



SERIE DOCUMENTOS DE TRABAJO

No. 294

Diciembre de 2022

Firms, Informality & Institutions. The case
of Colombia

Cristina Fernández

Firms, Informality & Institutions. The case of Colombia

Cristina Fernández¹

Abstract

This paper illustrates how two well indented policies to reduce informality as the income tax waiver for small firms, and the income tax deduction of labor cost, end up generating a large amount of small firms hiring workers without a formal contract. This paper also shows the difficulties to reduce informality amidst the complex regulatory environment of Colombia. Policies oriented to reduce labor informality have a limited impact and are costly from the fiscal point of view, policies oriented to reduce business informality are more effective, but does not necessarily reduce labor informality if they are directed towards low productivity firms, because such firms do not have incentives to hire formally. The methodology used to illustrate these facts was the estimation of Ulyssea (2018) for the case of Colombia with the mentioned institutional constraints and a minimum wage. The data base used compiles most of the firm information available in the country (Fernández, 2021).

JEL classification: D22, D58, E24, J21, J46, O17

Key words: Informality, Firm informality, Business informality, Informal labor market, Taxonomy of informality, Policy recommendations for informality.

I. Introduction

One of the first questions that people ask when first approaching the analysis of Colombian productive sector and labor market is why there are so many small low productivity firms hiring informal workers. One usual explanation is a stronger enforcement on larger firms, but this explanation falls short when considering the weak enforcement institutions in Colombia. An alternative hypothesis is the existence of regulations incentivizing this behavior. The research question of this paper is how the complex set of fiscal, social security and labor policies in Colombia, shape business and workers informality along the size distribution of firms. My hypothesis is that three major features of the institutional framework are causing this firm behavior:

First, is the existence of an income threshold under which firms are not obliged to pay taxes. In Colombia business do not need to pay income taxes if they earn a yearly gross income

¹ Economics PhD student at Universidad del Rosario and researcher of Fedesarrollo. I would like to thank the unvaluable help of Andres García-Suaza, Fernando Jaramillo, Alain Desdoigts and Juan Miguel Gallego in developing this paper. Comments by Gabriel Ulyssea, Marcela Eslava and Luis Fernando Mejía were also very helpful. This working paper is funded by the Colombia Científica-Alianza EFI Research Program, with code 60185 and contract number FP44842-220-2018, funded by The World Bank through the call Scientific Ecosystems, managed by the Colombian Ministry of Science, Technology, and Innovation. I also would also like to thank the Departamento Nacional de Planeación (DNP), that financed a precious version of this paper.

lower than a COP\$46 million (nearly US\$12000)². This threshold exists only for business registered as “natural persons”, but most business do not have many incentives to do otherwise. There is another threshold for exempted VAT at COP\$100 million (nearly US\$26000).

Second, is the possibility to deduct formal labor costs from the income tax base. Due to this deduction income taxpayers are almost indifferent between hiring workers formally and informally (the effective rate after this deduction is nearly 4.8%) while exempted firms face higher incentives to hire informally (the effective rate is nearly 47%). This feature, which has been relatively ignored by the literature, proves to be an efficient policy to promote formal hiring among taxpayers.

Third, is the minimum wage. The minimum wage can be understood as an extra social security contribution over unskilled employees that is received directly by the worker. Lower income taxpayers are more affected by the minimum wage because they do not receive the income-tax deduction incentive, and because they tend to hire more unskilled workers. The extra social security contribution implied by the minimum wage (T_{wmin}) is calculated as the ratio between the minimum wage (or the equilibrium wage if not binding) and the equilibrium wage for informal workers.

Using the 2019 income tax rate (τ_y , 28.8%), VAT tax rate (τ_{vat} , 19%), and a bidding minimum wage, Table 1 summarizes the total taxes and labor contributions implied by these three elements and faced by business below and above the thresholds. According to this table, large firms face high VAT and income taxes, but lower employers’ contributions; whereas smaller firms do not face VAT and income tax, but a relatively high formal labor cost, particularly if they hire unskilled workers³.

Table 1. Taxes and contributions faced by business

Gross income Yearly \$COP millions	τ_{vat}^* Including income tax deduction. τ_{vat} (1- τ_y)	τ_y	τ_{wl}^* All labor contributions for skilled workers. Including income tax deduction. $\tau_w(1- \tau_y)$	τ_{w2}^* All labor contributions for unskilled workers, including income tax deduction and minimum wage $\tau_w(1- \tau_y)(1+ \tau_{wmin})^1$
< 46.	0%	0%	47%	57%
> 46 & < 100.	0%	28.8%	4.8%	5.8%
> 100	14.5%	28.8%	4.8%	5.8%

² The threshold to pay income taxes is not fixed and depends upon the percentage of expenditures reported by the entrepreneur. For simplicity I assume only one threshold, without deductions. This assumption finds support in the fact that a firm must fulfill a series of requirements in order to validate these deductions.

³ It might be easier to understand the problem with an example: Assume a formal firm with an income of COP\$1000 and a wage bill of COP\$500. This firm should pay a payroll bill of COP\$237 ($t_w=47\%$) and having a tax base of \$235 (income-wage bill-payroll) should pay an income tax of COP\$76 ($t_y=28.8\%$). Without the formal labor cost deduction, the tax base will be (COP\$1000) and the tax, COP\$288. The value that the firm saves in taxes for hiring formal workers is (COP\$288-COP\$76=COP\$212), and the value of the payroll bill net of tax deductions is equal to (COP\$237-COP\$212=COP\$23), that is equivalent to a tax rate of 4.8%

Source: Own calculations. Note: Binding minimum wage is assumed.

Although the tax thresholds seem low, they cover an important percentage microbusiness in Colombia, that in turn account for around 96% of all firms in the country. As shown in Table 2, 77% of the microbusiness are below the income and VAT thresholds; 10% above the income tax threshold but below the VAT threshold, and 13% above both thresholds (Colombian Microbusiness Survey, EMICRON). Table 2 also shows that 86% of the small formal microbusiness, are registered as “*natural persons*”, and therefore suitable to be exempted from income tax.

Table 2. Number of firms above and below the income thresholds and those registered as “natural persons”

	Total	%	Informal	%	Formal	%	Formal firms registered as “ <i>natural person</i> ” (%)
Microbusiness	1,411,670	100%	1,370,133	100%	41,536	100%	73%
< 46	1,087,547	77%	1,077,821	79%	9,725	23%	86%
> 46 & < 100	145,088	10%	137,608	10%	7,480	18%	87%
> 100	179,033	13%	154,704	11%	24,329	59%	63%

Source: EMICRON and own calculations. Excludes firms with one worker. Informal: not registered recently or not formal accounts.

Table 3 summarizes the hypothesis on how these three institutional features interact with enforcement policies to incentivize or constraint the extensive and intensive margin of informality, where the extensive margin refers to the formality of the firm and the intensive margin whereas the intensive margin refers to the percentage of formal workers hired. Larger firms tend to show a low intensive margin, since they can deduct formal labor cost and face high enforcement policies. On the other side, smaller firms face high incentives to hire informally, because of the high formal labor cost. They are also more affected by the minimum wage because the “extra-contribution” is not deductible for them, and because they also tend to hire more unskilled workers⁴. These mechanisms, not only shape the distribution of informality but also the distribution of firms, productivity, and labor across different firm sizes.

Table 3. Forces affecting the formality decisions across firm sizes

IB Yearly \$COP millions	Extensive margin	Intensive margin
< 100	• Low business enforcement • Low labor enforcement • High formal labor cost	• Low labor enforcement • Hight formal labor cost
> 100	• High business enforcement • High labor enforcement • Profit taxes and VAT	• High labor enforcement • Lower labor cost

⁴ Although small businesses are the most affected by the minimum wage they are not included in the respective negotiations.

	• Lower labor cost	
--	--------------------	--

Source: Own hypothesis

The methodology I used to test these hypotheses is to estimate Ulyssea (2018), a model that proved to replicate accurately the Brazilian informality case, with and without these three institutional constraints. According to the results the constrained model reproduces well the distribution of the number of firms, the intensive and extensive margin, and the share of skill workers across different firm sizes for the case of Colombia, by estimating lower enforcement on both business and labor formality. The reduction of the role of the enforcement mechanism suits well the case of developing countries where enforcement institutions tend to be rather weak.

This contribution has important policy implications because it moves the focus of recommendations from payroll taxes and enforcement to a holistic analysis of the tax, labor, and social security institutions. I welcome this shift in priorities, since payroll taxes policies have shown positive but limited effects on informality; and enforcement policies applied to small business, can be ineffective, and even harmful for employment and welfare. Comparative statics also allow me to observe the impact of tax and labor policies on informality, policies oriented to reduce labor informality have a limited impact and are costly from the fiscal point of view, policies oriented to reduce business informality are more effective, but does not necessarily reduce labor informality if they are directed towards small firms.

Although the model is estimated for the Colombian case, the main conclusions of this paper can be applied to a variety of developing countries, that typically face high informality and have institutional constraints in the form of minimum wages, formal labor cost tax deductions and tax brackets that begin with a zero-rate (Torres, Mellbye and Brys, 2013).

Self-employment continues to be an unfilled gap in explaining informality and a pending item in the agenda. In fact, I have realized that this topic, although tremendously important for the Colombian case, should be analyzed with an occupational choice model, rather than with a firm's perspective model as Ulyssea (2018), and therefore is left for future research.

This paper is structured as follows: Section II briefly reviews the existing literature, section III shows the main facts of informality in Colombia, section IV presents the theoretical model that results from introducing institutional arrangements to the model of Ulyssea (2018), sections V and VI estimates the model and show the fitting for the Colombian case, section VII illustrates some comparative static exercises and section VIII concludes.

