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## Abstract<sup>1</sup>

This paper empirically explores the effects of payroll taxes, value-added taxes and corporate income taxes on a variety of labor market outcomes such as employment, unemployment, informality, and wages. Using national-level data on labor variables for 15 Latin American countries, the results indicate that the effects of each tax are distinctly different and may depend on several aspects of labor and tax institutions. Payroll taxes reduce employment and increase labor costs when their benefits are not valued by workers, but otherwise increase labor participation and do not raise labor costs. Value-added taxes increase informality and reduce skilled labor demand. In contrast, corporate income taxes may help reduce informality, especially among low-education workers but, when tax enforcement capabilities are strong, may reduce labor participation and employment of medium- and high-education workers.

**JEL Classification:** J21, J30, J32, H24, H25

**Keywords:** VAT, Payroll tax, Corporate income tax, Employment, Informality, Wages, Latin America

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## 1. Introduction

In the last two decades, Latin American tax systems have undergone substantial transformations. Trade liberalization initiated the process by slashing import tariffs and prompting governments to strengthen alternative revenue sources, particularly value-added taxes. VAT has become common in LAC, as in most of the developing world. It now raises about a third of fiscal revenues, as general VAT tax rates have increased from an average of 12.1 percent in 1985 (in the 13 countries with VAT systems) to 14.8 percent in 2009 (in 18 countries).<sup>2</sup>

Parallel with this process, there have been important changes in social security and social protection systems, due to the maturation of traditional pay-as-you-go pension programs and their total or partial replacement by fully-funded defined contribution systems in several countries, the extension of health insurance programs and the creation of a diversity of social protection programs. An important part of the additional revenues required by these systems are currently levied by a variety of payroll taxes and contributions, which either did not exist two decades ago or were substantially lower (increasing from an average of 21 percent in 1985 to 24.3 percent in 2009).

In contrast to these changes, income taxes have remained relatively constant since the mid- 1980s, at least in terms of the revenues generated (around 4 percent of GDP). Nonetheless, the maximum tax rates of the corporate income tax have been reduced from 44 percent in 1985 to about 30 percent since the mid-1990s, and that of the individual income tax from 50 percent in 1985 to around 30 percent since the mid-1990s. Furthermore, the bases, exemptions and other features of the taxes have been the subject of continuous adjustments in most countries (Lora, 2007).

The effects of all these changes on employment and wages are still poorly understood. While an extensive theoretical and empirical literature has studied the labor effects of trade taxes, and to some extent payroll taxes, a comparable effort is still wanting with respect to the VAT and income taxes.

This paper reviews the theoretical and empirical literature on the labor effects of taxes and explores empirically the effects of payroll taxes, the VAT and corporate income taxes. It uses national-level data of labor variables for 15 Latin American countries processed in a

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<sup>2</sup> For further information on these figures and sources of data, see Section 3.

homogeneous way from household surveys, avoiding the methodological limitations and discontinuities of other sources.

With respect to payroll taxes, this paper confirms some of the findings of previous literature, such as their deleterious effects on employment, and expands on an important aspect of those taxes that has been recognized by the theoretical literature but has been largely neglected by empirical works: the different effects of payroll taxes that give access to benefits to the workers taxed compared with those that are pure taxes.

Value-added taxes are often considered less distortive than other taxes because they affect all sectors and factors in a more homogeneous. However, our results suggest that the effects of VAT on labor outcomes differ strongly by the level of skills of the workers, a result that seems to be the consequence of the presence of large informal segments and the different degree of substitutability with capital of unskilled and skilled labor.

Our findings on the corporate income tax reaffirm the conclusion that unskilled and skilled workers may be affected differently by taxes and that the effects are mediated by institutional factors such as tax collection capabilities, minimum wages and the degree of labor flexibility allowed by the labor code.

The rest of this paper is as follows. Section 2 is devoted to a review of the theoretical and empirical literature on the labor effects of personal income taxes, payroll taxes, value-added taxes, corporate income taxes and tariffs. Section 3 describes the data sources, and Section 4 presents the econometric strategy. Section 5 offers a simple analytical framework to facilitate the presentation of the empirical results, which is undertaken in Sections 6 through 8. Section 9 concludes and offer suggestions for further research.

## **2. Literature Review**

### ***2.1 The Labor Effects of Personal Income Taxes***

Since personal income taxes are the most direct form of taxing labor incomes, it is convenient to discuss them at the outset, even though their effects on labor markets have attracted much less research than those of other taxes, especially payroll taxes.<sup>3</sup>

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<sup>3</sup> The effects of personal income taxes will not be assessed in the empirical section of this work for reasons explained below.

Income taxes may affect both the supply of and the demand for labor. Labor supply is basically the result of two decisions made by individuals: whether to enter the labor force or not and, if employed, how many hours to work. Income taxes will also affect the decision of whether to work in the formal sector or, in order to evade those (and other) taxes, move to the informal sector (understood as small firms and independent workers that can escape the purview of the tax administration).

To assess the participation decision, theoretical models assume that individuals have a reservation wage, namely the minimum net wage at which they will be willing to work, and which is associated with the alternative uses of their time (e.g. leisure, education), the fixed costs of working (transportation or childcare costs), and their non-labor income (including unemployment benefits and other government transfers). The theoretical prediction is that an income tax will reduce labor participation because it will push the net-of-tax wage below the reservation wage for some people. Empirical studies for developed countries find that male labor participation responsiveness to changes in after-tax income is low or close to zero, especially for high-skilled men, but high for women, especially for single mothers and for married women living in very poor households (for a survey of this research see OECD, 2011, pp. 30–31).

When considering the effect of income taxes on hours worked, the theoretical prediction is ambiguous. Higher income taxes will reduce the relative price of leisure, making it more attractive and encouraging less work. However, as income is reduced, the incentive to work is stronger. Since these substitution and income effects move in opposite directions, the response of hours of work to taxation is uncertain. Most empirical works find positive elasticities of hours of work to after-tax incomes for women (although with wide differences across studies) and close to zero for men (OECD, 2011, pp. 30–31; Causa, 2008).

The effects of (labor) income taxes on labor demand depend on whether gross wages are affected or not by the tax. If an income tax increase is completely absorbed by the workers, labor demand and unemployment will not be affected directly. However, depending on the wage-setting mechanisms in place, part of the tax increase may be absorbed by the firms in the form of higher gross wages. Most empirical studies for developed countries have found that income taxes or, more in general, so-called tax wedges (see below) do increase gross wages (for a survey, see Melguizo, 2009). Unionization and minimum wage negotiation practices are two main institutional features responsible for this effect, making firms absorb part of the tax increases,

and leading to lower employment and higher unemployment (Bassanini and Duval, 2006; Daveri and Tabellini, 2000; OECD 2006, 2011; Pissarides, 1998).

When assessing the effects of income taxes on wages and employment, many empirical studies for developed countries treat them as part of the so-called tax wedge, which includes also payroll taxes, and even consumption taxes (Alesina, Glaeser and Sacerdote, 2005; Bassanini and Duval, 2006; Causa, 2008; Nickell, 1997), instead of studying them separately. As discussed below, this treatment is inadequate when payroll taxes (in the form of social security contributions, for instance) give access to benefits that are valued by the worker.

Personal income taxes may also induce individuals to operate in the informal sector. A wealth of studies has uncovered strong evidence of the influence of income taxes on the size of the informal sector. However, most studies find that more important than the income tax rate are the complexity of income tax regulations and several institutional aspects, like the efficiency of the administration, the extent of control rights held by politicians and bureaucrats, the amount of bribery and especially corruption (see the literature review in Schneider and Enste, 2000).

The labor consequences of personal income taxes in Latin America or the developing world at large have been little studied. Some research suggests that, by increasing tax burdens, they contribute to informality. Vuletin (2008) has assessed the influence of several causal factors of informality, reaching the conclusion that the tax burden (measured as the average between the maximum personal and corporate income tax rates) is responsible for around 35 percent of the overall size of the informal economy on average among the 32 countries considered (29 of them Latin American or Caribbean countries).<sup>4</sup>

## ***2.2 The Labor Effects of Payroll Taxes<sup>5</sup>***

In theory, the effects of payroll taxes on employment, unemployment and wages are ambiguous (Gruber, 1997 and Kugler and Kugler, 2009, provide theoretical models. Unlike income taxes, most payroll taxes entitle workers to a set of benefits. When workers value the benefits as much as the contributions cost themselves and their employers, changes in payroll taxes should be fully shifted from firms to employees in the form of lower wages with no loss on employment. On the other hand, if payroll taxes finance benefits not completely accrued by employees, there will be

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<sup>4</sup> Although the study by Loayza (1996) shares many aspects with Vuletin (2008), it did not consider personal income taxes among the determinants of informality.

<sup>5</sup> This subsection draws heavily from the background paper by Kugler (2011).



only partial shifting and employment should be affected. The extent of shifting also depends on the elasticities of labor demand and supply. A higher labor demand elasticity increases the pass-through and reduces the impact on employment, but a larger labor supply elasticity has the effect of reducing the extent of pass-through and increasing the impact on employment. In addition, the ability to pass on payroll taxes as lower wages will depend on the extent to which there are downward wage rigidities (for example, due to minimum wages or union-bargained wages).

The theoretical predictions must be qualified when the presence of an informal sector is taken into consideration. Albrecht, Navarro, and Vroman (2008) develop a matching model of an economy with a formal and an informal sector, in which formal/informal activity is a choice made by the worker. In this model, workers are heterogeneous in their productivity. The effect of an increase in payroll taxes is to reduce accessions and job creation in the formal sector and increase accessions into the informal sector. Unemployment among those searching formal jobs increases and aggregate employment falls. Thus, labor taxes may induce firms and workers to engage in informal sector activities in which they do not obey labor market regulations. There is, of course, a cost to not complying with these regulations, but if firms operate at a small scale they may be able to go undetected and still avoid paying taxes. Even if they go undetected, the fact that they have to operate at a small and possibly suboptimal scale would also impose costs. Nonetheless, if the taxes are high enough the costs of operating in the informal sector may still mean that firms prefer this option.

In general, the theoretical models predict that the magnitude of the impact of labor taxes on employment should depend on how much workers value the benefits received from payroll taxes, and on the degree of wage rigidities. Since we expect that workers do not fully value benefits and that there is some degree of wage rigidities, higher payroll taxes should decrease employment and increase unemployment. In the presence of informality, formal sector employment should fall.

These theoretical predictions have been confirmed by a host of empirical studies. Most of those that use aggregate data at the country level include developed countries only. They find that the effect of payroll taxes on employment is small or not statistically significant (Brittain, 1972; Vroman, 1974a; Blanchard and Wolfers, 2000; Daveri and Tabellini, 2000), and that the shifting of the social security contributions onto wages is either complete (Gordon, 1972, who uses quarterly data from 1954–70 for the United States) or partial (40 percent, according to

Vroman, 1974b, based on manufacturing quarterly data from 1956 to 1974 in the United Kingdom; about one-third according to Hamermesh, 1979, based on U.S. data for the period from 1967 to 1973; also about one-third for Sweden between 1951 and 1979 according to Holmlund, 1983; and 80 percent for the Netherlands between 1950 and 1966, according to Weitenberg, 1969).

The only study that uses country-level data that include Latin American countries, Heckman and Pagés (2004), lends strong support to the theoretical prediction that, with partial shifting of social security contributions to wages, employment falls. The authors construct an unbalanced panel of 38 countries (23 in the OECD and 15 in Latin America) for the period 1983–1999 and estimate the effects of social security contributions on wages and employment. They find that the pass-through of higher social security contributions is nil in the OECD countries, but 36 percent in Latin America. A 10 percent increase in contributions reduces employment by 10 percent in OECD countries, but only by 4.5 percent in Latin America, where it is partly borne by workers.

The findings of a growing number of empirical studies that rely on micro-data are also mostly consistent with the theoretical predictions. These studies do not suffer from the two main potential weaknesses of those based on aggregate data, namely reverse causality, as labor outcomes may influence tax rates, and omitted variable bias, as payroll tax rates across countries may be correlated to other institutional factors that also relate to labor outcomes.

The more credible micro-based evidence exploits variation in payroll tax rates within countries that apply differentially across groups of individuals, firms, sectors, or regions, which make it possible to contrast within the same institutional environment how changing labor taxes affects labor outcomes of the groups subject to the change but not the labor outcomes of others. Studies for the United State find that reducing payroll taxes increases employment (Bishop, 1981; Bishop and Montgomery, 1993; Katz, 1996; Perloff and Wachter, 1979). Similar findings support the conclusion for Spain (Kugler, Jimeno and Hernanz, 2003) and the United Kingdom (Beach and Balfour, 1983).

A comprehensive survey of both country-level and micro-based studies concludes that, although the results are very heterogeneous, they consistently indicate that payroll taxes are *partially* shifted to workers in the form of lower salaries, and that the effect is stronger in the

longer run, and depends on the institutional features of labor markets and the type of taxes (Melguizo, 2009).

Evidence for Latin America is still limited but growing. Gruber (1997) exploits increases in payroll taxes over time in Chile that vary across firms to estimate the impact of payroll taxes on employment and wages, and finds no effect at all on employment, consistent with the fact that the additional labor costs are fully shifted to workers, given the strong connection between contributions and benefits. In a similar way, Cox Edwards (2002), differentiating between workers that contribute to the new Chilean pension system and those who do not, finds full shifting for women and partial shifting for men. Cruces, Galiani and Kidyba (2010) exploit the changes in payroll taxes in Argentina across regions in the 1990s. Using administrative data from the Integrated Retirement and Pension System they find no effect on employment (in spite of the fact that, probably due to downward wage rigidities, only 55 percent of the payroll tax is shifted to workers). In many other countries the link between benefits and contributions is likely to be weaker than in Chile or Argentina. Kugler and Kugler (2009) examined the effects of changes in payroll taxes over the 1980s and 1990s on formal employment and wages in Colombia, using a panel of manufacturing plants. They find that a 10 percent increase in payroll taxes lowered formal employment by between 4 percent and 5 percent and reduced wages between 1.4 percent and 2.3 percent. The low shifting in Colombia is likely to be the result of weak linkages between benefits and taxes and the presence of downward wage rigidities induced by a binding minimum wage. Since the authors find less shifting and larger employment losses for production than non-production workers, they conclude that reducing the social security contributions of low-wage workers may boost demand for this type of labor.

