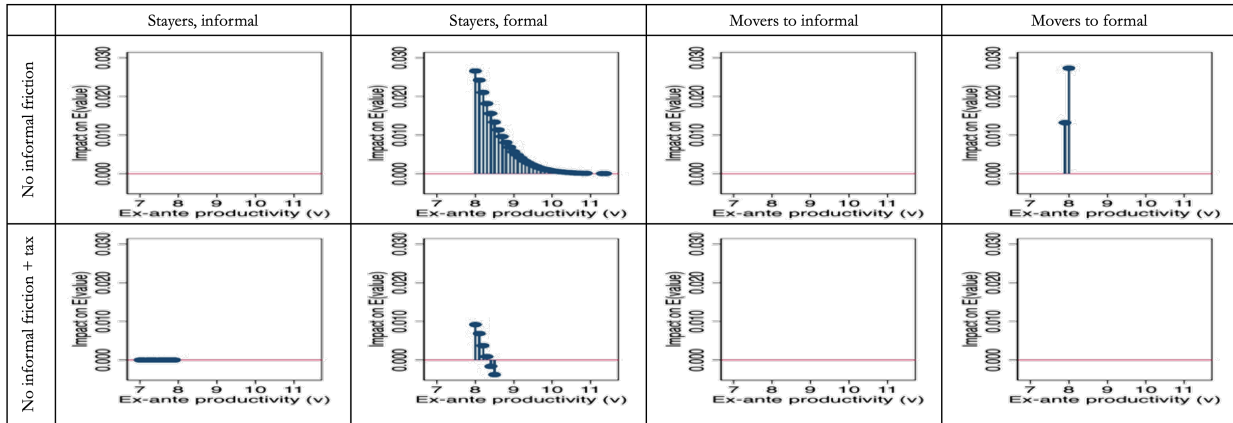
Source: Simulated data based on EEG (2019).

5.2 Reducing size firm’s friction in using capital

In this simulation, the parameter C of the logistic function is increased by 0.5 pp. In Figure 5 the cost of using capital for formal firms (light line) is moved inward, which means increasing the amount of formal firms for which the preferential rate is available. According to Figure 9, lowering the cost of accessing capital for micro-business is positive in the short run for formal firms, at a point where some informal firms become formal (column 4, row 1). However, if the policy is tax-financed, the impact disappears (column 4, row 2) and the impact on formal firms is lower. In the longer term (Figure 10), since there is an incentive to use more capital, interest

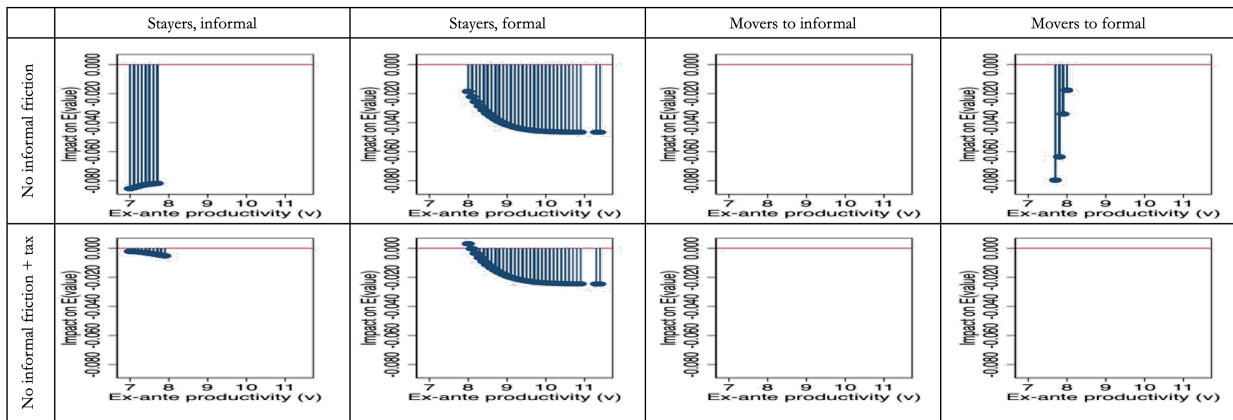
rates increase, and large formal firms are negatively affected (column 2) particularly if the policy is financed by taxes. In contrast, when policies are financed but taxes alleviate the informal sector, because of competition.

Figure 9. Micro effects of reducing the microbusiness distortion in accessing to capital (t=0)



Source: Simulated data based on EEG (2019)

Figure 10. Micro effects of reducing the microbusiness distortion in accessing to capital (t=1)



Source: Simulated data based on EEG (2019)

Regarding macro effects, Table 7 shows how the economy adjusts by increasing risk-free interest rates (from 0.8% to 0.9%), but the adjustment is lower if taxes are increased. GDP and the informality of business and labor decrease (from 87% to 76%), but if it is financed through taxes, the reduction is compensated, because in overall formal firms get hurt.