II. Literature review

Historically, the analysis of informality has debated between the segmented and integrated view. The segmented view led by (Lewis, 1954 and Harris y Todaro, 1970), advocates for two different markets with few transitions between them: one including low educated and low productivity firms and the other high educated and high productivity firms. The integrated view led by Levy (2018) and Maloney (2003) stand up for a sole market where firms and workers freely transit between formality and informality. Yet, some others as De Soto et al., (1989) and De Soto (2000) support a third view where firms and workers

transitions are limited by excessive regulation. Recently, informality has been understood as a phenomenon that encompasses the three different types of informality mentioned above, depending upon the size and productivity distribution of firm (Perry et al. 2007; Loayza (2016), Fernández, Villar and Gómez (2017) and Ulyssea (2018).

According to Perry et al (2007) the informal firms include small subsistence firms, regulation restricted firms and firms of a larger size that fail to comply with the regulations. They argue that some firms can benefit of lowering the costs of informality and react to an increase in the costs of being informal, but they also understand that the best policy for small firms require policies as access to formal credit, training, and business development services. Loayza (2016) reinforced this framework and policy recommendations with a model calibrated for Latin American countries, where the type and the amount of informality is very much linked to the cost of formality, which in turns harms productivity.

Although these models and analysis stress the importance of lowering the cost of formality, most empirical analysis have found a limited and sometimes inexistent impact of policies as payroll taxes and registration cost cuts. One positive example is the payroll taxes reduction from 29,5% to 16% that took place in Colombia, 2012. This measure reduced the informality rate of dependent workers in 4.8 p.p., which is consistent with a 2.4 p.p. reduction in the informality rate of the economy (Fernández and Villar, 2013). Similarly, Kugler, Kugler and Herrera - Prada (2017) found that this reduction increased formal employment in more than 3% and reduced informal employment in 2,9%. However, the reduction of the Peruvian microbusiness labor cost from 54% to 17% of mean wages, did not generated a significant reduction in informality when controlling for growth (Chacaltana, 2016). According, to Jaramillo (2016) this might be related to a lack of enforcement.

Ulyssea (2018) shifted the focus of the analysis from the cost of formality to the cost of informality. He developed a model that departs from Merlitz (2003) but includes an internal and external margin of informality. When applied this model to the Brazilian case, the author finds that while reducing payroll taxes can be an effective policy recommendation, enforcement is the main driver of the shape of informality in the size distribution of firms, and the most effective variable to reduce informality. This emphasis in enforcement might have been inspired by Brazilian case. According to Hanwinckel and Soares (2020) Brazil increased the percentage of workers supervised by labor inspectors in 34 p.p. between 2003 and 2012, along with a new scheme of incentives. Impact analysis of this increase in enforcement are mixed: Fairris and Jonasson (2016) found a positive impact and Almeida y Carneiro (2012) no impact over formality.

Another possible explanation for the limited impact of reducing informality costs, is the interaction of the enforcement polices with the tax and labor regulations. Antón and Rasteletti (2018) included a more detailed model of the tax institutions in their model for the case of Mexico, but their analysis is more focused on the fiscal impact of formalization policies. Dix-Carneiro, Goldberg, Meguir and Ulyssea (2021) formulated a model with tax and minimum wage frictions, but in this case the model is oriented to analyze the impact of trade. Acosta (2020) analyzed the relationship between tax rates, and an enforcement rate whose effectiveness depends upon the size of the informal sector (measured by its assets) and

government expenditure. According to his findings, this enforcement perspective creates a Laffer curve, where an increase in taxes can reduce informality, under specific circumstances.

The mono-tax schemes literature tends to consider a richer institutional framework, particularly in the cases of Brazil and Uruguay, where the mono-tax includes social security contributions. Alaimo et al. (2015) estimated that these schemes formalized about half a million Brazilian microbusiness and two million of jobs between 2000 and 2005; and together with Fajnzylber, Maloney and Montes-Rojas (2011), found that the firms that opted for the mono tax scheme have shown higher levels of income, profits, hire more workers and are more capital intensive. Llambí et al. (2014) conclude that the mono-tax policies in Uruguay increased formal employment between 10% and 35% and increased the number of registered business and investment. According to Amarante and Perazzo (2013) this scheme increased the number of formal self-employments from 6% to 23% between 2006 y 2010.

In the case of Colombia, the recent “Employment Mission” (Levy and Maldonado, 2021) suggested that the behavior of employment and informality in Colombia was mostly due to the complicated labor, and social security systems but did not elaborate much on their interaction with the tax system. This paper aims to fill this gap.

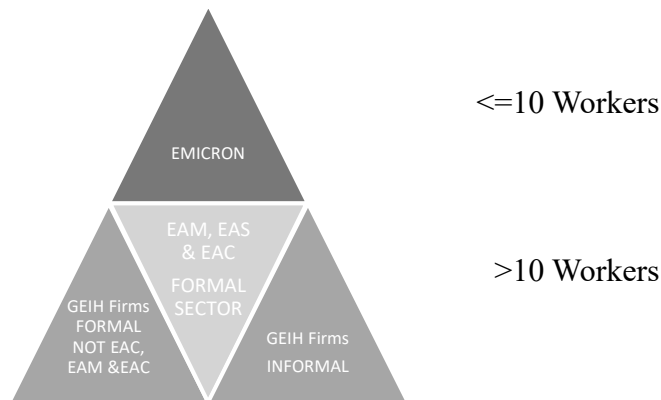
III. A panorama of informality in Colombia

One of the limitations in analyzing informality in Colombia, and particularly business informality, is the lack of a business census or a representative survey. Fernández (2021) partially filled this gap by compiling information on nearly 1 million multi-worker firms from EMICRON (employer-employee microbusiness survey), the structural surveys of manufacturing, services, and trade (EAM, EAS, and EAC), and the section of the household survey (GEIH) that asks questions to entrepreneurs. Government, domestic services, financial services, and agriculture were excluded from the survey. Firms with only one individual were also excluded since they can be understood as an occupational choice rather than a firm.

Figure 1 shows the procedure used for building this new data base (EEG: EMICRON, structural and GEIH surveys): information of firms with less than 10 workers is taken from EMICRON (0.97 million); firms with more than 10 workers are represented by the structural surveys (EAM, EAS and EAC - 13,500 firms) and by the GEIH if they are informal or belong or are not covered by the structural surveys (24,000 firms). The comparison of the EEG with other attempts to gather firms’ information can be found in the original paper. The set of variables collected through this procedure is rather wide and allows to generate a good characterization of informality in Colombia.⁵.

⁵ However, there were some gaps in identifying the workers characteristics for bigger firms, as the intensive margin, that are fulfilled through imputations using the GEIH’s workers module. Although these imputations are widely used in this chapter, they were seldomly used in the calibration of the model.

Figure 1. EEG (2019). Sources of information.



Source: Fernández (2021)

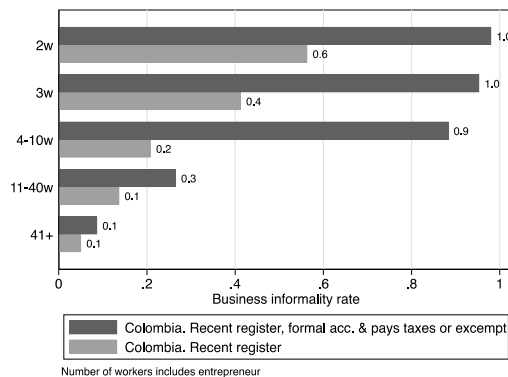
The EEG allows the identification of the following regularities that must be considered when modelling informality for the case of Colombia.

1. **Extensive margin of informality (business informality).** Business informality in the country is more of a continue than a binary variable, in the sense that there are firms that behold a larger or smaller portion of regulations. This is unlike the case of Brazil, where the mono-tax scheme embodies a large part of the legislation, generating a more discrete business informality variable.

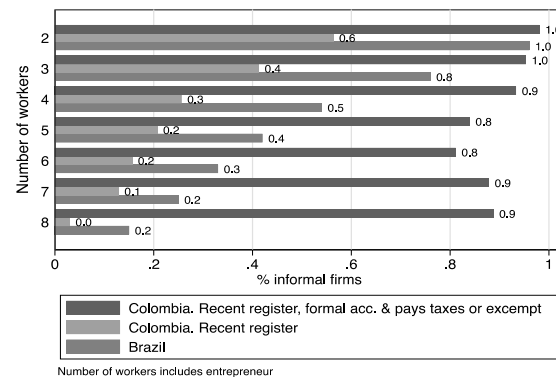
While it is difficult to estimate and model a continuous variable of business informality, it makes sense to use different informality scenarios in the analysis. Figure 2 shows the extensive margin for Colombia, according to two different definitions of business informality for all firms and microbusiness. The extensive margin for the case of microbusiness in Brazil is also included to allow comparisons. As it is shown in the graph, informality is widely spread among small firms and across all informality definitions, even after excluding one worker firms. Informality is also of a considerable size for firms with more than 10 workers. Therefore, assuming that these firms are formal, as in Ulyssea (2018), is not realistic for the Colombian case.