The theoretical prediction that payroll taxes encourage informality has found support in a few studies for Latin American and other developing countries. A study for Colombia (Mondragón-Vélez, Peña, and Wills, 2010) shows that a 10 percent increase in non-wage labor costs increases informality by 8 percent. Higher non-wage labor costs are associated with increased transitions from formal to informal employment and with decreased transitions from informal to formal employment. A study for Turkey (Betcherman Daysal, and Pagés, 2010) takes advantage of a reduction in social security contributions that affected some provinces but not others. The reduction increased the number of registered establishments and the number of employed workers registered and had no effect on wages.

### ***2.3 Labor Effects of VAT***

A flat tax levied on the value added in each of the production and distribution stages of all consumption goods is considered less distortive than other taxes that are levied on only some stages, some goods or some types of income because it does not affect production or investment decisions by firms.

However, since leisure is not taxed, the VAT will distort the allocation of workers' time between home (or, more in general, non-market) and work (or market) activities. Since leisure becomes cheaper, less time will be devoted to work. However, since disposable real income falls (as consumption goods are more expensive due to the VAT), there will be a greater incentive to work. Depending on whether the substitution or the income effect dominates, the supply of hours of work by those in the labor force may fall or increase. The VAT may also affect workers' participation decision. Since the VAT increases the cost of working, and therefore raises the reservation wage, it may reduce labor participation. These effects of VAT on labor supply are the same as those of income taxes, as discussed above. An important difference, however, is that the VAT does not tax all income, but only the part that is consumed. As happens with labor supply, the VAT may or may not increase saving because of the opposite directions in which the substitution and the income effect operate (the former will tend to increase saving, but the latter will tend to reduce it).<sup>6</sup>

The distinctive feature of VAT is that is paid by firms on the value added at each production stage, based on the difference between total sales and total input costs. The main difference between a VAT and a retail sales tax lies in the way it is collected and in who remits the tax to the government, a difference thought to create significant incentives to reduce tax evasion (Slemrod, 2008). Firms have an incentive to ask their suppliers for accurate receipts because they can deduct input costs from their VAT bill. In developing countries, where informality is pervasive, the self-enforcing nature of VAT is appealing to governments and tax administration offices, and no doubt it has contributed to its adoption throughout the world (Keen and Lockwood, 2010), from 47 countries in 1990 to over 140 today (Bird and Gendron, 2007).

However, the VAT may induce further informality. The labor allocation effects caused by the incomplete coverage of VAT due to the presence of an informal sector have largely been

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<sup>6</sup> For a textbook explanation of these effects, see Mankiw (2006), Chapter 21.

ignored in the literature, with a few important recent exceptions. Piggott and Whalley (2001) present numerical examples of a general equilibrium model, where a VAT base broadening increases informality and reduces welfare because the production of the goods previously excluded from the tax base becomes more informal. Emran and Stiglitz (2005) assess the welfare effects of revenue-neutral reforms that substitute VAT for trade taxes, taking into account the presence of formal and informal sectors that produce final goods that are imperfect substitutes. Contrary to the consensus that favors this type of reforms on welfare grounds, they find that, under plausible assumptions, informality increases and welfare is reduced. A similar conclusion is reached by Bird and Smart (2011) comparing the effects of payroll taxes and VAT in a general equilibrium model with informality. Each firm may decide to become informal in order to evade all payroll and value-added taxes, but if a firm becomes informal it suffers a scale penalty that reduces its productivity. As a result of this trade-off the most productive firms operate in the formal sector and the less productive in the informal sector. Compared to a payroll tax, in the presence of informality a VAT at the same tax rate results in lower real net wages paid to workers, a smaller formal sector and a larger informal production sector. Ahmad and Best (2012) construct a theoretical general equilibrium model that considers both the decision of the workers to move between formality and informality and the decision by firms to underreport their sales and profits in order to evade VAT and corporate income taxes. Therefore high VAT rates interact with corporate income taxes on incentives to underreport sales.

An important limitation of the general equilibrium models in all these papers is the absence of intermediate goods, making them ill-suited to represent the actual workings of the VAT, which is paid at each stage of production. Some recent work has attempted to fill this gap. Keen (2008) uses a general equilibrium model with informality and intermediate goods to highlight the importance of a feature of VAT that is stressed by practitioners but overlooked by models with no intermediate goods: that the VAT functions, in part, as a tax on the purchases of informal operators from formal sector business. As in previous models, an increase in the VAT rate reduces aggregate output and raises the share of the informal economy. However, the implication is not that tariffs are preferable to the VAT (as in Emran and Stiglitz, 2005), because it is more efficient to use a combination of VAT and withholding taxes that differentially tax the inputs of firms that are not tax compliant.

Antón, Hernández, and Levy (2012) develop a computable equilibrium model (calibrated for Mexico) with informality and intermediate goods to assess the labor effects of income and value-added taxes and social security contributions. In the model, the economy produces two intermediate and two final goods. One of the consumption goods, which is a close substitute for the other consumption good, is produced by self-employed workers and family firms, does not use inputs and does not pay any type of taxes or contributions. The remaining three goods are legally required to pay social security contributions, as well as income and value-added taxes (the latter at rates differentiated by good), though they may partly evade (some or all of) these obligations (risking fines with probabilities that increase with firm size). Therefore, there are two types of informal workers: those who work independently or in family firms and those who work for a salary at organized firms but do not pay social security contributions (so called “illegal workers”). Higher social security contributions increase the proportion of illegal workers in salaried work and raise the share of independent workers in total employment. (Since labor supply is fixed and wages are flexible no changes in total employment or unemployment occur.) Higher VAT rates, given government’s enforcement efforts, reduce total salaried employment and increase non-salaried work, as in previous models.

Since the model distinguishes intermediate and final goods it is well suited to take into account the key feature of VAT, namely that the tax applies to each sale and firms receive a credit for the VAT paid in the previous stage of production. If tax compliance is incomplete, firms in the final sector face a trade-off, since higher evasion in the intermediate sector implies lower input prices but also lower tax credit claims. The authors demonstrate that, as a result, the relative sizes of the sectors are affected by the degree of compliance with the VAT in each sector, as well as by the degree of differentiation of VAT rates.

The implications for informality of the credit method of collection of VAT have been modeled and empirically tested by De Paula and Scheinkman (2010). Their model exploits the idea that collecting value-added taxes according to a credit scheme sets in motion a mechanism for the transmission of informality. Since purchases from informal suppliers do not generate tax credits and informal buyers cannot use tax payment from formal suppliers, there is an incentive for informal firms to deal with other informal firms. Firms that evade taxes have to pay fines with a probability that increases with firm size. Therefore, firms trade off the cost of paying taxes versus the scale limitations of becoming informal. Their empirical analysis with data for around

48,000 small firms in Brazil shows that, in fact, various measures of formality of suppliers and purchasers are correlated with the formality of a firm.<sup>7</sup>

Apart from the work by De Paula and Scheinkman (2010), there is a dearth of empirical work on the effects of VAT on informality and other labor outcomes. While some previous works have uncovered evidence that higher tax rates induce informality (Johnson, Kaufmann, and Shleifer, 1997; Friedman et al., 2000), none has focused on VAT.

#### ***2.4 Labor Effects of Corporate Income Taxes***

Research on the labor market implications of corporate taxation is scant, both in the developed and the developing world. Yet, through their indirect effect on labor demand, corporate taxes may affect employment and wages and may contribute to informality and involuntary unemployment. Any increase in the cost of capital, including taxes, can affect the labor market by reducing output, by inducing factor substitution, and by reducing labor productivity. The higher cost of capital due to a corporate tax will increase production costs and lead to a fall in output, thereby decreasing the demand for both capital and labor. However, the increase in the relative price of capital with respect to labor will favor the relative demand for labor, partly offsetting the former effect. Finally, lower levels of capital will reduce the productivity of workers leading to a fall in the wage rate. The corporate income tax may also result in some production moving from the formal to the informal sector, increasing demand for labor in the latter, and at least partially countering the negative effect on employment in the formal sector. The overall effect on employment in the economy will depend on the relative labor intensities between the two sectors and the substitutability of labor and capital (see OECD, 2011, for further elaboration and references).

Corporate income taxes (CITs) may also interact with other taxes affecting the labor market in unintended ways. For instance, the general equilibrium model by Ahmad and Best (2012) mentioned above shows that corporate income taxes induce joint underreporting of profits and sales in order to evade both the CIT and the VAT. On the opposite direction, however, the CIT makes formal workers relatively cheaper reducing incentives to operate in the informal sector.

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<sup>7</sup> Enforcement efforts may affect the transmission of evasion of VAT, as found through a randomized experiment among Chilean firms by Pomeranz (2010).

Empirical research on these theoretical predictions is still very limited. Carroll et al. (2000) analyze the effect of the 1986 tax reform in the U.S on the labor demand by sole proprietors. They find that a reduction of 10 percent in the personal income tax rate increases the probability that a firm (or the proprietor) hires someone by 12.1 percent and reduces the rate of growth of the wage bill. Focused on the European Union, Bettendorf, van der Horst, and De Mooij (2009) analyze the impact of corporate taxation on employment and unemployment in the context of an imperfect labor market model. The analysis is performed with an applied general equilibrium model that adopts a union bargaining framework to explain equilibrium unemployment on the basis of several institutional variables. They find that raising the corporate income tax revenue by 0.5 percent leads to a 0.2 percentage point increase in unemployment and a 0.2 percent reduction in labor supply (on average for the 17 EU countries).

There is scant evidence on the impact of corporate taxes on labor demand in developing countries. Chile has been the subject of some of the few studies. Martínez, Morales, and Valdés (2001) assess the employment effect of corporate taxes through potential complementarities. They conclude that the labor to cost of capital elasticity is near 0.2, implying that, by increasing the cost of capital a higher corporate tax rate should depress labor demand. Cerda and Larraín (2010), using firm-level data from Chile for 1981–96 (a period of high volatility in corporate income tax rates), find that corporate income taxes reduce the demand for labor due to its complementarity with capital. A 1 percent increase in corporate income tax revenue reduces labor demand by 0.2 percent. Of special interest is the asymmetric effect of taxation according to company size. The impact on labor demand is significantly higher in large corporations than in small enterprises, while the demand for capital is more responsive to corporate tax changes in small firms (being less credit constrained larger firms are more easily able to cover the high costs of firing workers). It should be noted the dataset used in this study includes only registered firms with more than 10 employees, and therefore its findings are silent with respect to the impact of corporate income taxes on micro-size firms and independent workers (which are identified with informality in our empirical work below). Presumably, by shifting labor from larger to smaller firms the corporate income tax may have deleterious effects on the formal/informal composition of employment, a topic that has been studied empirically by Loayza (1996). Using data from Latin American countries in the early 1990s, Loayza finds that the size of the informal sector depends positively on the maximum corporate income tax rate. His results also confirm the



importance of the quality of government institutions for discouraging informality. A sequel of Loayza's work is Vuletin (2008), mentioned above, which includes corporate income taxes as part of the tax burden variable that is causally related to informality.

### ***2.5 Trade Taxes and Labor Outcomes***

The influence of import tariffs on labor outcomes attracted a great deal of attention by policymakers and researchers in the wake of the trade liberalization wave of the late 1980s and early 1990s in Latin America. According to basic international comparative advantage theory, the promoters of the reforms expected that trade liberalization would stimulate the demand for unskilled labor as a factor of production assumed to be relatively abundant in the Latin American countries, and hence it would increase wages. They were aware that in the short run slashing import tariffs and restrictions could increase unemployment and reduce wages in the sectors most heavily protected by the trade barriers before the reforms. Given the widely held opinion that trade liberalization did not deliver the promised improvements in labor outcomes but contributed to unemployment and wage declines and worsened income distribution (see, for instance, SAPRIN, 2002), a veritable army of researchers put themselves to the task of disentangling the labor impacts of trade taxes. For the purposes of this paper a brief summary of the main findings of this abundant research should suffice (for a detailed survey see Lora, 2011).

The econometric evidence (Márquez and Pagés, 1998) does not provide a basis for saying that import tariff reductions (or other trade liberalization measures) lowered total levels of employment or raised unemployment rates. Although several studies conclude that trade liberalization does seem to have affected industrial employment, the effect was surprisingly small in view of the extent of reductions in tariffs and other mechanisms for protecting industry (Cárdenas and Gutiérrez, 1997; Hanson and Harrison, 1999; Haltiwanger et al., 2004; Márquez and Pagés, 1998; Revenga, 1997).<sup>8</sup> The explanation lies partly in the fact that the adjustment took place through wages and partly because tariff reductions had little impact on production in the affected sectors.

Wages in the manufacturing sectors fell substantially as a result of tariff reductions (Goldberg and Pavcnik, 2001; Revenga, 1997). For instance, in the cases of Mexico and

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<sup>8</sup> The only country with large employment effects was Uruguay (Casacuberta, Fachola, and Gandelman, 2004; Rama, 1994).

Colombia, it is calculated that the tariff reductions caused a 3–4 percent drop in wages in the manufacturing sector as a whole. However, due to their short time horizon, the studies do not provide a basis for saying whether the wage drops were permanent.

Given the increase of wage gaps between skilled and unskilled workers observed in most Latin American countries in the 1990s, many researchers wondered whether it was due to trade liberalization. Although various studies did find a significant relationship between the two variables, there is consensus that the influence of liberalization on the wage gap was modest and indirect, possibly reflecting the influence of technological change (see, among many others, Galiani and Sanguinetti, 2003 for Argentina; Goldberg and Pavcnik, 2005 for Colombia; Pavcnik et al., 2002 for Brazil; and Hanson and Harrison, 1999 for Mexico).