Table 7. Macro effects of reducing the microbusiness distortion in accessing to capital (t=1)

	Baseline	Micro friction	Micro friction + increase in profit tax
Informal firms	87.5%	76.8%	86.2%
Informal GDP	20.2%	16.5%	19.9%
Mass of firms (miilons)	1.38	1.43	1.39
Informal workers	29.0%	21.30%	27.83%
Skilled informal workers	13.3%	9.98%	12.68%
Unskilled informal workers	31.8%	23.31%	30.51%
Skilled wage	1,302	1,401	1,318
Unskilled wage	774	839	780
Interest rate	0.8%	0.9%	0.8%
Capital cost formal firms	1.3%	1.2%	1.1%
Capital cost informal firms	1.8%	1.8%	1.8%
Capital share of informal firms	0.04	0.03	0.04
Capital share of formal microfirms	0.01	0.01	0.01
ln (K/L) formal	10.87	10.76	10.84
ln (K/L) informal	8.29	8.32	8.31
TFP (% baseline)	9.92	9.89	9.91
Ollye & Parks	1.77	1.91	1.80
Output (mm)	165	161	164
Tax revenues	38%	44%	39%
Welfare	1348	1220	1198

Source: Simulated data based on EEG (2019).

6 Conclusions and policy implications

Colombia is a micro-business country. One of the possible explanations for this fact is the tax threshold below which firms are not obliged to pay taxes. Micro-businesses, and most likely unskilled, have incentives to hire workers informal, whereas larger firms have incentive to hire informal because they have a tax deduction plus high enforcement. On top of that, micro-businesses also have low incentives to get capital, because they face a friction due to size and another due to informality. Therefore, the demography of Colombian companies is polluted by small firms with few incentives to hire capital and skilled workers and therefore unproductive.

This paper analyzed the impact of policies oriented to reduce the distortion in capital accumulation caused by size - smaller firms tend to face higher cost of using capital - and by informality - informal firms tend to face higher interest rates. The methodology used to estimate this impact is the estimation of a General Equilibrium model for the case of Colombia, that considers formal/informal and small/large firms, as well as a tax structure that is typical of developing countries, and the accumulation of capital, that obeys a cost of using capital that is assumed to follow a logistic function behavior.

Programs oriented to reduce the informality distortion on capital increase informality, at a point that informal small firms disappear. Productivity and GDP also decrease because informal firms

are less productive. Actions directed at reducing the size distortion increase formality without changing much output and productivity, but as they need to be financed, some groups might end up affected. Online banking represents a huge opportunity to improve in this field, since it can reduce the size and informal distortions in accessing credit and increase access to international finance without additional cost. It can also speed up credit access, which is one of the features that matter the most for small business.

References

- Alvarez, J., & Ruane, M. C. (2019). *Informality and Aggregate Productivity: The Case of Mexico*. International Monetary Fund.
- Chisari, O. O., Romero, C. A., & Martínez, J. P. V. (2016). Economy-Wide Effects of Improving Small Firms Access to Capital Markets: An Applied General Equilibrium Assessment. *Revista de Análisis Económico–Economic Analysis Review*, 31(1), 15–36.
- Chowdhury, M. J. A. (2009). *Microcredit, Micro-enterprises, and Self-Employment of Women: Experience from the Grameen Bank in Bangladesh* (Vol. 209; Working Paper). Dhaka, Bangladesh: Center for Microfinance and Development.
- De Paula, A., & Scheinkman, J. A. (2011). The Informal Sector: An Equilibrium Model and Some Empirical Evidence from Brazil. *Review of Income and Wealth*, 57, S8–S26.
- D’Erasmus, P. N., & Boedo, H. J. M. (2012). Financial Structure, Informality and Development. *Journal of Monetary Economics*, 59(3), 286–302.
- Erosa, A., Fuster, L., & Martinez, T. R. (2023). Public Financing with Financial Frictions and Underground Economy. *Journal of Monetary Economics*, 135, 20–36.
- Estrada, D. A., & Hernández Rubio, A. (2019). *Situación Actual e Impacto del Microcrédito en Colombia*. Banco de la República de Colombia. Retrieved from <https://repositorio.banrep.gov.co/handle/20.500.12134/9723>
- Fernández, C. (2023a). The impact of tax asymmetries on labor and business informality. *Forthcoming*.
- Fernández, C. (2023b). MSMEs and informality: A new employer–employee database for Colombia. *Forthcoming*.
- Granda, C., & Hamann, F. (2015). *Informality, Saving and Wealth Inequality in Colombia* (Working Paper No. 575). Washington, D.C.: Inter-American Development Bank.
- Hamann-Salcedo, F. A., & Mejía, L. F. (2013). *Formalizando la Informalidad Empresarial en Colombia* (Vol. Capítulo 10. Pág.:399-427). Banco de la República de Colombia.
- Loayza, N. V. (2016). Informality in the Process of Development and Growth. *The World Economy*, 39(12), 1856–1916.
- OECD. (2020). *Financing SMEs and Entrepreneurs 2020: An OECD Scoreboard*. OECD Publishing.
- OECD. (2022). *Financing SMEs and Entrepreneurs 2022: An OECD Scoreboard*. OECD Publishing.
- Rebolledo Abanto, P. A., & Soto Chavéz, R. (2004). Estructura del Mercado de Créditos y Tasas de Interés: Una Aproximación al Segmento de las Microfinanzas. *Revista Estudios Económicos*(11).
- Ulyssea, G. (2018). Firms, Informality, and Development: Theory and Evidence from Brazil. *American Economic Review*, 108(8), 2015–2047.
- Veyrune, M. R. M., Della Valle, G., & Guo, S. (2018). *Relationship Between Short-Term Interest Rates and Excess Reserves: A Logistic Approach*. International Monetary Fund.