Figure 2. Extensive margin of informality according to 3 definitions of informality

2a. All firms



2b. Total firms

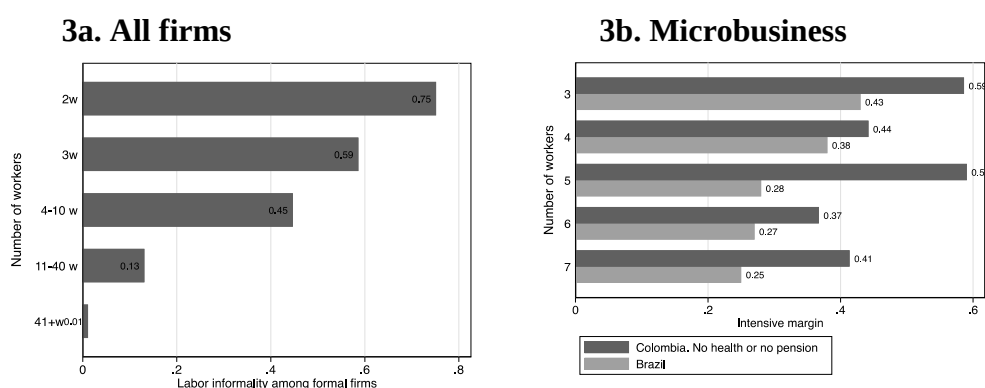


Source: Emicron (2019), Fernández (2021) and Ulyssea (2018)

Although is very important to have the perspective of business informality for several definitions of the variable, for the specific purpose of this paper formal firms should be restricted to those that are close to pay taxes and therefore, it is more accurate to have a strict definition of informality considering three criteria: Renewed or new registration to the Chamber of Commerce⁶, formal accounts⁷, and being tax contributors or exempted⁸ (bolder bar in the graphs). However, it should be noted that the behavior of strict business informality among microbusiness is less nicely behaved.

2. **The intensive margin of informality** is defined as the percentage of workers that do not make health or pension contributions and are being hired by formal firms with at least 2 dependents (3 workers). Figure 3 shows this statistic for microbusiness (EMICRON, 2019) and for all firms (EEG, 2019)⁹. The intensive margin for microbusiness does not show a smoothly decreasing behavior, probably due to the number of observations available. However, arranging the information by ranges generates a smoothly decreasing intensive margin but still significant for relatively large firms, as expected. Therefore, and unlike the case of Brazil, we cannot assume a null intensive margin for larger firms.

Figure 3. Intensive margin of informality



Source: Emicron (2019), Fernández (2021) and Ulyssea (2018). The intensive margin for firms with more than 10 workers is imputed.

⁶ The question in the GEIH also includes RUT registration

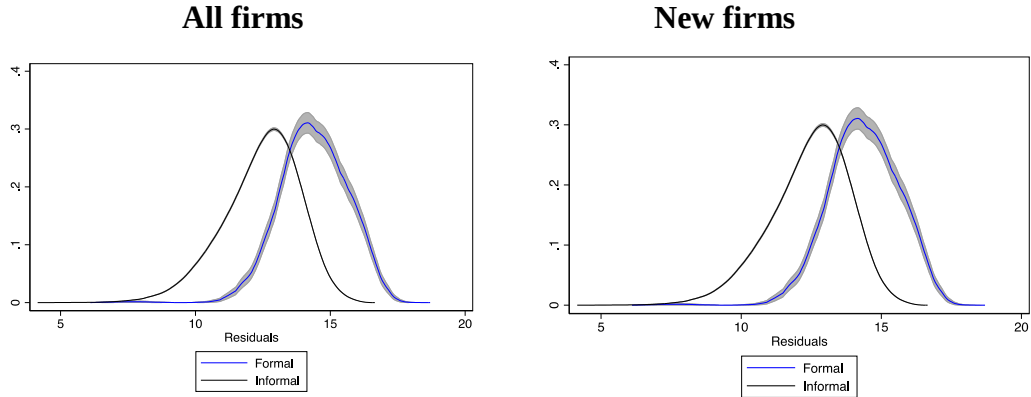
⁷ General Balance or Profit and Losses Statement or with a daily register book

⁸ In the case of micro-business, it also includes as formal firms that not supposed to pay taxes. Firms with more than 10 workers (GEIH) are assumed to pay taxes.

⁹ The informality rate is observed for firms with less than 10 workers (EMICRON). All workers in firms reported by EAC, EAM and EAS are assumed to be formal, and informality for larger firms (bigger than 10 workers) outside of these structural surveys is estimated as the conditional probability of being informal working in a formal firm given that the worker works in a formal firm, after matching data from the dependent workers household survey (GEIH) to the independent workers household survey (GEIH). Non remunerated workers, partners and entrepreneurs are also classified according to their informality status and therefore, included in the denominator.

3. **Value-added distributions.** The EEG (2019) also allows for the comparison of value-added per worker formal and informal distributions¹⁰. According to Ulyssea (2018), the overlap of formal and informal value added per worker distributions, with formal firms having a higher mean, is consistent with heterogeneous firms that take the formality/informality decision with limited information. As shown in Figure 4, Colombian case shows a high overlap between formal and informal distributions suggesting high uncertainty in all and new firms. Perfect foreseen in his model would predict totally independent distributions and a complete dual economy.

Figure 4. Value added per worker



Source: Fernández (2021). New firms (≥ 2 years) do not include manufacturing sector

According to this panorama, Ulyssea (2018) is a good model to understand informality in Colombia for four reasons: includes microbusiness and larger companies in the analysis, contemplates the two margins of informality, considers some firms and worker's heterogeneity, and allows modifications to obtain a detailed institutional framework, as shown in next section.

IV. *A model to understand informality with institutional frictions*

The methodology I used to show the importance of institutions in shaping informality is to estimate Ulyssea (2018) for the case of Colombia with and without institutional constraints. The idea of this model is that based on an economic assessment, firms decide to comply or not with two sets of regulations: The ones relative to the extensive margin such as paying taxes, and the ones related to the intensive margin, which includes health and pension contributions.

This model assumes same production function and prices (normalized to 1) for formal and informal firms, one factor of production (labor), and a single good. The concave production function for each sector is $y_s(\theta) = \theta l_s^\alpha$, with $\alpha < 1$ and $s = I, F$, where the subscript S refers to whether the workers is hired by a formal or informal firm. The model considers two levels of qualification (skilled (1) and unskilled (2)) aggregated through a CES function with shares

¹⁰ The Emicron and the structural surveys provide this information for microbusiness and firms in the services, trade, and manufacturing sector. Other firms' value added is estimated by using factor remunerations. The complete methodology can be found in Fernández (2021).

of skilled workers η_i and η_f and elasticity of substitution $\frac{1}{1-\rho}$. Therefore, $l_F = (\eta_i l_{F1}^\rho + (1 - \eta_f) l_{F2}^\rho)^{\frac{1}{\rho}}$.

On top of regulation, informal firms face fix and variable costs of production, and an enforcement cost applied to the extensive margin that is increasing on size, and of the following form $T(l_I) = \left(1 + \frac{l_I}{b_I}\right)$, where b_I is an exogenous parameter. Since informal firms are assumed to only hire informal workers, the earnings of informal firms I can be expressed as follows:

$$\max_{l_{I1}, l_{I2}} \pi = \theta l_I^\alpha - \left(1 + \frac{l_{I1}}{b_I}\right) w_1 l_{I1} - FC_I$$

$$s.t \quad l_I = (\eta_i l_{I1}^\rho + (1 - \eta_f) l_{I2}^\rho)^{\frac{1}{\rho}}, l_I > 0, \alpha < 1, w_1 > w_2$$

On the other hand, formal firms F must pay income taxes (τ_y) charged over the value-added net of formal costs, and vat taxes charged over revenues (τ_{vat}). τ_y is equal to zero if income is lower than the income tax threshold (Y_y) and τ_{vat} is equal to zero if income is lower than the VAT threshold (Y_{vat}). Formal firms can hire formal workers, paying social security contributions (τ_w) and a minimum wage if binding on unskilled wages¹¹; and/or informal workers, that are being affected by enforcement costs, like those faced by informal firms

$$T(l_{Fs}) = \left(1 + \frac{l_{Fs}}{b_s}\right) s = 1, 2$$

Workers are assumed to perform the same activities within the formal firm, subject to their level of qualification. They are hired according to their relative costs, but there is a critical threshold $\tilde{l}$ above which, only informal workers are hired. $\tilde{l}$ can be seen as an informal workers dotation for every firm, even larges formal ones¹². Skilled workers are assumed to face a higher enforcement on skilled workers, therefore, the threshold for this type of labor is lower. This feature generates three types of firms: i) Firms that hire only informal ($l_{F1} < \tilde{l}_1$ & $l_{F2} < \tilde{l}_2$), ii) Firms that hire some formal skilled workers ($l_{F1} > \tilde{l}_1$ & $l_{F2} < \tilde{l}_2$) and iii) Firms that hire some formal skilled and unskilled workers ($l_{F1} > \tilde{l}_1$ & $l_{F2} > \tilde{l}_2$). The profits of formal firms (F) can be expressed as:

$$\Pi_F = \max_l \{(1 - \tau_y - \tau_{vat}) \theta l_F^\alpha - C(l)\}$$

$$C(l) = \left(1 + \frac{l_{Fi1}}{b_s}\right) l_{Fi1} w_1 + \left(1 + \frac{l_{Fi2}}{b_s}\right) l_{Fi2} w_2 + \lambda_1 (1 + \tau_w) (1 - \tau_y) l_{Ff1} w_1 \\ + \lambda_2 (1 + \tau_w) (1 - \tau_y) (1 + \tau_{wmin}) l_{Ff2} w_2$$

$$s.t \quad l_F = (\eta_i l_{F1}^\rho + (1 - \eta_f) l_{F2}^\rho)^{\frac{1}{\rho}}, l_F > 0, \alpha < 1, w_1 > w_2 \text{ \& } b_2 > b_1 > 0,$$

¹¹ According to Loayza et al (2021) whether the minimum wage is binding or not can be written as $\text{Max}(\text{wage}_{\text{unskilled}}, w_{\text{min}})$, then $\tau_{wmin} = \frac{\max(\text{wage}_{\text{unskilled}}, w_{\text{min}})}{\text{wage}_{\text{unskilled}}}$

¹² A way to understand this, is the existence of some activities within the firm subject to be performed by independent workers, that pay social security on their own.