In summary, against the expectations of the reformers, and the fears of their detractors, trade tax reductions did not have major consequences on labor outcomes. The most salient effect was a reduction in wages in the manufacturing sectors previously protected.

### **3. Data Sources**

The remaining of this paper is an empirical exploration of the effects of taxes on employment, unemployment, informality, and wages in Latin America. The information on all the labor variables comes from a single source, namely SEDLAC (CEDLAS and the World Bank, 2011), based on about 200 household surveys for 15 countries between 1990 and 2009. The advantage of this source is that all the variables were computed using identical methodologies, thus ensuring internal consistency and minimizing measurement errors. We describe the main labor variables in Table 1 and provide basic statistical indicators of these variables in Table 2.

To assess the influence of taxation policies on labor outcomes, we focus on statutory tax rates rather than tax revenues or tax productivity variables, since the latter are more susceptible to be endogenous to the labor outcomes. The set of tax variables of interest in our analysis are payroll taxes, VAT, and corporate income taxes. Personal income taxes were excluded of the analysis because the tax rates applicable to the income levels of the large majority of workers in our samples are nil or extremely low, and display very little variation through time. Considering the extensive knowledge on the effects of import tariffs, they also have been excluded from the analysis (although average effective tariff rates are included as controls in our regressions

below). Tax rates come from government agencies, ECLAC, and KPMG and Lora (2001). Table 3 contains basic statistical indicators of the tax variables.

**Table 1. Description of Labor Variables**

<b>Labor Force Participation Rate</b>	Proportion of a country's working-age population that engages actively in the labor market, either by working or looking for work.
<b>Employment-to-population Ratio</b>	Proportion of a country's working-age population that is employed.
<b>Unemployment Rate</b>	Proportion of a country's labor force that is looking for work.
<b>Informality Rate</b>	Ratio between the number of persons in informal sector employment and the total number of employed persons. A worker is informal if either (s)he works in a small firm (1), or is self-employed or is an unpaid worker.
<b>Monthly Wages</b>	Wages paid by principal work activity (usually net of contributions and tax withholdings)
<b>Monthly Wages, Formal Workers</b>	Wages paid by principal work activity of formal workers, using the productive definition of informality.
<b>Monthly Wages, Informal Workers</b>	Wages paid by principal work activity of informal workers, using the productive definition of informality.
<b>Education levels: low, medium, high</b>	Low: 9 or less years of formal education; medium: between 9 and 12 years of formal education; high: 13 or more years of formal education.

*Source:* Socio-Economic Database for Latin America and the Caribbean (CEDLAS and World Bank).

*Note:* (1) In most household surveys small firms are defined as those with up to five workers.

**Table 2. Basic Statistical Indicators of Labor Outcomes 1990-2009**

Country	Number of Surveys	Participation Rate		Employment to Population Rate		Unemployment Rate		Informality Rate	
		<i>Average</i>	<i>Std. Dev</i>	<i>Average</i>	<i>Std. Dev</i>	<i>Average</i>	<i>Std. Dev</i>	<i>Average</i>	<i>Std. Dev</i>
Argentina	18	0.611	0.010	0.524	0.025	0.129	0.041	0.461	0.039
Bolivia	12	0.719	0.014	0.688	0.013	0.042	0.011	0.733	0.028
Brazil	26	0.662	0.026	0.617	0.017	0.067	0.020	0.556	0.034
Chile	7	0.555	0.018	0.506	0.017	0.089	0.018	0.375	0.028
Colombia	12	0.640	0.021	0.559	0.021	0.126	0.024	0.602	0.013
Costa Rica	21	0.587	0.019	0.555	0.015	0.054	0.011	0.423	0.021
Dominican Republic	10	0.556	0.006	0.534	0.008	0.040	0.010	0.526	0.009
Ecuador	10	0.682	0.025	0.637	0.017	0.063	0.034	0.628	0.025
El Salvador	15	0.602	0.009	0.560	0.009	0.069	0.006	0.563	0.016
Guatemala	5	0.659	0.013	0.648	0.014	0.018	0.003	0.674	0.021
Honduras	17	0.601	0.022	0.583	0.022	0.029	0.006	0.597	0.025
Mexico	11	0.605	0.028	0.584	0.027	0.034	0.008	0.506	0.028
Nicaragua	4	0.654	0.019	0.561	0.051	0.143	0.066	0.649	0.009
Panama	14	0.595	0.026	0.538	0.032	0.095	0.022	0.470	0.023
Paraguay	11	0.692	0.015	0.644	0.017	0.069	0.015	0.705	0.022
Peru	13	0.720	0.018	0.684	0.021	0.049	0.007	0.653	0.015
Uruguay	16	0.606	0.020	0.539	0.029	0.110	0.029	0.423	0.022
Venezuela	13	0.650	0.036	0.573	0.023	0.115	0.034	0.471	0.057
<b>Average</b>	<i>13</i>	<i>0.633</i>	<i>0.019</i>	<i>0.585</i>	<i>0.021</i>	<i>0.075</i>	<i>0.020</i>	<i>0.556</i>	<i>0.024</i>

Source: Socio-Economic Database for Latin America and the Caribbean (CEDLAS and World Bank, 2011)

**Table 2. Basic Statistical Indicators of Labor Outcomes, 1990-2009 (continued)**

Country	Log of Monthly Wage (2000 prices)		Log of Monthly Wage , Informal Workers (2000 prices)		Log of Monthly Wage , Formal Workers (2000 prices)		Log of Informal/Formal Real Monthly Wage	
	<i>Average</i>	<i>Std. Dev</i>	<i>Average</i>	<i>Std. Dev</i>	<i>Average</i>	<i>Std. Dev</i>	<i>Average</i>	<i>Std. Dev</i>
Argentina	6.905	0.122	6.635	0.181	7.080	0.112	-0.444	0.129
Bolivia	7.306	0.101	6.901	0.099	7.763	0.104	-0.862	0.128
Brazil	6.773	0.061	6.255	0.080	7.098	0.051	-0.843	0.052
Chile	12.878	0.127	12.643	0.125	13.024	0.119	-0.380	0.060
Colombia	13.232	0.103	12.814	0.029	13.796	0.020	-0.982	0.013
Costa Rica	11.967	0.105	11.720	0.096	12.110	0.111	-0.390	0.061
Dominican Republic	8.707	0.147	8.518	0.145	8.873	0.152	-0.355	0.045
Ecuador	15.444	0.213	15.173	0.169	15.720	0.229	-0.548	0.109
El Salvador	7.946	0.063	7.629	0.051	8.260	0.136	-0.631	0.144
Guatemala	7.503	0.070	7.135	0.069	7.856	0.082	-0.722	0.062
Honduras	8.212	0.139	7.831	0.176	8.527	0.149	-0.696	0.087
Mexico	8.610	0.097	8.147	0.101	8.839	0.087	-0.692	0.068
Nicaragua	7.805	0.062	7.608	0.228	8.018	0.091	-0.412	0.382
Panama	6.368	0.082	5.895	0.189	6.600	0.038	-0.705	0.165
Paraguay	13.915	0.108	13.588	0.135	14.349	0.112	-0.761	0.135
Peru	6.866	0.112	6.465	0.125	7.249	0.109	-0.784	0.083
Uruguay	9.027	0.114	8.674	0.143	9.216	0.099	-0.542	0.076
Venezuela	12.743	0.169	12.501	0.163	12.914	0.144	-0.413	0.055
<i>Average</i>	<i>9.567</i>	<i>0.111</i>	<i>9.230</i>	<i>0.128</i>	<i>9.850</i>	<i>0.108</i>	<i>-0.620</i>	<i>0.103</i>

Source: Socio-Economic Database for Latin America and the Caribbean (CEDLAS and World Bank 2011).

**Table 3. Basic Statistical Indicators of Tax Variables, 1985-2009**

Country	Total payroll taxes			Contribution rate to health (sickness and maternity) programs			Other payroll taxes (1)		
	<i>Average</i>	<i>Std. Dev</i>	<i>No. Changes</i>	<i>Average</i>	<i>Std. Dev</i>	<i>No. Changes</i>	<i>Average</i>	<i>Std. Dev</i>	<i>No. Changes</i>
Argentina	0.480	0.067	6	0.081	0.020	6	0.399	0.048	2
Bolivia	0.231	0.012	4	0.100	0.000	4	0.131	0.012	0
Brazil	0.323	0.027	4	(a)	.	.	(a)	.	.
Chile	0.199	0.015	2	0.070	0.000	2	0.129	0.014	0
Colombia	0.309	0.057	9	0.107	0.023	8	0.202	0.040	5
Costa Rica	0.321	0.021	3	0.148	0.000	2	0.173	0.021	0
Dominican Republic	0.153	0.042	8	0.097 (b)	0.004	7	0.115 (b)	0.011	5
Ecuador	0.192	0.002	1	0.049	0.006	2	0.142	0.003	2
El Salvador	0.171	0.039	6	0.099	0.008	1	0.072	0.033	6
Guatemala	0.165	0.008	2	0.060	0.000	0	0.105	0.008	2
Honduras	0.130	0.001	1	0.075	0.000	0	0.055	0.001	1
Mexico	0.293	0.046	12	0.139	0.053	12	0.153	0.007	2
Nicaragua	0.188	0.023	1	0.083	0.000	0	0.105	0.023	1
Panama	.	.	.	.	.	.	.	.	.
Paraguay	0.255	0.000	0	(a)	.	.	(a)	.	.
Peru	0.242	0.033	12	0.090	0.000	0	0.151	0.033	12
Uruguay	0.344	0.021	4	0.077	0.005	1	0.267	0.020	3
Venezuela	0.183	0.030	5	0.053 (c)	0.000	0	0.146 (c)	0.002	1
<b><i>Average</i></b>	<b><i>0.246</i></b>	<b><i>0.026</i></b>	<b><i>4.706</i></b>	<b><i>0.091</i></b>	<b><i>0.008</i></b>	<b><i>3.000</i></b>	<b><i>0.160</i></b>	<b><i>0.018</i></b>	<b><i>2.800</i></b>

Sources: Government agencies; ECLAC; KPMG.

Notes:

1) Includes mandatory contributions to five types of programs: Old age, disability, and survivors; Work injury; Unemployment and Family allowances, as well as mandatory contributions to subsidized housing and labor training programs

(a) Contribution rate does not discriminate contributions to different social security subsystems

(b) Data available from 2002.

(c) Data available from 1998.

**Table 3. Basic Statistical Indicators of the Tax Variables. 1985-2009 (continued)**

Country	VAT			Corporate Income Taxes (Maximum Rate)		
	<i>Average</i>	<i>Std. Dev</i>	<i>No. Changes</i>	<i>Average</i>	<i>Std. Dev</i>	<i>No. Changes</i>
Argentina	0.194	0.023	4	0.318	0.042	3
Bolivia	0.122	0.014	1	0.162	0.124	2
Brazil	0.300	0.009	2	0.354	0.068	5
Chile	0.184	0.010	3	0.144	0.026	4
Colombia	0.140	0.025	4	0.336	0.026	5
Costa Rica	0.119	0.017	3	0.316	0.055	1
Dominican Republic	0.092	0.039	4	0.323	0.109	5
Ecuador	0.109	0.010	1	0.280	0.061	1
El Salvador	0.125	0.012	1	0.278	0.043	2
Guatemala	0.092	0.021	2	0.322	0.050	4
Honduras	0.087	0.031	2	0.357	0.085	5
Mexico	0.144	0.017	1	0.341	0.036	8
Nicaragua	.	.	.	.	.	.
Panama	0.050	0.000	0	0.403	0.081	3
Paraguay	0.100	0.000	0	0.264	0.076	2
Peru	0.164	0.038	9	0.325	0.055	4
Uruguay	.	.	.	.	.	.
Venezuela	0.136	0.026	7	0.388	0.079	2
<b><i>Average</i></b>	<i>0.135</i>	<i>0.018</i>	<i>2.750</i>	<i>0.307</i>	<i>0.064</i>	<i>3.500</i>

*Sources:* Government agencies; ECLAC; KPMG

Other control variables included in the regressions are the GDP per capita (PPP terms, in logs) and the terms of trade (in logs). In addition, we have econometric specifications including the Kaufmann index of government effectiveness (Kaufmann, Kraay, and Mastruzzi, 2009), the statutory minimum wage and a labor flexibility index (see Appendix 1 for details of the index). Other variables included for robustness checks are as follows (all from WEO and WDI databases).

- Country's GDP growth
- Growth of Terms of Trade
- Population ages 25–54 (percent of total WAP) and Population ages 55–64 (percent of total WAP)
- USA Real Lending Interest Rate
- World GDP growth
- Real Effective Exchange Rate.

#### 4. Econometric Strategy

The econometric strategy attempts to exploit the (within country) variation of statutory tax rates over time in an (unbalanced) panel of 15 countries containing nearly 200 annual observations for a set of labor outcome variables during the period 1990-2009.

To relate a set of tax variables  $T_{it}$  to a set of labor variables  $Y_{it}$ , which are our dependent variables, controlling for other variables  $X_{it}$  in country  $i$  for period  $t$ , we estimate the following model:

$$Y_{it} = \beta T_{it-1} + \delta X_{it-1} + \tau_i + \varepsilon_{it} \tag{1}$$

where  $\tau_i$  are country fixed effects and  $\varepsilon_{it}$  a mean zero error. The explanatory variables are lagged one period in order to mitigate potential endogeneity and to allow for slow adjustment processes of the dependent variables in response to changes in the regressors. Given the infrequent changes across time in the explanatory variables of interest ( $T_{it}$ ) this implies little cost in terms of not adequately exploiting the dynamics of the dependent variables. The use of country fixed effects is dictated by our interest in assessing the effects on labor outcomes of changes in tax rates within countries across time controlling for unobserved variables that might be correlated with the tax variables.