Where

$$l_{Ffs} = l_{Fs} - \tilde{l}_s \quad s = 1, 2, \lambda_s = 1 \text{ if } l_{Ffs} > \tilde{l}_s \text{ and } 0 \text{ otherwise, } s=1, 2 \quad \tau_y=0 \text{ if } \theta l_F^\alpha < Y_y, \\ \tau_{vat}=0 \text{ if } \theta l_F^\alpha < Y_{vat} \text{ and } \tau_{wmin} = \frac{\max(w_2, w_{min})}{w_2}$$

More clearly the maximization problem of formal firms according to size of the firm is the following

1. Formal firms that hire only informal ($l_{F1} < \tilde{l}_1$ & $l_{F2} < \tilde{l}_2$)

$$\max_{l_{f1}, l_{f2}} \pi_F = (1 - \tau_y - \tau_{vat}) \theta l_F^\alpha - \left(1 + \frac{l_{Fi1}}{b_1}\right) w_1 l_{Fi1} - \left(1 + \frac{l_{Fi2}}{b_2}\right) w_2 l_{Fi2} - FC_F$$

$$s.t \quad l_F = (\eta_i l_{F1}^\rho + (1 - \eta_f) l_{F2}^\rho)^{\frac{1}{\rho}}, \quad l_F > 0, \alpha < 1, w_1 > w_2 \text{ \& } b_2 > b_1 > 0,$$

$$l_{Ffs} = l_{Fs} - \tilde{l}_s \quad s = 1, 2, \tau_y=0 \text{ if } \theta l_F^\alpha < Y_y, \quad \tau_{vat}=0 \text{ if } \theta l_F^\alpha < Y_{vat}$$

2. Formal firms that hire some formal skilled workers ($l_{F1} > \tilde{l}_1$ & $l_{F2} < \tilde{l}_2$)

$$\max_{l_{f1}, l_{f2}} \pi_F = (1 - \tau_y - \tau_{vat}) \theta l_F^\alpha - \left(1 + \frac{\tilde{l}_1}{b_1}\right) w_1 \tilde{l}_1 \\ - \left(1 + \frac{l_{Fi2}}{b_2}\right) w_2 l_{Fi2} - (1 + \tau_w)(1 - \tau_y) w_1 l_{Ff1} - FC_F$$

$$s.t \quad l_F = (\eta_i l_{F1}^\rho + (1 - \eta_f) l_{F2}^\rho)^{\frac{1}{\rho}}, \quad l_F > 0, \alpha < 1, w_1 > w_2 \text{ \& } b_2 > b_1 > 0,$$

$$l_{Ffs} = l_{Fs} - \tilde{l}_s \quad s = 1, 2, \tau_y=0 \text{ if } \theta l_F^\alpha < Y_y, \quad \tau_{vat}=0 \text{ if } \theta l_F^\alpha < Y_{vat}$$

3. Firms that hire some formal skilled and unskilled workers ($l_{F1} > \tilde{l}_1$ & $l_{F2} > \tilde{l}_2$)

$$\max_{l_{f1}, l_{f2}} \pi_F = (1 - \tau_y - \tau_{vat}) \theta L^\alpha - \left(1 + \frac{\tilde{l}_1}{b_1}\right) w_1 \tilde{l}_1 - \left(1 + \frac{\tilde{l}_{F2}}{b_2}\right) w_2 \tilde{l}_2 - FC_F \\ - (1 + \tau_w)(1 - \tau_y)(w_1 l_{Ff1} + \max(w_2, w_{wmin}) l_{Ff2})$$

$$s.t \quad l_F = (\eta_i l_{F1}^\rho + (1 - \eta_f) l_{F2}^\rho)^{\frac{1}{\rho}}, \quad l_F > 0, \alpha < 1, w_1 > w_2 \text{ \& } b_2 > b_1 > 0,$$

$$l_{Ffs} = l_{Fs} - \tilde{l}_s \quad s = 1, 2, \tau_y=0 \text{ if } \theta l_F^\alpha < Y_y, \quad \tau_{vat}=0 \text{ if } \theta l_F^\alpha < Y_{vat}, \tau_{wmin} = \frac{\max(w_2, w_{min})}{w_2}$$

The informal workers thresholds ($\tilde{l}_s \quad s = 1, 2$) can be derived by equalizing the marginal cost of hiring informally ($w_2 + \frac{2w_2 l_{F2}}{b_2}$) and formally $\{(1 + t_w)(1 + t_y) \max(w_2, w_{min})\}$. The threshold for

unskilled workers can be derived as follows. $\tilde{l}_2 = \frac{(1+t_w)(1-t_y)b_2 w_2^*}{2}$; $w_2^* = \max(w_2, w_{min})$. Similarly, the threshold for skilled workers, that do not face the minimum wage restriction can be written as: $\tilde{l}_1 = \frac{(1+t_w)(1-t_y)b_1}{2}$.

Each period a potential number of firms M enters the market, these firms only observe a vague production function v that is a parameter that distorts true productivity. v is identically distributed among all participants. To enter the formal sector, firms must pay a fixed cost, denominated in output units, $E_f > E_i$. Once the firms enter the market, they obtain their true productivity from the function $F(\theta/v)$, which remains constant once the firms enter the market. There is a positive relationship between v y θ . This ex-ante uncertainty mechanism explains why formal and informal firms coexist in the same productivity ranges. If firms face unexpectedly low productivity, they exit the market before they start producing. Firms face a possibility of exiting the market κ_i or κ_f , depending on whether they are formal or informal. Since prices and productivity remain constant, the firm value function can be expressed as: $V_s(\theta, w) = \max\left\{0, \frac{\pi_s(\theta, w)}{\kappa_s}\right\}$; $s = I, F$ and the respective expected value, as: $V_s^e(\theta, w) = \int V_s(\theta, w) dF\left(\frac{\theta}{v}\right)$; $s = I, F$

V. *Estimation of the model*

To observe the impact of the tax, labor, and social security institutions on the behavior of informality, I estimated the model, detailed above, for the case of Colombia with and without the institutional constraints. Following, Ulyssea (2018) I estimated the model using a two-stage minimum distance (SMD) estimator. This estimator uses the value of some structural parameters and guess values of estimated parameters, wages for skilled and unskilled workers, productivity shocks, and the distribution functions of some key variables of the economy. Some moments of these distributions are compared with the same moments obtained from the distributions of the real data, and the estimated parameters are adjusted until the model converges.¹³

The estimation of the model involves gathering information of the structural parameters in the economy, as well as giving and giving an accurate guess for the initial values of the estimated parameters, which is important given that the SMD is a procedure to find local rather than global minimums. The sources of the structural parameters and the initial values of the estimated parameters, for the unconstrained and the institutional constrained model, is detailed below.

Equilibrium wages for skilled and unskilled workers: To estimate wages not affected by the composition of the labor force or the sectoral composition in the GEIH, a logarithmic regression of the wage was estimated with an adjusted variable for highly qualified workers and other business and worker's control variables (2021). To further minimize measurement error, the sample is restricted to employees who are between 18 and 69 years old and who have worked at least 20 hours in the reference week, but at most 84 hours (which is the 99th percentile). The lower limit of 20 hours is intended to exclude interns who are still in school and workers with very little connection to the labor market. The estimated regression is used to calculate the adjusted wage for high-skilled workers (COP\$ 984,633), unskilled workers (COP\$820,020) and unskilled informal workers (COP\$ 687,225).

¹³ To give robustness to the results, again following Ulyssea (2018) I simulated 300,000 observations and 20 databases

Function parameters of the distributions: According to Ulyssea (2018), the production function follows a Cobb-Douglas distribution, the distribution of firms follows a Pareto distribution and the mixture of skill and unskilled labor, a CES distribution. Medina and Posso (2010) estimated the elasticity of substitution for unskilled/skilled labor in Colombia at $\sigma=1.47$ and $\sigma=1.31$, if controlling for unemployment and minimum wage. This implies CES parameters of $\rho=0.32$ and $\rho=0.24$, respectively, given $\sigma=1/(1-\rho)$. The simple shares of skill workers in formal and informal firms (0.88 and 0.59, respectively) were used as initial values for estimating the CES shares. Workers with secondary education are considered as skilled workers. The Pareto location structural parameter is calibrated at 7.3; and the shape initial parameter, is 3, according to the fitting of the data for a firm of minimum size of 2, according to Jenkins (2007). The initial parameter used for the Cobb Douglas coefficient was $\alpha=0.4952$, according to the Penn World Tables.

Exit probability of formal and informal firms: I calculated the parameter for formal and informal firms at 16.5% and 23.9%, respectively, as the monthly average of the change in the number of entrepreneurs in the GEIH (proxy for the change in the number of firms), discounting the number of entrepreneurs who have been in business for less than 12 months for the 2019/2018 period. It is important to bear in mind that, in any case, these parameters not only contain the effect of entry and exit of the firm, but also involve the effect of transitions between formality and informality.

Taxes and contributions. The income tax (T_y) was estimated as the relationship between taxes paid by companies and gross profits (income minus direct or material inputs), according to the database of the Superintendencia de Sociedades. The resulting income tax is 28.8%. Gómez (2014) and Gomez and Steiner (2013) estimate the income tax rate in 30%. The vat tax (T_{vat}) used is the statutory rate (19%) net of income tax deductions (14.5%). The effective payroll tax rate is estimated using the statutory rates on wages observed in the GEIH for 2019 of formal workers in firms with 2 or more workers and includes: transportation subsidy, severance, interest on severance, additional annual wages (prima), vacations, employer's health, social security and "Caja de compensacion", ICBF and SENA contributions (when apply) and occupational risk insurance. The total contribution amounts to 47.2%. The threshold of the income tax is set as the monthly equivalent of an annual revenue of COP\$46 million (assuming to deductions¹⁴), and the threshold of the t_{vat} at COP\$100 millions, assuming no deductions.

Cost of entry or minimum scale required to participate in the formal and informal sector, denominated in units of production. In most countries, business registration fees are paid once in a lifetime. However, in the case of Colombia they are paid periodically and therefore estimated as 12-months contributions (COP\$3'214,000 on average). Informal firms also face in average some contributions (COP\$457,932) since the strict criterion of informality is assumed.

¹⁴ This is an upper limit for the threshold. However, given that to obtain a deduction firms should use an "electronic bill", use electronic transactions, and prove that contractors pay their own social security, it is reasonable to assume this upper limit in the model.

Annual fix cost: assuming that property costs are flexible, which is the specification that resemble more closely Ulyssea (2018), the annual fix cost are limited to formalization cost that are 0.34% as percentage of unskilled wage for formal firms, and close to 0.4% for informal firms (Fernández, 2021). The estimation of the model for the Colombian case sets the informal costs as a structural parameter and the formal cost as the flexible, because the estimative for informal firms is more reliable and to avoid negative solutions, without setting additional restrictions.

Other initial parameters: Other initial parameters as the enforcement parameters and variance of pre-productivity shocks, and structural parameters as the mean productivity shocks used Ulyssea (2018) values. Also, like in Ulyssea (2018), individual company productivity is estimated using a grid θ that impacts income. This grid is created to save computational time, and a non-binding high range is used so as not to limit the results. Additionally, a vector of transition probabilities is created for each point of the grid to calculate the expected post-entry values in each sector for each possible participant, with the method of Tauchen (1986).

Table 4 summarizes the parameters used by Ulyssea (2018) and Alvarez and Ruane (2019) to analyze the cases of Brazil and Mexico; the initial parameters used for the case of Colombia; and the parameters resulting from the calibration. As explained before, some of the original parameter measurements had to be adjusted to the current structure of the model. This is the case of the payroll contributions parameter in the unconstrained model, to which the income tax deduction was applied, to avoid further structural changes to the model. As it can be observed, I preferred to estimate the cost of operating in the formal sector, for which I have less available information, than in the informal sector; therefore, the former was included as an estimated parameter and the last as an exogenous parameter.

Table 4. Structural Parameters used in the estimation

		Brazil	Mexico	Colombia unconstraint	Colombia constraint
ω_1	Equilibrium wage of skilled workers	844	2.35	985	973
ω_2	Equilibrium wage of unskilled informal workers	591			688
ω_2	Equilibrium wage of unskilled workers			820	
τ_w	Payroll/Payroll Contributions	0.37	0.35	0.34	0.47
τ_y	Income taxes	0.29	0.00	0.14	0.29
V_0	Pareto parameter, ex ante productivity	7.00	7.08	7.30	7.30
κ_f	Exit probability of formal firms	0.13	0.08	0.16	0.16
γ_f	Cost of operating in the formal sector / unskilled wage	0.45	0.45		
γ_i	Cost of operating in the informal sector / unskilled wage			0.05	0.05
τ_{vat}	VAT tax (net of income tax deduction)				0.145
y_{ty}	Monthly threshold for paying income tax (40% deductions)				5597
y_{IVAT}	Monthly threshold for paying VAT				9995

Sources: Ulyssea (2018), Alvarez and Ruane (2019) and those referred above in the text.

Table 5 shows the initial and final values of the estimated parameters in the Colombian case, and the final parameters for the Brazilian and Mexican parameters. There are three important changes in the final version of Colombia with respect to the initial values and the final values registered in other countries.

Foremost, the cost of enforcement is lower in the case of Colombia. As explained in the introduction, the weakness of Colombian enforcement authorities, means that enforcement is a much less relevant explanation to the distribution of informality than what was found by Ulyssea (2018) for the case of Brazil. The way the model converges from the case of Brazil to a larger rate of labor and business informality in Colombia us through a lower business formality enforcement, in the model without institutional constrains; and lower business and labor formality enforcement, in the model with institutional constrains. It should be noted that in the unconstrained model, the enforcement parameter of skilled workers is higher than the enforcement parameter of unskilled workers, meaning that hiring the former informally is less risky than hiring the later informally. This probably is related with incorrect relative prices that arise for no considering the tax deductions of hiring formal workers.

Other important difference with the case of Brazil is the higher productivity ex post variance, that is consistent with the productivity of formal and informal firms having a greater overlapping section in the case of Colombia (Fernández, 2021); and the lower entry cost to the formal sector, probably related with Colombian having periodical rather than upfront registration costs.

Table 5. Estimated Parameters

		Brazil	Mexico	Colombia		
				Initial guess	Without constraints	With institutional constraints
b_f	Intensive margin cost, skilled workers	2.61	2.35	2.61	5.71	24.2
b_f	Intensive margin cost, unskilled workers	4.94		4.94	4.72	41.3
b_i	Cost of extensive margin	5.01	4.58	5.01	29.1	8.92
δ_i	Exit probability of informal firms	0.38	0.27	0.24	0.25	0.27
γ_i	Cost of operating in the informal sector / w_2	0.25	0.19			
γ_f	Cost of operating in the formal sector / w_2			0.33	0.36	0.36
ξ_i	Pareto shape parameter	3.08	1.57	2.99	3.01	2.44
E_f	Cost of entering the formal sector	4282	93193	3214	3077	2946
E_e	Cost of entering the informal sector	2023	8	457	799	765
α	Cobb Douglas function parameter	0.6	0.32	0.50	0.65	0.57
σ	Productivity variance ex post	0.24	0.27	0.24	0.33	0.54
ρ	CES elasticity parameter	0.29		0.29	0.37	0.30
η_i	Skilled worker CES share. Informal firms	0.48		0.59	0.58	0.63
η_F	Skilled worker CES share. Formal firms	0.59		0.88	0.77	0.78

Sources: Ulyssea (2018), Alvarez and Ruane (2019) and those referred above in the text.

VI. Fitness of the model

Table 6 shows the moments of the distributions of the main variables estimated with the model and with the data, which serves as support for the calibration process. These moments were specifically selected for the Colombian case and for this reason, they are not compared with the Brazilian ones. As can be seen in the results, the constrained model replicates all the parameters remarkably well.

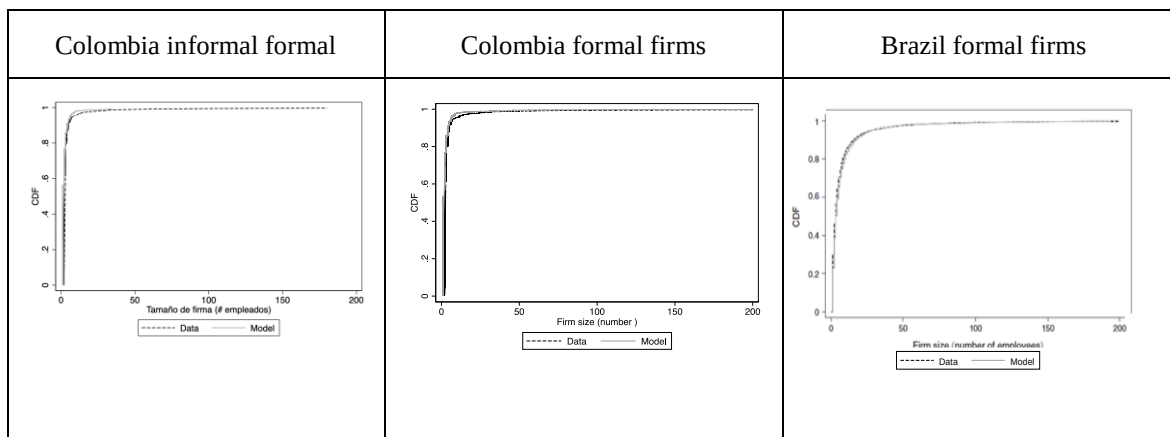
Table 6. Estimated moments (observed & simulated data)

	EEG and GEIH	Model with institutional constraints
Moment 1. Formal workers among dependents (GEIH, workers)	37%	37%
Moment 2. Informal workers among the unskilled (GEIH, workers)	61%	61%
Moment 3. Informal workers among the qualified (GEIH, workers)	28%	28%
Moment 4. Business informality rate	93%	96%
Moment 5. Business informality rate in firms with 1/3 dependents (2/4 workers)	97%	96%
Moment 6. Business informality rate in firms with 4/9 dependents (5/10 workers)	83%	86%
Moment 7. Business informality rate in firms with 10+ dependents (11+ workers)	22%	24%
Moment 8. Intensive margin in firms with 2/4 dependents (3/5 workers)	55%	55%
Moment 9. Intensive margin in firms with 5/19 dependents (6/20 workers)	24%	21%
Moment 10. Intensive margin in firms with 20+ dependents (21+ workers)	3%	4%
Moment 11: % of informal firms with 1/4 dependents (2/5 workers) in total informal firms	95%	95%
Moment 12: % of informal firms with 1/9 dependents (1/10 workers) in total informal firms	99%	99%
Moment 13: % of formal firms with 1/9 dependents (2/10 workers) in total formal firms	54%	51%
Moment 14: % of formal firms with 10/19 dependents (11/20 workers) in total formal firms	18%	18%
Moment 15: % of formal firms with 20/39 dependents (21/40 workers) in total formal firms	13%	14%
Moment 16: % of formal firms with 40+ dependents (41+ workers) in total formal firms	15%	18%

Source: EEG and model estimates under the strict informality scenario.

In addition to estimating the similarity of the models in terms of means, the distributions by size of some of the key variables were compared. Figure 5 shows the informal and formal firm distribution for Colombia institutionally constrained model and Brazilian firms.