Since institutional differences across countries in a set of dimensions  $Z_{it}$  (which also vary over time) are important sources of heterogeneity in our analysis, the previous basic model will be expanded in the following form:

$$Y_{it} = \beta T_{it-1} + \delta X_{it-1} + \theta Z_{it-1} + \gamma(T_{it-1} * Z_{it-1}) + \tau_i + \varepsilon_{it} \quad (2)$$

In addition, we estimate several models to check for robustness of both (1) and (2). The set of other explanatory variables ( $W_{it}$ ) include the additional controls mentioned in the last paragraph of the previous section. We estimate separate models for each additional control, which means we have six different robustness checks for the model of each dependent variable  $Y_{it}$  with and without including the interaction of taxes with institutional variables. Therefore, we have two different specifications:

$$Y_{it} = \beta T_{it-1} + \delta X_{it-1} + \theta W_{it-1} + \tau_i + \varepsilon_{it} \quad (3)$$

and

$$Y_{it} = \beta T_{it-1} + \delta X_{it-1} + \theta Z_{it-1} + \gamma(T_{it-1} * Z_{it-1}) + \theta W_{it-1} + \tau_i + \varepsilon_{it} \quad (4)$$

A matter of terminology: we will consider as “strongly robust” any coefficient that is significant at least at the 5 percent level in at least five of the six alternative robustness tests, as “mildly robust” any that is significant in three or four of the six tests, and as “not robust” those that do not meet the previous criteria.

The fixed-effect estimation results of the basic model in equation (1) can be seen in Table 4, but detailed explanation of effects below is based on results shown in Tables 6 through 8, which come from alternative versions of (3) and (4) above, but show the relevant coefficients for the independent variables of interest only, not the control variables or further tests or statistics. In other words, each coefficient in Tables 6 through 8 comes from a separate regression (and the number of -/+ signs indicate the degree of robustness of the coefficient, taking into account the six additional regressions per coefficient (not shown)).

**Table 4. Fixed-Effects Model of the Labor Effects of Taxes**

Fixed Effects Model	Participation Rate	Employment to Population Rate	Unemployment Rate	Informality Rate	Log of Monthly Wage (2000 prices)	Log of Monthly Wage, Informal Workers (2000 prices)	Log of Monthly Wage, Formal Workers (2000 prices)	Log of Informal/Formal Real Monthly Wage	Theil coefficient
Total Payroll Taxes (t-1)	0.047 (0.051)	-0.041 (0.062)	0.082 (0.062)	0.201* (0.098)	0.385 (0.761)	1.358* (0.736)	0.279 (0.703)	1.080** (0.372)	-0.176 (0.139)
VAT (t-1)	-0.130 (0.149)	-0.249 (0.149)	0.202 (0.259)	0.300* (0.141)	-0.959 (1.347)	-1.582 (1.394)	-0.242 (1.621)	-1.340** (0.495)	0.593 (0.478)
Maximum Businesses' Tax Rate (t-1)	0.048 (0.047)	0.008 (0.050)	0.079 (0.046)	-0.078 (0.072)	0.113 (0.417)	-0.218 (0.471)	0.099 (0.501)	-0.317* (0.178)	-0.003 (0.102)
Average Import Tariffs (t-1)	-0.057 (0.033)	-0.033 (0.021)	-0.028 (0.043)	-0.031 (0.045)	-0.111 (0.447)	0.058 (0.410)	-0.032 (0.517)	0.090 (0.188)	-0.392*** (0.075)
Log of GDP per capita (PPP) (t-1)	0.029** (0.011)	0.044*** (0.009)	-0.019 (0.015)	-0.084*** (0.019)	0.173 (0.109)	0.149 (0.089)	0.171 (0.115)	-0.022 (0.057)	-0.094** (0.032)
Log of Terms of Trade (t-1)	0.004 (0.009)	0.019** (0.007)	-0.026*** (0.008)	-0.016 (0.015)	-0.001 (0.052)	0.060 (0.066)	-0.027 (0.066)	0.087 (0.050)	-0.026 (0.030)
Constant	0.367*** (0.099)	0.167* (0.092)	0.279** (0.108)	1.283*** (0.112)	8.422*** (0.907)	7.827*** (0.718)	8.636*** (0.859)	-0.809 (0.533)	1.459*** (0.289)
Observations	177	177	177	165	201	189	189	189	176
R-squared	0.227	0.342	0.133	0.498	0.157	0.207	0.127	0.194	0.139
Number of countries	15	15	15	15	15	15	15	15	15
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors clustered at the country level in parentheses

Significant variable at: \*\*\* 1%, \*\* 5%, \* 10%

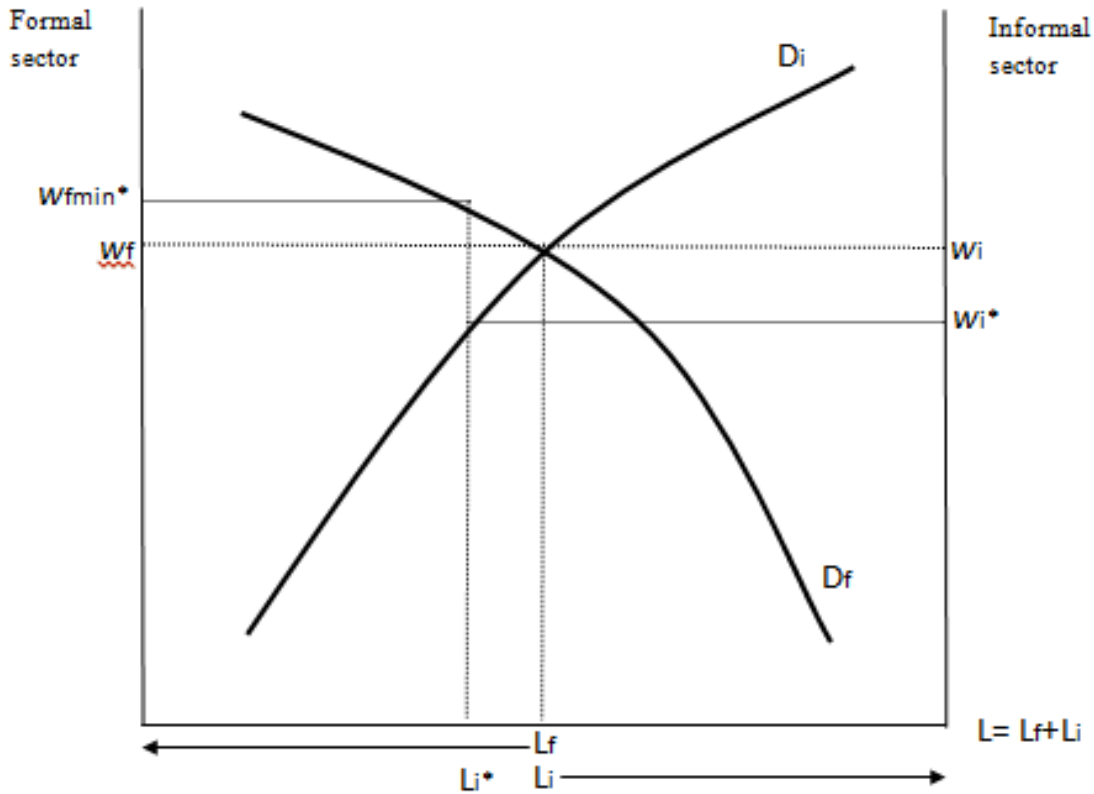
*Note:*

Fixed effects model with robust standard errors clustered at the country-level. The specification includes tax variables lagged one period as well as one lag of the log of the GDP per capita (2000 constant dollars) and the log of Terms of Trade.

## 5. A Simple Analytical Framework

In order to discuss the econometric results on the basis of theoretical predictions, it is useful to introduce a simple analytical framework that describes the labor market of an economy with formal and informal firms and no unemployment (taken from Levy, 2008, pp. 142-155). Figure 1 represents such an economy under the assumption that the labor supply, which is fixed at  $L$ , is fully occupied in the formal and the informal segments of the labor market (initially,  $L=L_f+L_i$ ). Each segment has its own labor demand, which depends on the capital stocks and the technologies used in each sector, and which is assumed to be consistent with profit maximization. Labor demand in the informal segment ( $D_i$ ) is drawn from right to left. At equilibrium, if there are no wage rigidities, wages in both segments are the same ( $w_f=w_i$ ), since workers are assumed to move freely between them. If a binding minimum wage ( $w_{fmin}^*$ ) is introduced in the formal segment, informality will increase to  $L_i^*$ , and informal wages will fall to  $w_i^*$ . In this simplified model, there will be no involuntary unemployment. Taxes will be introduced subsequently in the following sections.

**Figure 1. Formal and Informal Segments of the Labor Market without Taxation**

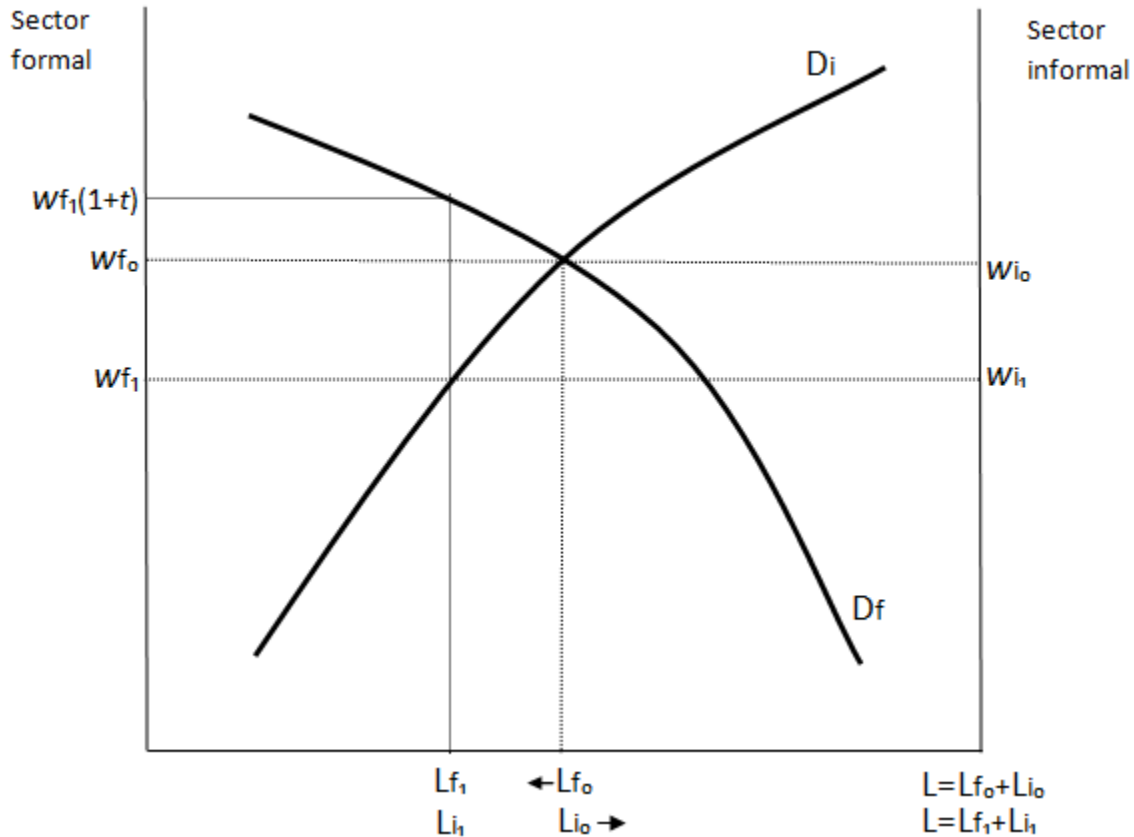


*Explanation:* Labor supply, which is fixed at  $L$ , is fully employed in the formal and the informal segments of the labor market ( $L=L_f+L_i$ ). Notice that labor demand in the formal segment ( $D_f$ ) and formal employment ( $L_f$ ) are shown from left to right, while labor demand in the informal segment ( $D_i$ ) and informal employment ( $L_i$ ) are shown from right to left. At equilibrium, if there are no wage rigidities, wages in both segments are the same ( $w_f=w_i$ ), since workers are assumed to move freely between them. If a binding minimum wage ( $w_{fmin}^*$ ) is introduced in the formal segment, informality will increase to  $L_i^*$ , and informal wages will fall to  $w_i^*$ . There will be no unemployment.

## 6. The Labor Effects of Payroll Taxes

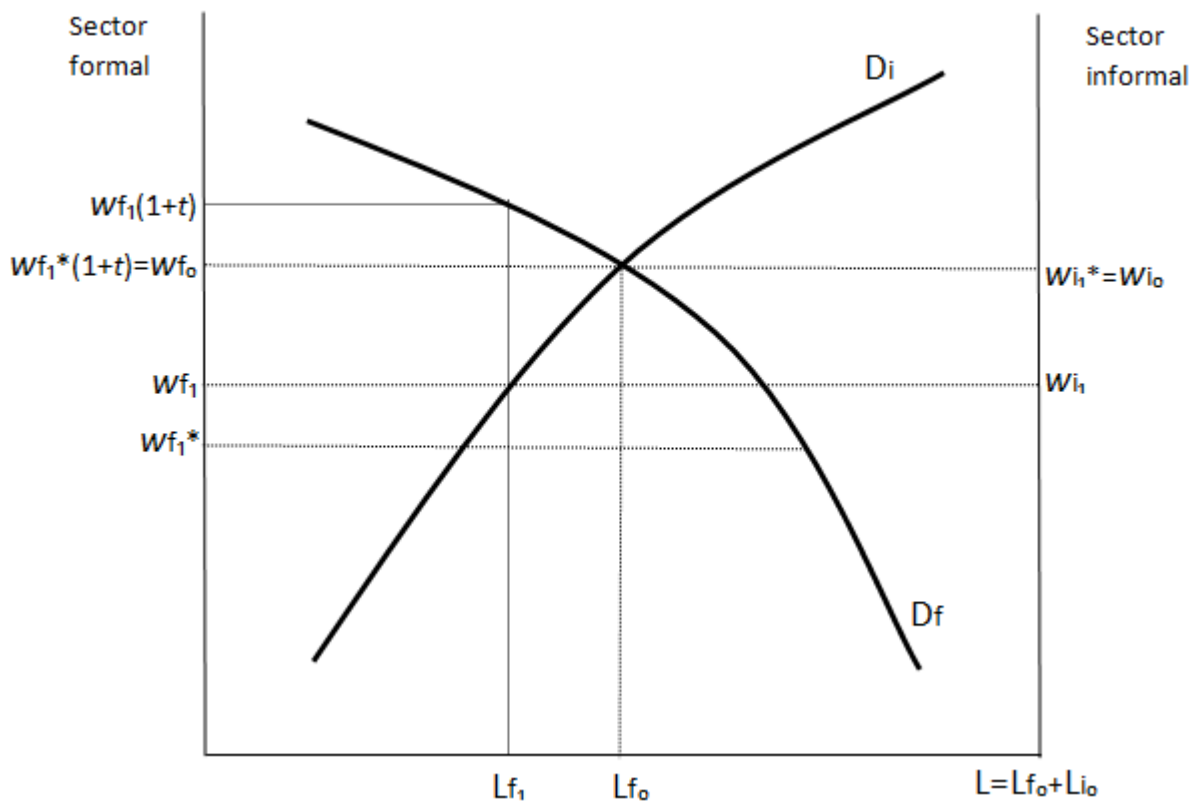
As discussed, theoretical models predict that the labor effects of payroll taxes depend on whether workers value the benefits associated with those taxes. Figure 2 represents the case where there are no benefits, wages are fully flexible and the labor supply is fixed. The tax introduces a wedge ( $t$ ) between the cost paid by the firm and the net wage received by the workers. As a result, formal employment falls to  $Lf_1$  and net wages received by workers are reduced to  $wf_1$  in the formal segment and  $wi_1$  in the informal segment, so that all the labor force is occupied ( $L=Lf_0+Li_0$ ). Thus, this simple framework predicts that a payroll tax that offers no individual benefits to workers increases informality and reduces wages across both sectors. If net wages in the formal segment face downward rigidity, the relative wages of the informal workers would fall. On the other hand, a payroll tax that generates benefits valued by the workers by exactly the same amount as the tax would leave the original labor market equilibrium unchanged, because the tax would be considered by workers as part of their income (Figure 3). In this case, however, the relative wages of the informal workers would increase (in the amount of the tax) with respect to the net wages of the formal workers. Table 5 summarizes the theoretical predictions based on this analytical framework, including other possible cases that require no additional explanation.

**Figure 2. Formal and Informal Segments of the Labor Market with a Payroll Tax (and no benefits)**



*Explanation:* As in Figure 1, in the absence of taxation, the labor market is in equilibrium when wages are the same in the formal and the informal segments ( $w_{f_0} = w_{i_0}$ ) and all the labor force is employed in the formal and the informal segments ( $L = L_{f_0} + L_{i_0}$ ). A payroll tax introduces a proportional wedge ( $t$ ) between the cost of labor for the firm and the wage received by workers. This implies that formal employment falls to  $L_{f_1}$  and net wages received by workers to  $w_{f_1}$ , since this is the only possible combination that makes (net) wages received by workers equal in the formal and the informal segments ( $w_{f_1} = w_{i_1}$ ) and assures full employment ( $L = L_{f_0} + L_{i_0}$ ). Therefore, the tax reduces wages received by all workers and increases informality. For further explanation see Levy (2008, pp. 142-155).

**Figure 3. Formal and Informal Segments of the Labor Market with a Payroll Tax that Generates Benefits by the Same Amount**



*Explanation:* Starting with the situation depicted in Figure 2, this figure shows what would occur if the tax generates individual benefits to the workers by exactly the same amount as the tax. This amounts to formal workers considering the tax part of their remuneration. The labor market can only achieve equilibrium when *gross* wages in the formal segment are equal to the remuneration received by informal workers ( $w_{f_1}^*(1+t) = w_{i_1}^*$ ) and all the labor force is employed in the formal and the informal segments combined. The equilibrium is the same as if there were no tax. For further explanation see Levy (2008, pp. 142-155).

**Table 5. Predicted Changes in Labor Outcomes of Introducing a Payroll Tax  
(when labor supply is fixed)**

	Net wage rigidity in formal segment?	Informality	Net wages of formal workers	Wages of informal workers	Relative wages of informal workers
No benefits	No	+	-	-	0
	Yes	+	0	-	-
Benefits by same amount	No	0	-	0	+
	Yes	+	0	-	-
Benefits by less than the tax	No	+	-	-	+
	Yes	+	0	-	-

A summary of regression results testing these hypotheses is presented in Table 6. In the base model informality increases, wages of informal workers go up and relative wages of informal workers increase, but only the latter effect is robust across specifications.<sup>9</sup> This set of results is consistent with the case where benefits are valued by less than the tax and there are no wage rigidities. However, in that case the analytical framework predicts that net wages, both in the formal and the informal segments should fall, which is not observed. The results by educational group are even weaker. Only in the case of medium education workers is it observed that the relative wages of informal workers increase, but informality does not increase and wages do not fall.

Apparently, therefore, payroll taxes do not have clear effects on labor markets. This, however, is the result of mixing different types of payroll taxes within the bag of total payroll taxes.

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<sup>9</sup> As mentioned before, robustness checks are performed introducing six controls, one by one. The number of positive or negative signs in the summary tables corresponds to the number of those checks where the coefficient is significant at least at the 95 percent confidence level. Complete regression results are presented as appendices.



**Table 6. The Labor Effects of Payroll Taxes**

Payroll Taxes	Participation Rate	Employment to Population Rate	Unemployment Rate	Informality Rate	Log of Monthly Wage (2000 prices)	Log of Monthly Wage, Informal Workers (2000 prices)	Log of Monthly Wage, Formal Workers (2000 prices)	Log of Informal/Formal Real Monthly Wage
a. Base Model								
i. All groups	0.047	-0.041	0.082	0.201*	0.385	1.358*	0.279	1.080**
				+				+++++
ii. By Educational Group								
-Low	-0.001	-0.128*	0.153*	0.117	0.399	2.012	-0.034	2.046
		-						
-Medium	0.134*	0.055	0.031	-0.125	0.385	1.135	0.203	0.932**
	+					+		+++++
-High	0.178*	0.084	0.007	-0.213	0.385	0.983	0.846	0.137
b. By Type of Social Security Contribution								
- Others (all groups)	-0.099**	-0.136**	0.021	0.066	2.094***	2.527***	0.726	1.802***
	---	---			+++++	+++++		+++++
- Health (all groups)	0.408***	0.117	0.372	0.359*	-1.304***	0.441	0.358	0.084
	+++++	+		++	----			
c. Interaction with Institutional Variables (all groups)								
Payroll Taxes	0.071	-0.043	0.124	0.170	-0.129	0.722	-0.300	1.022**
								+++++
x Government Effectiveness	0.046	-0.010	0.055	0.068	1.342*	1.599**	2.193*	-0.593
						+++++		
Payroll Taxes	-0.022	-0.046	0.015	0.039	0.084	0.684	0.118	0.566
x Minimum Wage / Mean Wage	0.005	0.049	-0.024	-0.240*	-0.019	-0.571	0.424	-0.995
				---				
Payroll Taxes	0.314**	0.263**	0.049	0.399**	-3.355***	-1.858*	-2.135	0.277
	+++++	++++		++++	----	-		
x Labor Reform Index	-0.416**	-0.477**	0.055	-0.262	6.088***	5.150***	3.863	1.287
	----	----			+++++	+++++	+	
c.1 Valuing Effects								
At the Mean of Government Effectiveness	0.063	-0.041	0.114	0.158	-0.362	0.444	-0.682	1.125
+1 Std. Dev. of Government Effectiveness	0.087	-0.047	0.144	0.194	0.350	1.293	0.483	0.810
At the Mean of Minimum Wage / Mean Wage	-0.022	-0.044	0.014	0.028	0.083	0.659	0.137	0.522
+1 Std. Dev. of Minimum Wage / Mean Wage	-0.021	-0.032	0.008	-0.027	0.079	0.526	0.235	0.290
At the Mean of Labor Reform Index	0.262	0.204	0.056	0.366	-2.598	-1.218	-1.655	0.437
+1 Std. Dev. of Labor Reform Index	0.228	0.165	0.060	0.345	-2.103	-0.799	-1.340	0.542

Significant variable at: \*\*\* 1%, \*\* 5%, \* 10%

Notes:

- Base Model: Fixed effects model with robust standard errors clustered at the country-level. The specification includes tax variables lagged one period as well as one lag of the log of the GDP per capita (2000 constant dollars) and the log of Terms of Trade.
- We have six robustness checks. In each one, we include one of the following controls: 1. Population ages 25-54 (% of total WAP) and Population ages 55-64 (% of total WAP) 2. USA real lending interest rate. 3. World GDP growth (annual %) 4. Real Effective Exchange Rate, Consumer Price Index. 2000=100 5. Country's GDP growth (annual %) 6. Country's Terms of Trade growth (annual %).
- In red color, a cross (+) represents a significant and positive coefficient and a minus (-) a significant and negative coefficient of the variable of interest in one of the robustness checks.

## The Labor Effects of Payroll Taxes by Educational Level

### a. Low Level of Education

Payroll Taxes - Low Education Groups	Participation Rate	Employment to Population Rate	Unemployment Rate	Informality Rate	Log of Monthly Wage (2000 prices)	Log of Monthly Wage, Informal Workers (2000 prices)	Log of Monthly Wage, Formal Workers (2000 prices)	Log of Informal/Formal Real Monthly Wage
a. Base Model	-0.001	-0.128*	0.153*	0.117	0.399	2.012	-0.034	2.046
b. By Type of Social Security Contribution								
- Others (all groups)	-0.200**	-0.297***	0.111	-0.162	3.069***	8.802**	0.592	8.211**
	----	----			+++++	++++		++++
- Health (all groups)	0.412**	0.118*	0.421	0.561*	-2.520***	-7.512	-0.331	-7.182
	+++++	+++		++	----			
c. Interaction with Institutional Variables (all groups)								
Payroll Taxes	0.028	-0.108	0.172	0.018	-0.345	-0.466	-0.752	0.286
x Government Effectiveness	0.119	0.049	0.086	0.521	1.302*	10.516	2.442*	8.074
	+							
Payroll Taxes	-0.142*	-0.186**	0.045	0.093	-0.063	0.335	-0.210	0.545
		----						
x Minimum Wage / Mean Wage	-0.185	-0.222**	0.088	-0.382	0.029	-18.667*	1.181	-19.848*
	-	-----				-		--
Payroll Taxes	0.226	0.205	0.006	-0.506	-5.107***	-20.378*	-2.186	-18.191
	+				-----			
x Labor Reform Index	-0.346	-0.516***	0.235	1.002	8.975***	35.587*	3.329	32.258
	-	-----			+++++			
c.1 Valuing Effects								
At the Mean of Government Effectiveness	0.007	-0.117	0.157	-0.073	-0.572	-2.296	-1.177	-1.119
+1 Std. Dev. of Government Effectiveness	0.070	-0.091	0.203	0.204	0.120	3.289	0.120	3.169
At the Mean of Minimum Wage / Mean Wage	-0.150	-0.196	0.049	0.076	-0.062	-0.493	-0.158	-0.335
+1 Std. Dev. of Minimum Wage / Mean Wage	-0.193	-0.248	0.069	-0.013	-0.055	-4.837	0.117	-4.954
At the Mean of Labor Reform Index	0.183	0.141	0.035	-0.381	-3.991	-15.954	-1.772	-14.181
+1 Std. Dev. of Labor Reform Index	0.155	0.099	0.054	-0.300	-3.261	-13.058	-1.501	-11.556

Significant variable at: \*\*\* 1%, \*\* 5%, \* 10%

Notes:

- Base Model: Fixed effects model with robust standard errors clustered at the country-level. The specification includes tax variables lagged one period as well as one lag of the log of the GDP per capita (2000 constant dollars) and the log of Terms of Trade.
- We have six robustness checks. In each one, we include one of the following controls: 1. Population ages 25-54 (% of total WAP) and Population ages 55-64 (% of total WAP) 2. USA real lending interest rate. 3. World GDP growth (annual %) 4. Real Effective Exchange Rate, Consumer Price Index. 2000=100 5. Country's GDP growth (annual %) 6. Country's Terms of Trade growth (annual %).
- In red color, a cross (+) represents a significant and positive coefficient and a minus (-) a significant and negative coefficient of the variable of interest in one of the robustness checks.