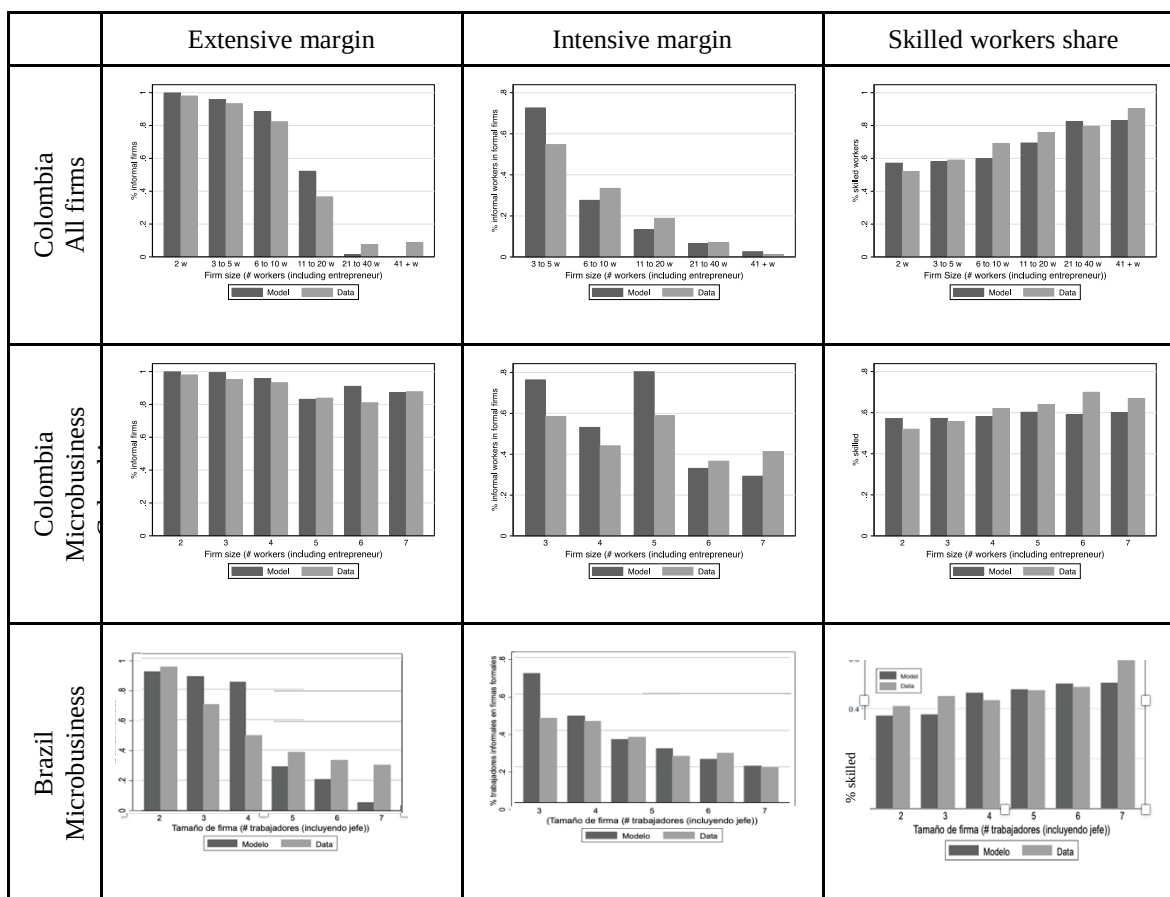
Figure 5. Firm size distribution.



Source: Author's calculations EEG (2019), GEIH (2019) and Ulyssea (2018)

Figure 6 shows the extensive and intensive margin of informality and the share of skilled workers in formal and informal firms, for constrained Colombia, constrained microbusiness (which is more comparable with Ulyssea, 2018) and Brazil. All these results were adapted to a perfect prediction of business informality, by using population weights in the simulated data. As shown in the figure the prediction of the model fits very the data well, considering the erratic behavior of the indicator for firms between 5 and 10 workers.

Figure 6. Firm size distribution of extensive margin, intensive margin and share of skilled workers

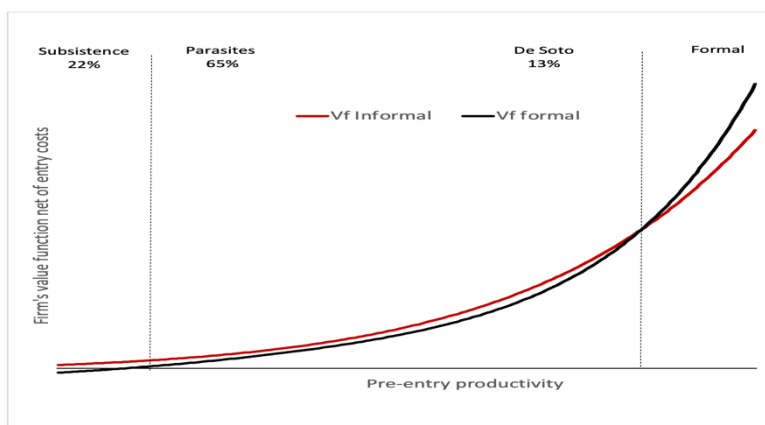


Source: Author's calculations, EEG (2019), GEIH (2019) and Ulyssea (2018)

One of the most important features of this model is that it allows to identify three types of firms: the Subsistence Firms that are the one that cannot operate formally; the Induced, that are those that could operate as formal but prefer to be informal because it is more profitable and the Naturally Formal Firms. According to Figure 7, the Subsistence Informality is relatively small in Colombia (22%), which makes sense since the fix entrance cost of formality are relatively small. Also, it is important to consider that unipersonal firms are excluded from this exercise. On the other hand, the Induced firms a quite large portion of informality, and the informal and formal firm's values are similar, which implies that policies that change the relative variable cost of operating formally might be effective¹⁵.

¹⁵ Ulyssea (2018) proposed a much complex taxonomy which depends upon a scenario where the entry barriers were eliminated. I prefer the one used here, not only because it is easier to be implemented but also because in the Colombian case the scenario without entry cost is affected by non-linearities and becomes difficult to use to formulate a taxonomy.

Figure 7. Taxonomy of informality

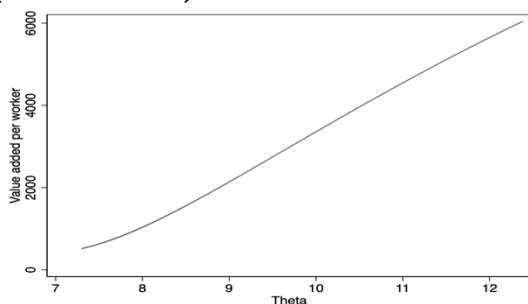


Source: Simulated data

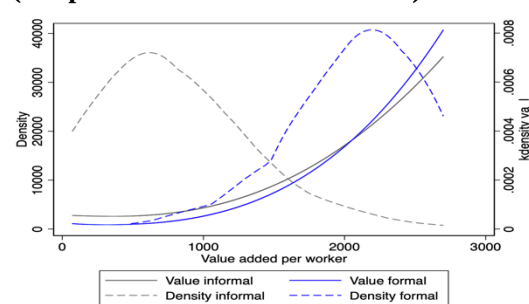
This taxonomy is interesting since considers the heterogeneity of informality in Latin America and is very useful to understand the impact of different policies. However, one inconvenient is that θ , an unobservable variable, is the parameter that allows to identify the different types of informality. An alternative is to build a taxonomy based in the value added per worker. As it is shown in Figure 8A, there is a lineal relationship between this variable and θ , and it can be corroborated in Figure 8B that the taxonomy is like the one based in θ . Figure 8B also shows that the density of formal and informal firms, along their size, responds to the incentives to be formal and informal. This finding will allow to target policies in a more efficient way. However, it is important to notice that the intersection between the formal and informal sector curves occurs, later the value added than in the pre-productivity taxonomy.

Figure 8. θ , value added per worker, and a taxonomy based on the later

8a. Theta and value added per worker (Simulated data)



8b. Taxonomy of informality (VA per worker vs value function)



Source: Simulated data

VII. *Comparative statics*

To analyze the impact of policies on a set up with a complex institutional arrangement as the Colombian case, I simulated the comparative statics exercises used by Ulyssea (2018) adding some tax scenarios. The objective of introducing these scenarios is not to suggest that tax policies should be implemented to reduce informality, but rather as informality being a side effect of these policies.

The exercises were divided in two groups: policies to reduce the external margin of informality and policies to reduce the internal margin, understanding that these two objectives can be strongly related. To observe changes clearly, the level of the changes in parameters tried to resemble extreme cases, but in some exercises, this was not possible without generating a corner solution, and softer versions of the change were analyzed instead. The best example of this limitation, is the reduction in payroll taxes that as Jaramillo (2022) pointed out, should follow the following rule $T_w > T_y + T_w * T_y$ to be able to find an internal solution of the model.