## b. Medium Level of Education

Payroll Taxes - Medium Education Groups	Participation Rate	Employment to Population Rate	Unemployment Rate	Informality Rate	Log of Monthly Wage (2000 prices)	Log of Monthly Wage, Informal Workers (2000 prices)	Log of Monthly Wage, Formal Workers (2000 prices)	Log of Informal/Formal Real Monthly Wage
a. Base Model	0.134* +	0.055	0.031	-0.125	0.385	1.135 +	0.203	0.932** +++++
b. By Type of Social Security Contribution								
- Others (all groups)	0.016	-0.027	-0.022	-0.852	2.094*** +++++	2.213** +++++	0.442	1.770** ++++
- Health (all groups)	0.520*** +++++	0.256* ++	0.316	0.841 +	-1.304*** ----	0.417	0.449	-0.032
c. Interaction with Institutional Variables (all groups)								
Payroll Taxes	0.148	0.040	0.094	-0.199	-0.129	0.377	-0.353	0.730
x Government Effectiveness	0.063	0.028	-0.014	0.890	1.342* +++++	1.785** +++++	1.598	0.187
Payroll Taxes	-0.004	-0.038	0.013	-0.106	0.329	0.783 +	0.284	0.499
x Minimum Wage / Mean Wage	-0.039	0.022	-0.053	-0.577	0.070	-0.458	1.196* +	-1.654*** -----
Payroll Taxes	0.467*** +++++	0.475*** +++++	-0.035	-1.257	-3.355*** -----	-1.473	-0.934	-0.539
x Labor Reform Index	-0.526** -----	-0.663*** -----	0.102	1.846	6.088*** +++++	4.072* +	1.679	2.394
c.1 Valuing Effects								
At the Mean of Government Effectiveness	0.137	0.035	0.096	-0.354	-0.362	0.066	-0.631	0.697
+1 Std. Dev. of Government Effectiveness	0.170	0.050	0.089	0.119	0.350	1.014	0.218	0.797
At the Mean of Minimum Wage / Mean Wage	-0.006	-0.037	0.011	-0.132	0.332	0.763	0.337	0.426
+1 Std. Dev. of Minimum Wage / Mean Wage	-0.015	-0.032	-0.002	-0.266	0.348	0.656	0.615	0.041
At the Mean of Labor Reform Index	0.402	0.393	-0.022	-1.027	-2.598	-0.967	-0.725	-0.241
+1 Std. Dev. of Labor Reform Index	0.359	0.339	-0.014	-0.877	-2.103	-0.635	-0.589	-0.047

Significant variable at: \*\*\* 1%, \*\* 5%, \* 10%

Notes:

- Base Model: Fixed effects model with robust standard errors clustered at the country-level. The specification includes tax variables lagged one period as well as one lag of the log of the GDP per capita (2000 constant dollars) and the log of Terms of Trade.
- We have six robustness checks. In each one, we include one of the following controls: 1. Population ages 25-54 (% of total WAP) and Population ages 55-64 (% of total WAP) 2. USA real lending interest rate. 3. World GDP growth (annual %) 4. Real Effective Exchange Rate, Consumer Price Index. 2000=100 5. Country's GDP growth (annual %) 6. Country's Terms of Trade growth (annual %).
- In red color, a cross (+) represents a significant and positive coefficient and a minus (-) a significant and negative coefficient of the variable of interest in one of the robustness checks.

### c. High Level of Education

Payroll Taxes - High Education Groups	Participation Rate	Employment to Population Rate	Unemployment Rate	Informality Rate	Log of Monthly Wage (2000 prices)	Log of Monthly Wage, Informal Workers (2000 prices)	Log of Monthly Wage, Formal Workers (2000 prices)	Log of Informal/Formal Real Monthly Wage
a. Base Model	0.178*	0.084	0.007	-0.213	0.385	0.983	0.846	0.137
b. By Type of Social Security Contribution								
- Others (all groups)	0.259**	0.208	-0.061	-0.752	2.094***	2.074	1.450**	0.623
	++++				++++		++++	
- Health (all groups)	0.192	-0.076	0.239	0.626	-1.304***	0.299	0.654	-0.355
				+	----			
c. Interaction with Institutional Variables (all groups)								
Payroll Taxes	0.161	0.034	0.064	-0.314	-0.129	0.147	0.297	-0.149
x Government Effectiveness	0.034	-0.025	0.019	0.767	1.342*	2.914*	1.765***	1.149
							+++++	
Payroll Taxes	0.026	0.008	-0.044	-0.179	0.502	1.095	0.734	0.361
			-					
x Minimum Wage / Mean Wage	0.028	0.102	-0.032	-0.451	-0.391	-0.887	0.029	-0.917
Payroll Taxes	-0.049	-0.047	0.038	-1.286	-3.355***	-2.776	-0.985	-1.791
					-----			
x Labor Reform Index	0.367	0.208	-0.042	1.715	6.088***	5.963	2.887	3.076
					+++++			
c.1 Valuing Effects								
At the Mean of Government Effectiveness	0.155	0.038	0.061	-0.447	-0.362	-0.360	-0.010	-0.349
+1 Std. Dev. of Government Effectiveness	0.173	0.025	0.071	-0.040	0.350	1.187	0.927	0.261
At the Mean of Minimum Wage / Mean Wage	0.027	0.013	-0.045	-0.199	0.485	1.056	0.735	0.320
+1 Std. Dev. of Minimum Wage / Mean Wage	0.034	0.036	-0.053	-0.304	0.394	0.849	0.742	0.107
At the Mean of Labor Reform Index	-0.003	-0.021	0.033	-1.073	-2.598	-2.035	-0.626	-1.409
+1 Std. Dev. of Labor Reform Index	0.026	-0.004	0.029	-0.933	-2.103	-1.549	-0.391	-1.158

Significant variable at: \*\*\* 1%, \*\* 5%, \* 10%

Notes:

- Base Model: Fixed effects model with robust standard errors clustered at the country-level. The specification includes tax variables lagged one period as well as one lag of the log of the GDP per capita (2000 constant dollars) and the log of Terms of Trade.
- We have six robustness checks. In each one, we include one of the following controls: 1. Population ages 25-54 (% of total WAP) and Population ages 55-64 (% of total WAP) 2. USA real lending interest rate. 3. World GDP growth (annual %) 4. Real Effective Exchange Rate, Consumer Price Index. 2000=100 5. Country's GDP growth (annual %) 6. Country's Terms of Trade growth (annual %).
- In red color, a cross (+) represents a significant and positive coefficient and a minus (-) a significant and negative coefficient of the variable of interest in one of the robustness checks.

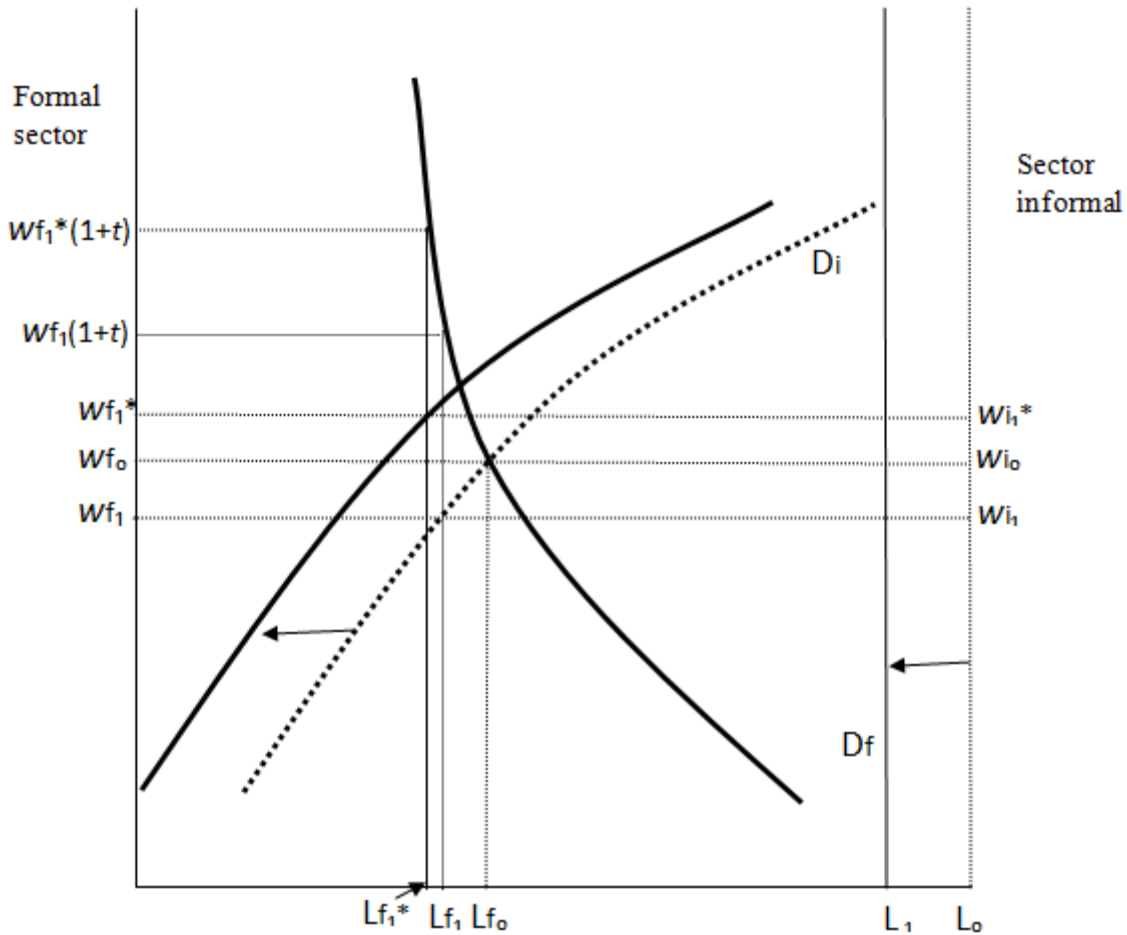
A simple distinction to be made is between contributions that entitle workers (and in some countries their families also) to health services, and other payroll taxes.<sup>10</sup> Presumably, contributions to health social security may be valued by the average worker more highly than other services usually financed by other payroll taxes, such as pensions, labor training, subsidized housing, and childcare and recreation services, which give access to benefits in a distant future (pensions) or benefit only some workers, and oftentimes benefit those not working (see Levy, 2008, for the case of Mexico). Furthermore, contributions that entitle workers to certain benefits that are highly valued by certain groups of workers may encourage labor participation by reducing the reservation wage of those workers. In an analogous way, contributions that finance social services to those not in the labor market may discourage labor participation. For convenience, we present the latter case first.

Consider Figure 4, which represents the effects of payroll taxes that offer no benefits to those contributing and discourage labor participation. Before the tax, equilibrium in the labor market is achieved when wages in the formal and the informal segments are equal at level  $wf_0 = wi_0$ . If the labor supply were fixed, the new net wage levels would be lower, at  $wf_1 = wi_1$ , and gross wages in the formal sector would be  $wf_1(1+t)$ , where  $t$  is the tax. However, the supply of labor may contract if the payroll tax finances social services that raise the reservation wage of some workers. In the figure this implies a shift to the left of total labor supply  $L$ , and a corresponding shift in the demand for labor in the informal sector (since it is drawn from right to left). This will increase wages with respect to the level  $wf_1 = wi_1$ . Depending on the elasticity of the demand for labor in the formal segment, the final wage levels ( $wf_1^* = wi_1^*$ ) may be even higher than  $wf_0 = wi_0$ , as shown in the figure. Informality rates may increase or fall, depending on the elasticities. If, in addition to the changes presented in the figure, the tax generates some (partial) benefits to formal workers, the relative wages of informal workers will increase.

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<sup>10</sup> Another possibility is to distinguish between social security contributions (including health and pensions) and other payroll taxes. With such distinction, the results presented below are basically the same, though somewhat weaker. More complex distinctions, though justifiable in theory, cannot be implemented with our database, given the limited number of changes in the relevant contribution rates.

**Figure 4. Formal and Informal Segments of the Labor Market with a Payroll Tax That Does Not Generate Benefits and Discourages Labor Participation**



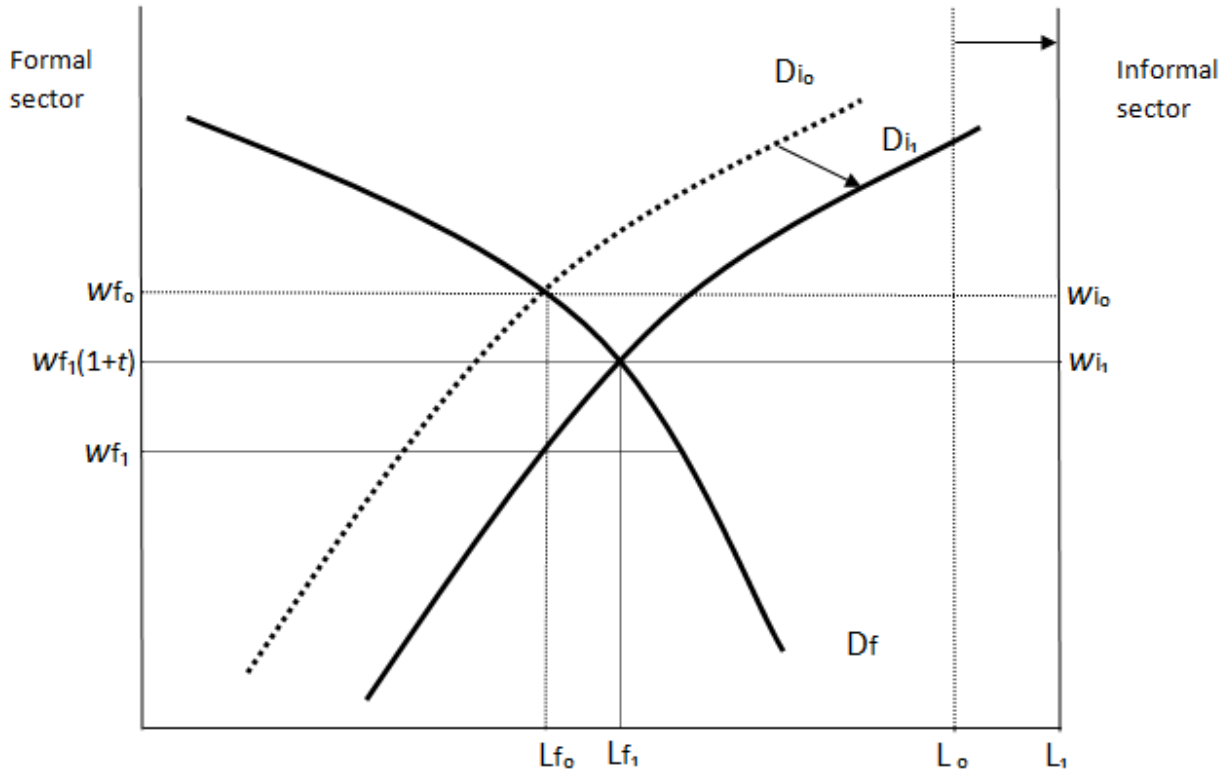
*Explanation:* Before the tax, equilibrium in the labor market is achieved when wages in the formal and the informal segments are equal at level  $w_{f_0} = w_{i_0}$ . If the labor supply is unchanged and a payroll tax that does not generate benefits is introduced, net wage levels after the tax would be lower, at  $w_{f_1} = w_{i_1}$ , and gross wages in the formal sector would be  $w_{f_1}(1+t)$ , where  $t$  is the tax. However, the supply of labor may contract if the payroll tax finances social services that raise the reservation wage of some workers. In the figure this implies a shift to the left of total labor supply  $L$ , and a corresponding shift in the demand for labor in the informal sector (since it is drawn from right to left). This will increase wages with respect to the level  $w_{f_1} = w_{i_1}$ . Depending on the elasticity of the demand for labor in the formal segment, the final wage levels ( $w_{f_1}^* = w_{i_1}^*$ ) may be even higher than  $w_{f_0} = w_{i_0}$ , as shown in the figure. Informality rates may increase or fall, depending on the elasticities.