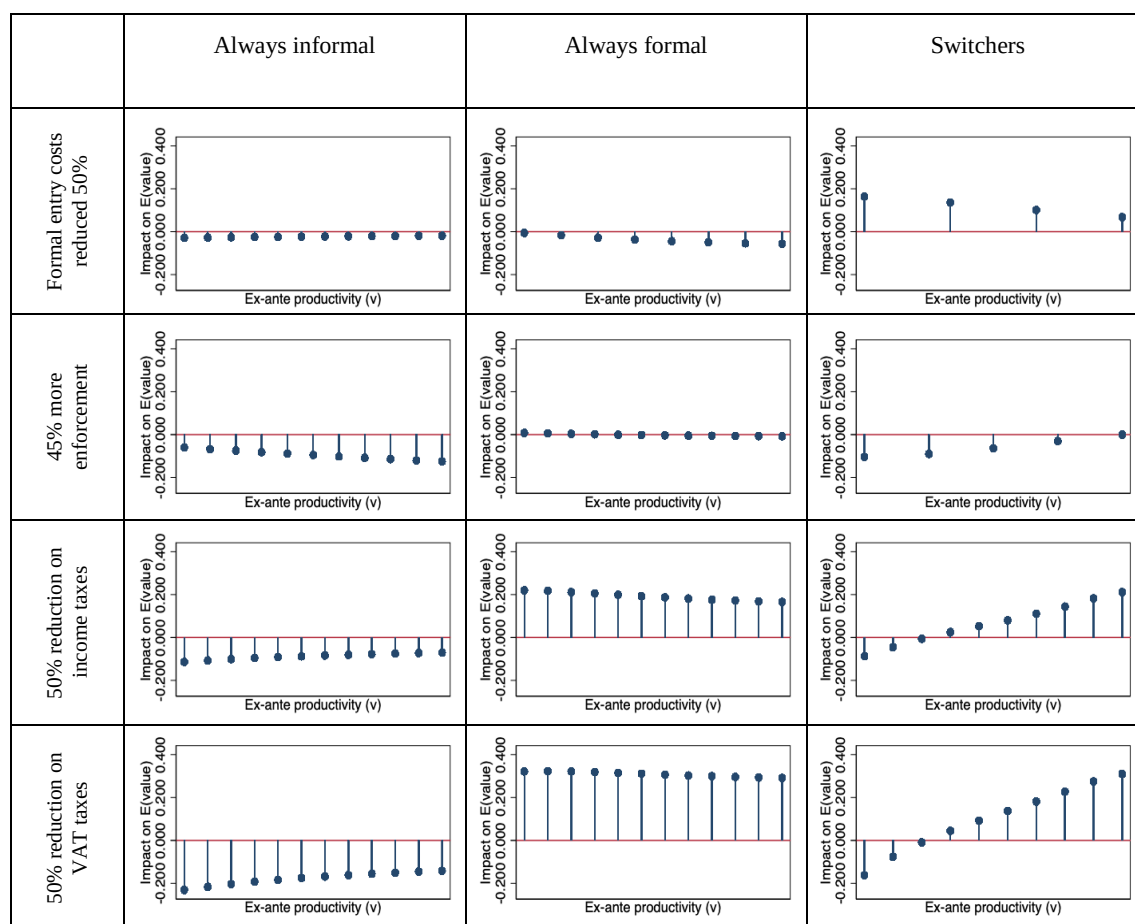
As in Ulyssea (2018) the impact of these policies was analyzed on the life-time value of the firm net of entry costs, for each percentile of the productivity distributions (that is positively related with size) and for each of the following groups: i) “*always formal*”: firms that are formal in the base case and in the counterfactual; ii) “*always informal*”: firms that are informal in the base case and in the counterfactual; iii) “*Switchers*”: informal firms in the base case becoming formal in the counterfactual. The macroeconomic implications of the policies were also included in the analysis.

1. Policies on the extensive margin of informality

These policies consider a carrot policy of 50% reduction on formal entry costs, a stick policy of 45% more enforcement on the extensive margin of informality and a 50% reduction on income and vat taxes. As shown in Figure 9, most policies are negative for the “*always informal*” firms, and positive or not very harmful for the always formal firms.

When formal entry costs are reduced, many firms, and particularly the low productivity ones, enter the market, because they are exempted from income and VAT taxes. This marginally hurts both always formal and always informal firms that face more competition. In the enforcement scenario, the value of “*always informal*” firms decreases because it becomes more costly to be informal; at the point that some firms decide to formalize (“*switchers*”). Although the most affected informal firms are the more productive ones, considering enforcement is increasing in size, most of the firms that decide to formalize are the smaller ones, because the income tax waiver. Concerning tax policies, the decrease in income tax and VAT are positive for formal firms, and negative for informal firms because of competition in the labor market. It also led firms to formalize, particularly the larger ones, that are subject to pay taxes.

Figure 9. Microeconomic impact of policies oriented to the extensive margin



Source: Simulated data

These results are in line with the macro impacts illustrated in Table 7. Indeed, external margin policies induce the entrance of new formal firms, the formalization of others, and a consequent reduction in business informality. The impact is bigger on informal GDP, when the new formal firms are among the most productive ones.

As formal firms hire more formal workers, business formalization should lead to labor formalization. However, this is only the case in the enforcement scenario. In the reduction in entry costs scenario, the labor informality rate increases because low productivity firms, intensive in informal workers enter the market. Interestingly, labor informality also increases when the income tax is reduced because the tax deduction also lowers. In terms of wages, as formal firms hire a higher proportion of skill workers, the wage premium increases. Unskilled wages substantially decrease in the enforcement scenario, where informal firms get severely hurt, because of general equilibrium means. As expected, taxes revenues decrease in tax scenarios or the entrance cost reduction, because small firms do not pay taxes and increase when facing higher enforcement. All experiments increase total GDP.

Table 7. Macroeconomic impact of policies oriented to the extensive margin (policy/baseline, constrained model)

	Lower entry cost	Higher enforcement	Lower income tax	No VAT tax
Informal firms	0.62	0.94	0.76	0.74
Informal GDP	0.62	0.77	0.55	0.48
Informal workers	1.08	0.87	1.17	1.07
Skilled informal workers	1.12	0.79	1.24	1.14
Unskilled informal workers	1.03	0.98	1.08	0.97
Skilled premium	1.11	1.15	1.08	1.07
Skilled wage	1.06	1.01	1.12	1.23
Unskilled wage	0.96	0.88	1.04	1.14
Mass of firms	1.13	1.03	1.09	1.08
Output	1.01	1.06	1.03	1.04
Tax revenues	0.96	1.08	0.90	0.96

Source: Simulated data

In sum, policies in the extensive margin are successful in reducing business informality. This would naturally reduce labor informality as in the VAT scenario. However, if the firms that formalize are the smaller ones, as in the entry cost scenario, labor informality can increase due to low productivity firms entering the market. In the income tax scenario labor informality increases because the lower tax deduction. One key question in this discussion is the questionable relevance of formalize firms if they do not pay taxes and do not hire workers formally.

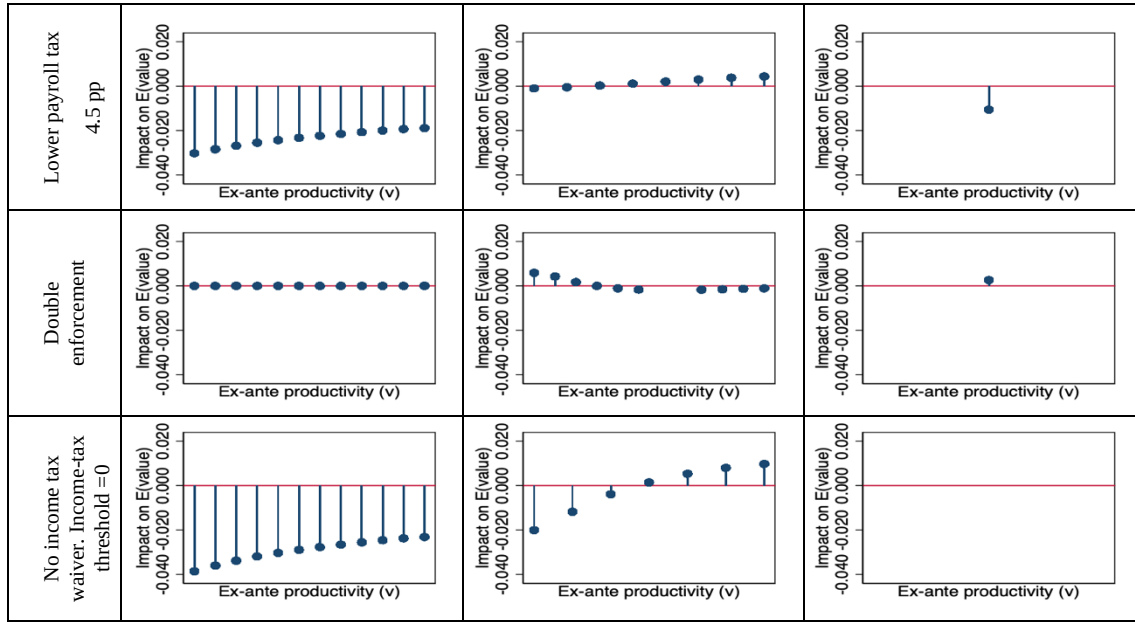
2. Policies on the intensive margin of informality

Figure 10 shows the impact of decreasing the payroll taxes in 4.5 pp, a 50% increase on the intensive margin enforcement, and an elimination of the income tax waiver on small firms (threshold for income taxes =0), that as shown before, generates a tax deduction on payroll taxes for small firms.

As shown in the introduction, payroll costs are higher for small firms because of the lack of the income tax deduction; but these firms do not hire many workers formally. Therefore, the reduction of payroll taxes is mostly beneficial to productive “*always formal*” firms, that are large formal workers employers, increasing labor demand, wages, and hurting informal firms, by general equilibrium means. On the contrary, the increase in labor enforcement, hurts large “*always formal firms*”, since enforcement is increasing in size. The impact of eliminated the tax waiver on small firms, is very similar to the impact of reducing payroll taxes, but large “*always formal*” firms get relatively more benefits, and small “*always formal*” firms end up being hurt.

Figure 10. Microeconomic impact of policies oriented to the intensive margin

	Always informal	Always formal	Switchers



Source: Simulated data

Consistently, Table 8 illustrates that intensive margin policies reduces labor informality to some extent, but this does not incentive firms to become formal. The reduction in labor informality is unbiased in the reduction of payroll taxes scenario but biased towards unskilled workers when income taxes become universal, because small firms get the formal labor tax deduction. Consequently, unskilled wages increase relatively more in the income tax scenario. Enforcement on the intensive margin scenario has a lower impact on labor informality since the formalization effect is controlled by the fact that it becomes more profitable for new firms to operate fully informal, than to operate formally and face a high enforcement on the hiring process. As expected, taxes revenues decreases when the payroll is reduced and increases when the waiver is eliminated.

Table 8. Macroeconomic impact of policies oriented to the intensive margin (policy/baseline, constrained model)

	Lower payroll tax	Higher labor enforcement	No income tax waiver
Informal firms	1.00	1.00	1.00
Informal GDP	0.95	0.99	0.97
Informal workers	0.93	0.98	0.94
Skilled informal workers	0.93	0.98	0.99
Unskilled informal workers	0.93	0.97	0.88
Skilled premium	1.01	1.00	0.93
Skilled wage	1.03	1.00	1.00
Unskilled wage	1.02	1.00	1.08
Mass of firms	1.00	1.00	1.00
Output	1.02	1.01	1.00
Tax revenues	0.94	1.01	2.15

Source: Simulated data

In sum, labor informality policies have a consistent but limited impact on labor informality, and few impacts over business informality. However, it is important to consider that a strong enforcement on the intensive margin, can end up making more profitable to small firms to become 100% informal. Another drawback of policies oriented to reduce labor informality is the fiscal cost. This result is in line with the evaluations of the 2012 reduction of payroll taxes in Colombia.

VIII. Final remarks

The recent Colombian Employment Mission (Levy and Maldonado, 2019) recommended an integral reform of the regulatory system to reduce unemployment; and warned against partial equilibrium solutions to the employment problem, that can generate wrong incentives and unwanted results. This paper presents a clear example of this situation. The waiver on income tax for small firms is an adequate policy to reduce informality in small firms, and the formal cost deductions from the income tax is an effective, thought barely analyzed policy, to reduce business informality. However, the combination of both policies with non-linear parameters ends up generating a large share of small firms hiring workers informally. A possible solution to this problem is to generate vouchers of social security payments, accountable for firms below the income tax threshold that hire workers through a formal contract, that can be used once the firm gets bigger. This recommendation on top of generating incentives to formalize, generates incentives to grow. Another recommendation is to include social security in the single tax scheme, or at least to estimate the tax base as total income net of formal labor costs.

This paper also makes evident that the reduction of labor informality does not have an easy way out, and this explains so many decades of unsuccessful efforts to reduce the problem. Consistently with the evaluations of the 2012 reduction on payroll taxes in Colombia, the estimated model shows that the reduction in payroll taxes, amidst a complicated regulatory environment, has a moderate impact on informality and ties the fiscal accounts. Policies on the extensive margin, are more effective, but they do not necessarily increase labor formality. Indeed, if policies are oriented to small firms, labor informality might remain unchanged because small formal firms hire as much informal workers than an informal firm. This leads to the question of the importance to formalize small business, if formal small firms do not pay taxes and do not hire with a formal contract.

In sum, there is not a single policy that can magically reduce informality by itself. A combination of different policies focused on different types of informality and trying to avoid non linearities and having in mind general equilibrium effects might be a better approach to solve the problem in the future.

Concerning future research, this paper makes an important contribution to the way to understand the interaction between business and labor informality in Colombia. This framework can easily be adjusted to understand several labor market problems that sum up to the institutional complexity, as migration or the impact of COVID-19. It is also important to complete the informality panorama in Colombia with the analysis of self-employment, that is one of the highest in Latin America.

IX. Bibliography

- Acosta. 2020. Law enforcement and the size of the informal sector. Draft paper.
- Alaimo, V., M. Bosch, D. Kaplan, C. Pages y L. Ripani. 2015. Empleos para crecer. 2da Edición. Washington, D.C.: BID.
- Almeida, R. y P. Carneiro. 2012. Enforcement of Labor Regulation and Informality. American Economic Journal: Applied Economics 4(3): 64 - 89
- Alvarez, J., & Ruane, C. (2019). Informality and Aggregate Productivity: The Case of Mexico.
- Amarante, V. e I. Perazzo. 2013. Trabajo por cuenta propia y monotributo en Uruguay. Documento de trabajo 04 - 13. Montevideo, Uruguay: Instituto de Economía de la Universidad de la República del Uruguay
- Banco de la República (2021) Reporte de estabilidad financiera. Primer semestre.
- Banco Mundial (2019). Doing Business.
https://colaboracion.dnp.gov.co/CDT/Desarrollo%20Empresarial/Doing_Business_2019.pdf
- Cárdenas, M. Fernández, C. Rastelletti, A. y Zamora D. Consideraciones para el diseño de políticas fiscales para reducir la informalidad en América Latina y el Caribe 2021. Documento de trabajo IADB DP 882. <https://publications.iadb.org/publications/spanish/document/Consideraciones-para-el-diseno-de-politicas-fiscales-para-reducir-la-informalidad-en-America-Latina-y-el-Caribe.pdf>
- De Soto, H. 1989. The Other Path: The Economic Answer to Terrorism. Nueva York, NY: Harper & Row.
- Dix-Carneiro, Rafael, Pinelopi Koujianou Goldberg, Costas Meghir, and Gabriel Ulyssea. 2021. "Trade and Informality in the Presence of Labor Market Frictions and Regulations." Upjohn Institute Working Paper 21-347. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research. <https://doi.org/10.17848/wp21-347>
- DNP (2019). CONPES 3956 Formalización Empresarial.
<https://colaboracion.dnp.gov.co/CDT/Conpes/Economicos/3956.pdf>
- DNP, (2021) descripción del universo empresarial en Colombia. Cálculos hechos a partir de una nueva base de datos. Documento radicado.
- Eslava M, Haltiwanger JC and Pinzón A. 2019. Job creation in Colombia versus the US: "Up or out dynamics" meets the "life cycle of plants." NBER Work. Pap. 25550
- Fairris, D. y E. Jonasson. 2016. Determinants of Changing Informal Employment in Brazil, 2000 - 2010. MPRA Paper. Munich, Alemania: University Library of Munich.
- Fajnzylber, P., W. Maloney y G. Montes - Rojas. 2011. Does Formality Improve Micro - Firm Performance Evidence from the Brazilian SIMPLES Program. Journal of Development Economics 94 (2) : 262 – 276
- Fernández (2021) Firms and informality. Firms and informality a new data base for Colombia. Alianza EFI. <https://alianzaefi.com/download/firms-and-informality-a-new-data-base-for-colombia/>
- Fernández, Villar y Gómez (2017). "Taxonomía de la informalidad en América Latina," Coyuntura Económica, Fedesarrollo, vol. 47(1 y 2), pages 137-167, December
- Gómez, H. J., & Steiner, R. (2013). La Reforma Tributaria y su impacto sobre la Tasa Efectiva de Tributación de las firmas en Colombia. Bogotá: Fedesarrollo.

Haanwinckel, D. y R. Soares. 2020. Workforce Composition, Productivity, and Labor Regulations in a Compensating Differentials Theory of Informality. Working Paper No. 2020 - 45. Becker Friedman Institute for Research in Economics

Harris, John R. & Todaro, Michael P. (1970), "Migration, Unemployment and Development: A Two-Sector Analysis", American Economic Review, 60 (1): 126–142, JSTOR 1807860

Holland, A. (2017). Forbearance as Redistribution: The Politics of Informal Welfare in Latin America (Cambridge Studies in Comparative Politics). Cambridge: Cambridge University Press. doi:10.1017/9781316795613

Jaramillo, Fernando (2020). Informalidad-margen intensivo. Mimeo. Universidad del Rosario.

Jaramillo, M. 2013. Employment Growth and Segmentation in Peru, 2001 - 2011. Country Case Study on Labour Market Segmentation. Ginebra, Suiza: OIT Jenkins & Van Kerm, 2007. "PARETOFIT: Stata module to fit a Type 1 Pareto distribution," Statistical Software Components S456832, Boston College Department of Economics, revised 11 Nov 2015.

Kugler, A. , M. Kugler y L. Herrera - Prada. 2017. Do Payroll Tax Breaks Stimulate Formality? Evidence from Colombia's Reform. Economía 18(1), 3 - 40

Levy Algazi, Santiago, 2018. "Under-Rewarded Efforts: The Elusive Quest for Prosperity in Mexico," IDB Publications (Books), Inter-American Development Bank, number 8971

Levy, S. and D. Maldonado (2021), *Misión de Empleo. Reporte resumen*

Lewis, W. Arthur. (1954) Economic development with unlimited supplies of labour. The Manchester school, 1954, vol. 22, no 2, p. 139-191

Loayza, N. (2016). Informality in the process of development and growth. (W. B. Group, Ed.) *Policy Research working paper* (no. WPS 7858).

Loayza, N. V., Ulyseas, G., & Utsumi, T. (2018, February). Informality and the labor market effects of mass migration: Theory and evidence from Syrian refugees in Turkey. In 7th Turkey labor market network meeting. Accessed September (Vol. 9, p. 2020).

Maloney, W. F. (2004). Informality revisited. *World development*, 32(7), 1159-1178.

Medina, C., & Posso, C. (2010). Technical change and polarization of the labor market: Evidence for Brazil, Colombia and Mexico. Borradores de Economía; No. 614.

Melitz, Marc J. 2003. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica* 71 (6): 1695–1725.

Paturot, D., Mellbye, K., & Brys, B. (2013). Average personal income tax rate and tax wedge progression in OECD countries.

Ulyseas, G. (2018). Firms, informality, and development: Theory and evidence from Brazil. *American Economic Review*, 108(8), 2015-47.