The empirical results presented in Table 6.a for “other payroll taxes” (other than health social security contributions) are consistent with the predictions of this analytical framework when the taxes discourage labor participation, some partial benefits are provided to formal workers and the elasticity for labor demand in the formal segment of the economy is inelastic. The fall of the employment rate is statistically significant and robust (0.136 for each point of increase in payroll taxes in the basic specification). Also statistically significant and robust are the increase in net real wages (2.1 percent) and the increase in the relative wages of informal workers (1.8 percent).

Similar results hold for the group of workers with low education (see Table 6.b). In the medium education groups (Table 6.c) no discouragement effect is observed, but still wages do go up, suggesting strong labor demand substitutability with the low education group. In the high education group (Table 6.d) higher payroll taxes encourage labor supply and increase wages evenly in the formal and the informal segments, though less than in the low education group (also suggesting high labor demand substitutability), and further implying that this type of workers do not value the benefits they may receive.

Consider next a payroll tax that entitle workers to benefits *and* encourages labor supply. As described in Figure 5, workers in both the formal and the informal segments will receive lower wages because of the increase in labor supply, but wages of informal workers relative to those in the formal workers will rise because the latter will consider the benefits part of their remuneration. Both formal and employment will increase, but the *rate* of informality may or may not go up depending on the demand elasticities.

**Figure 5. Formal and Informal Segments of the Labor Market with a Payroll Tax That Generates Benefits and Encourages Labor Participation**



*Explanation:* Starting with the situation depicted in Figure 3, this figure shows what would occur if labor supply increases. Notice that the initial equilibrium is the same as if there were no taxes, since benefits are assumed to be considered by workers as equivalent to the tax. If some individuals that were out of the labor market decide to participate, labor supply shifts from  $L_0$  to  $L_1$ . Labor demand in the informal segment shifts horizontally by the same amount because it is measured from right to left. The new equilibrium is found where the two labor demand curves cross. Workers in both segments receive lower wages, and gross wages in the formal segment are equal to wages in the informal segment ( $wf_1(1+t) = wi_1$ ). Formal employment increases (from  $Lf_0$  to  $Lf_1$ ) and the number of informal workers goes up as well, but the rate of informality may or may not go up depending on the demand elasticities.



This description partially fits the econometric results in the case of health social security contributions. They encourage labor participation and reduce wages across the board. Both results are robust, with estimated coefficients of 0.4 and -1.3, respectively (see Table 6.a, Health, all groups). In some specifications informality is increased, but the result is not robust. This is consistent with the hypothesis that, unlike other payroll taxes, their benefits are highly valued, especially by marginal workers. Indeed, the labor supply response and the reduction in wages are stronger among low and medium education groups (Tables 6.a and 6.b). Labor participation among high education groups is not affected but net wages do fall, implying that these workers do value health social security services (Table 6.c). However, the econometric results do not give support to the theoretical prediction on the relative wages of informal workers. The fact that their relative wages do not increase for any of the education groups (and do increase significantly for all groups combined) seems to imply that workers in small firms (our definition of informality) are not excluded from health services, because either they do contribute or have subsidized access to health services.

Whether higher payroll taxes do increase labor costs, especially in smaller firms, may depend on tax enforcement capabilities and other factors that influence tax compliance and tax morale. In order to test the hypothesis that better tax enforcement capabilities may affect the labor effects of payroll taxes, an interaction term (payroll taxes X government effectiveness) is introduced in the basic regression (see Table 6), where government effectiveness is taken as a proxy of those capabilities. As expected, the results indicate that stronger capabilities reinforce the influence of payroll taxes on the wages of informal workers, a result that is strongly robust across specifications. However, no significant changes are observed in other labor variables.

Theory and previous empirical studies for developed countries indicate that wage rigidities and labor market institutions in general may alter the influence of payroll taxes on labor outcomes. In order to test the hypothesis we expand our basic estimates with interaction terms of payroll taxes with the relative level of minimum wages (with respect to average wages) and with an index of labor market flexibility (as described in Appendix 1).

Minimum wages do not seem to have any significant influence on the labor effects of payroll taxes (the conclusion is valid for each of the three education groups). This does not completely rule out the hypothesis, however, because the variable measuring minimum wages does not capture the degree of compliance.

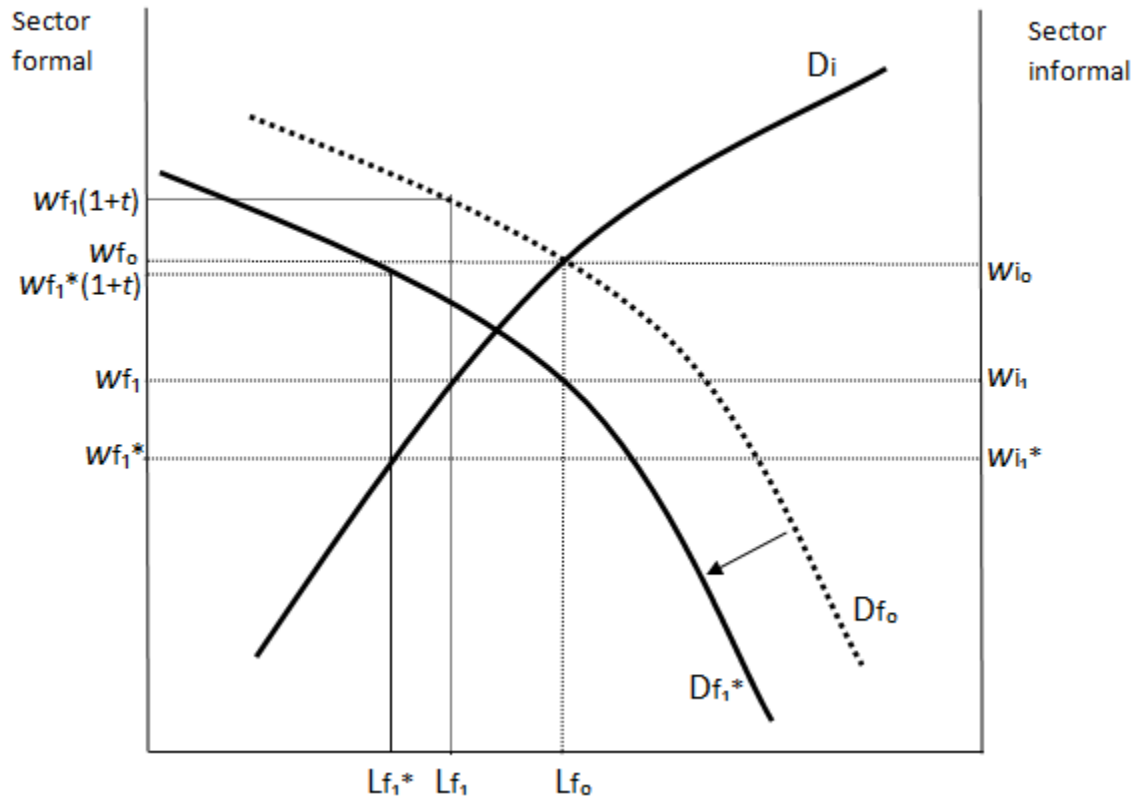
The flexibility of labor market institutions does have important influence on the impact of payroll taxes. Since more flexible labor markets facilitate hiring and firing workers (and to adjust wages faster through labor churning), they should be expected to reinforce the effects of payroll taxes on participation, employment, and wages, as is indeed found. The coefficients of this interaction term (payroll taxes X labor reform index) are highly significant and strongly robust in the regressions of those dependent variables. This also holds for the low and medium education groups, though not for the high education group.

In synthesis, the effects of payroll taxes on the labor market depend strongly on the type of tax, and to some extent on the level of education of the workers and the flexibility of labor market institutions. Payroll taxes have more deleterious effects on the labor market when their contributions are not valued by workers, but such valuation seems to be heterogeneous across education groups. Effects are stronger when labor markets are more flexible.

## **7. The Labor Effects of VAT**

The main difference between a payroll tax (not tied to benefits for the workers paying it) and a flat VAT is that the former is levied on the value added by labor only, while the latter is levied both on labor and capital earnings. In the presence of informality, a VAT will induce more informality and lower wages than a payroll tax levied at the same rate, as represented in Figure 6. As a VAT is levied on profits also, it reduces formal labor demand, because the resulting fall in the stock of capital in the formal segment reduces labor productivity. In the figure we assume that nothing happens with labor demand in the informal sector, which is a simplification. Labor productivity in the informal sector may increase if capital moves to the sector, attracted by the cost advantage that a VAT implicitly gives to the smaller firms, which have a better chance of being undetected if they do not pay taxes. On the other hand, since informal firms buy at least some of their inputs from formal firms, more expensive inputs may impair labor productivity. As shown in the figure, compared with a payroll tax at the same rate, a VAT produces a larger decline in wages and more informality (given total labor supply).

**Figure 6. Formal and Informal Segments of the Labor Market with a VAT**



*Explanation:* Labor market equilibrium is found at the intersection of the two initial labor demand curves ( $D_{f_0}$  and  $D_i$ ). Wages are the same in the formal and the informal segments ( $w_{f_0} = w_{i_0}$ ) and all the labor force is employed ( $L = L_{f_0} + L_{i_0}$ ). As in Figure 2, a tax levied on only wages (but not on profits) causes formal employment to fall to  $L_{f_1}$  and net wages received by formal workers to fall to  $w_{f_1}$ . As a VAT is levied on profits also, it makes formal labor demand shift from  $D_{f_0}$  to  $D_{f_1^*}$ , because the resulting fall in the stock of capital reduces labor productivity. As a result, formal employment declines from  $L_{f_1}$  to  $L_{f_1^*}$ , since this is the employment level at which net wages paid to formal workers are the same as wages received by informal workers ( $w_{f_1^*} = w_{i_1^*}$ ) and all the labor force remains employed. Therefore, a VAT reduces wages further, and generates more informality than a payroll tax levied at the same rate  $t$ .

The econometric results in Table 7.a confirm the effect on informality (which is mildly robust): each point of increase in the VAT raises the informality rate by 0.3 percent points. The results indicate that total wages do fall, unlike in the case of other payroll taxes. However, the coefficient is never significant. Since relative wages of informal workers fall significantly, this suggests that formal wages may face some downward rigidity, as discussed below.

The increase of informality is largely due to changes in the composition of labor, as employment rates fall for the medium and high education groups, which have lower informality rates. The fall in the relative wages of the informal workers is less affected by the compositional changes mentioned: most of the effect results from a reduction in the relative remuneration of informal workers in each education group, especially in the medium education group.

The differential effects of the VAT by education groups may be due to different degrees of substitutability between capital and low and high skills. If capital is a substitute for unskilled labor but a complement to skilled labor (Krusell et al., 2000) the demand for the former will fall less than that for the latter. In Figure 6, this would imply that the demand for labor in the formal sector is shifted less to the left in the case of unskilled labor; and under some assumptions about the elasticities of substitution may even shift to the right. If, in addition, there is some type of wage rigidity that impedes a wage decline in the formal segment, wages in the informal segment will fall with respect to those in the formal segment, especially among skilled workers.

Indeed, the remunerations of high education workers are not immune to changes in VAT rates, as the basic estimates in Table 7.a would suggest. On average across countries, the effect is not significant because of the heterogeneity across countries in the degree of wage rigidity. But, as shown in Table 7.d, in a country with a level of minimum wages equivalent to the average for the region, one percentage point of increase in the VAT basic rate is associated with a decline of 3.1 percentage points in the absolute level of wages of informal workers, and a 0.7 point increase in those of formal workers. In contrast, in a country where the minimum wage is one standard deviation higher, the wages of the informal fall 4.4 percentage points for each point of increase in the VAT, and those of the formal workers remain the same.

**Table 7. Labor Effects of VAT**

VAT	Participation Rate	Employment to Population Rate	Unemployment Rate	Informality Rate	Log of Monthly Wage (2000 prices)	Log of Monthly Wage, Informal Workers (2000 prices)	Log of Monthly Wage, Formal Workers (2000 prices)	Log of Informal/Formal Real Monthly Wage
a. Base Model								
i. All groups	-0.130	-0.249	0.202	0.300*	-0.959	-1.582	-0.242	-1.340**
		-		++++				-----
ii. By Educational Group								
-Low	0.076	-0.060	0.242	0.066	-0.845	-6.383	-1.092	-5.292
				+				
-Medium	-0.178	-0.342*	0.294	-0.086	-0.959	-1.015	-0.081	-0.934**
		---						-----
-High	-0.234	-0.305	0.140	-0.179	-0.959	-1.415	-0.006	-1.408
								-
b. Interaction with Institutional Variables (all groups)								
VAT	-0.063	-0.257	0.300	0.178	-0.378	-1.178	0.795	-1.973***
		-						-----
x Government Effectiveness	0.309**	-0.038	0.458**	-0.438	1.890	1.148	4.025	-2.877***
	+++++		+++++					-----
VAT	-0.085	-0.119	0.054	0.322***	-1.924**	-2.123**	-0.993	-1.130
				+++++	---	---		
x Minimum Wage / Mean Wage	0.033	-0.039	0.031	-0.402*	-0.479	0.507	-0.584	1.090
				--				
VAT	-0.724	-0.126	-0.806	-0.085	-2.547*	-2.312*	0.094	-2.406
x Labor Reform Index	1.048	-0.208	1.767	0.687	2.857	1.228	-0.727	1.956
b.1 Valuing Effects								
At the Mean of Government Effectiveness	-0.117	-0.250	0.220	0.254	-0.707	-1.378	0.095	-1.472
+1 Std. Dev. of Government Effectiveness	0.047	-0.271	0.464	0.022	0.297	-0.768	2.232	-3.000
At the Mean of Minimum Wage / Mean Wage	-0.084	-0.121	0.055	0.304	-1.945	-2.101	-1.019	-1.082
+1 Std. Dev. of Minimum Wage / Mean Wage	-0.076	-0.130	0.063	0.211	-2.057	-1.983	-1.155	-0.828
At the Mean of Labor Reform Index	-0.594	-0.152	-0.586	0.000	-2.192	-2.159	0.004	-2.163
+1 Std. Dev. of Labor Reform Index	-0.508	-0.169	-0.443	0.056	-1.959	-2.059	-0.056	-2.004

Significant variable at: \*\*\* 1%, \*\* 5%, \* 10%

Notes:

- Base Model: Fixed effects model with robust standard errors clustered at the country-level. The specification includes tax variables lagged one period as well as one lag of the log of the GDP per capita (2000 constant dollars) and the log of Terms of Trade.
- We have six robustness checks. In each one, we include one of the following controls: 1. Population ages 25-54 (% of total WAP) and Population ages 55-64 (% of total WAP) 2. USA real lending interest rate. 3. World GDP growth (annual %) 4. Real Effective Exchange Rate, Consumer Price Index. 2000=100 5. Country's GDP growth (annual %) 6. Country's Terms of Trade growth (annual %).
- In red color, a cross (+) represents a significant and positive coefficient and a minus (-) a significant and negative coefficient of the variable of interest in one of the robustness checks.

## Labor Effects of VAT by Educational Level

### a. Low Level of Education

VAT - Low Education Groups	Participation Rate	Employment to Population Rate	Unemployment Rate	Informality Rate	Log of Monthly Wage (2000 prices)	Log of Monthly Wage, Informal Workers (2000 prices)	Log of Monthly Wage, Formal Workers (2000 prices)	Log of Informal/Formal Real Monthly Wage
a. Base Model	0.076	-0.060	0.242	0.066 +	-0.845	-6.383	-1.092	-5.292
b. Interaction with Institutional Variables (all groups)								
VAT	0.078	-0.141	0.365	0.189	-0.327	-2.436	0.263	-2.699
x Government Effectiveness	0.148	-0.191	0.510** +++	0.447	1.208	14.834	4.821*	10.013
VAT	0.156	-0.220	0.644	0.142	-1.293	-9.815	0.045	-9.860
x Minimum Wage / Mean Wage	-0.100	-0.059	-0.070	0.080	-4.101** ---	-22.470	-1.011	-21.459
VAT	-0.731*	0.020	-1.156	-1.956	-1.239	-21.355	0.175	-21.530
x Labor Reform Index	1.436** +++	-0.120	2.448	3.410	0.547	26.836	-2.574	29.410
b.1 Valuing Effects								
At the Mean of Government Effectiveness	0.052	-0.108	0.276	0.111	-0.537	-5.017	-0.576	-4.441
+1 Std. Dev. of Government Effectiveness	0.131	-0.209	0.547	0.349	0.104	2.860	1.984	0.876
At the Mean of Minimum Wage / Mean	0.152	-0.223	0.641	0.146	-1.475	-10.812	0.000	-10.812
+1 Std. Dev. of Minimum Wage / Mean	0.128	-0.236	0.625	0.164	-2.429	-16.040	-0.235	-15.805
At the Mean of Labor Reform Index	-0.552	0.005	-0.852	-1.532	-1.171	-18.019	-0.145	-17.874
+1 Std. Dev. of Labor Reform Index	-0.436	-0.005	-0.652	-1.255	-1.126	-15.835	-0.354	-15.481

Significant variable at: \*\*\* 1%, \*\* 5%, \* 10%

Notes:

- a. Base Model: Fixed effects model with robust standard errors clustered at the country-level. The specification includes tax variables lagged one period as well as one lag of the log of the GDP per capita (2000 constant dollars) and the log of Terms of Trade.
- b. We have six robustness checks. In each one, we include one of the following controls: 1. Population ages 25-54 (% of total WAP) and Population ages 55-64 (% of total WAP) 2. USA real lending interest rate. 3. World GDP growth (annual %) 4. Real Effective Exchange Rate, Consumer Price Index. 2000=100 5. Country's GDP growth (annual %) 6. Country's Terms of Trade growth (annual %).
- c. In red color, a cross (+) represents a significant and positive coefficient and a minus (-) a significant and negative coefficient of the variable of interest in one of the robustness checks.

## b. Medium Level of Education

VAT - Medium Education Groups	Participation Rate	Employment to Population Rate	Unemployment Rate	Informality Rate	Log of Monthly Wage (2000 prices)	Log of Monthly Wage, Informal Workers (2000 prices)	Log of Monthly Wage, Formal Workers (2000 prices)	Log of Informal/Formal Real Monthly Wage
a. Base Model	-0.178	-0.342* ---	0.294	-0.086	-0.959	-1.015	-0.081	-0.934** ---
b. Interaction with Institutional Variables (all groups)								
VAT	-0.063	-0.302* --	0.358	-0.098	-0.378	-0.595	0.657	-1.252*** -----
x Government Effectiveness	0.028 ++	0.034	0.026	-0.174	-0.018	-0.142	-0.266	0.124
VAT	0.430* ++	0.044	0.525	-0.888	-1.044	-1.340*	0.063	-1.403** ---
x Minimum Wage / Mean Wage	0.446	0.328	0.056	-0.110	-2.848*	-3.653** -----	-2.456*	-1.197 -
VAT	-0.459	0.019	-0.519	-1.532 +	-2.547*	-1.774	0.045	-1.818** -----
x Labor Reform Index	0.489	-0.630	1.414	2.499 -	2.857	1.201	-0.442	1.643
b.1 Valuing Effects								
At the Mean of Government Effectiveness	-0.142	-0.321	0.295	-0.151	-0.707	-0.776	0.228	-1.004
+1 Std. Dev. of Government Effectiveness	0.100	-0.262	0.488	0.011	0.297	-0.223	1.538	-1.761
At the Mean of Minimum Wage / Mean Wage	0.450	0.059	0.527	-0.893	-1.170	-1.502	-0.046	-1.456
+1 Std. Dev. of Minimum Wage / Mean Wage	0.554	0.135	0.541	-0.918	-1.833	-2.352	-0.617	-1.735
At the Mean of Labor Reform Index	-0.398	-0.059	-0.343	-1.221	-2.192	-1.625	-0.010	-1.614
+1 Std. Dev. of Labor Reform Index	-0.358	-0.111	-0.228	-1.018	-1.959	-1.527	-0.046	-1.480

Significant variable at: \*\*\* 1%, \*\* 5%, \* 10%

Notes:

- Base Model: Fixed effects model with robust standard errors clustered at the country-level. The specification includes tax variables lagged one period as well as one lag of the log of the GDP per capita (2000 constant dollars) and the log of Terms of Trade.
- We have six robustness checks. In each one, we include one of the following controls: 1. Population ages 25-54 (% of total WAP) and Population ages 55-64 (% of total WAP) 2. USA real lending interest rate. 3. World GDP growth (annual %) 4. Real Effective Exchange Rate, Consumer Price Index. 2000=100 5. Country's GDP growth (annual %) 6. Country's Terms of Trade growth (annual %).
- In red color, a cross (+) represents a significant and positive coefficient and a minus (-) a significant and negative coefficient of the variable of interest in one of the robustness checks.

### c. High Level of Education

VAT - High Education Groups	Participation Rate	Employment to Population Rate	Unemployment Rate	Informality Rate	Log of Monthly Wage (2000 prices)	Log of Monthly Wage, Informal Workers (2000 prices)	Log of Monthly Wage, Formal Workers (2000 prices)	Log of Informal/Formal Real Monthly Wage
a. Base Model	-0.234	-0.305	0.140	-0.179	-0.959	-1.415	-0.006	-1.408 -
b. Interaction with Institutional Variables (all groups)								
VAT	-0.079	-0.189	0.155	-0.012	-0.378	-0.268	0.753	-1.021
x Government Effectiveness	0.492	0.250	0.203	0.722	1.890	4.058	2.624	1.434
VAT	0.547 +	0.309	0.240	-0.288	-1.044	-2.893*** -----	0.892* ++++	-3.786*** -----
x Minimum Wage / Mean Wage	0.451 +	0.361	0.065	0.284	-2.848* -----	-5.548** -----	-3.349** ---	-2.199** ---
VAT	-1.167	-0.886	-0.058	-2.860	-2.547*	-5.047*	-0.883	-4.164** -----
x Labor Reform Index	1.646	1.015	0.358	4.522	2.857	6.576	1.519	5.057
b.1 Valuing Effects								
At the Mean of Government Effectiveness	-0.165	-0.232	0.120	-0.138	-0.707	-0.974	0.296	-1.270
+1 Std. Dev. of Government Effectiveness	0.097	-0.100	0.227	0.246	0.297	1.181	1.690	-0.509
At the Mean of Minimum Wage / Mean Wage	0.567	0.325	0.243	-0.275	-1.170	-3.139	0.743	-3.884
+1 Std. Dev. of Minimum Wage / Mean Wage	0.672	0.409	0.258	-0.209	-1.833	-4.430	-0.036	-4.395
At the Mean of Labor Reform Index	-0.962	-0.760	-0.013	-2.298	-2.192	-4.229	-0.694	-3.535
+1 Std. Dev. of Labor Reform Index	-0.828	-0.677	0.016	-1.930	-1.959	-3.694	-0.571	-3.124

Significant variable at: \*\*\* 1%, \*\* 5%, \* 10%

Notes:

- Base Model: Fixed effects model with robust standard errors clustered at the country-level. The specification includes tax variables lagged one period as well as one lag of the log of the GDP per capita (2000 constant dollars) and the log of Terms of Trade.
- We have six robustness checks. In each one, we include one of the following controls: 1. Population ages 25-54 (% of total WAP) and Population ages 55-64 (% of total WAP) 2. USA real lending interest rate. 3. World GDP growth (annual %) 4. Real Effective Exchange Rate, Consumer Price Index. 2000=100 5. Country's GDP growth (annual %) 6. Country's Terms of Trade growth (annual %).
- In red color, a cross (+) represents a significant and positive coefficient and a minus (-) a significant and negative coefficient of the variable of interest in one of the robustness checks.



Heterogeneity in tax enforcement capabilities (proxied here by the variable government effectiveness) may also alter the impact of the VAT. When capabilities are stronger, an increase in the VAT rate is associated with higher unemployment rates among the low education groups (the effect is only mildly robust).

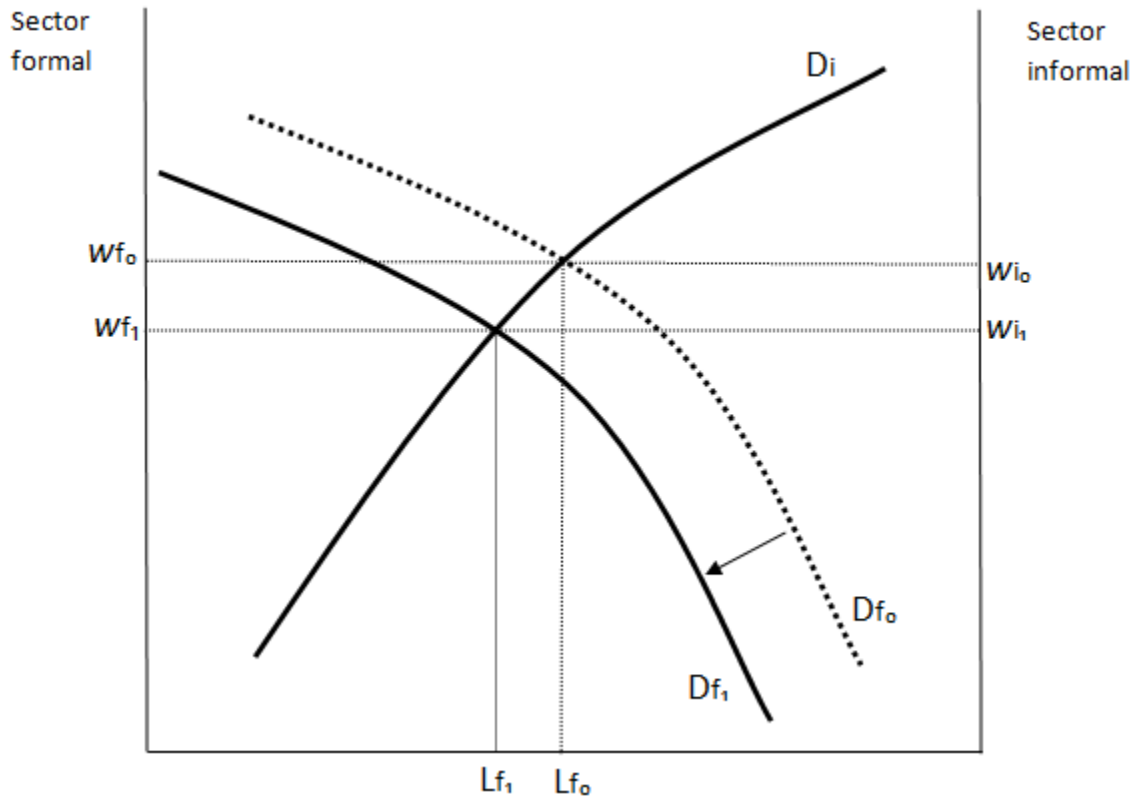
Value-added taxes are often considered less distortive than other taxes because they affect all sectors and factors in a more homogeneous way than other taxes. However, our results suggest that, in the presence of informality, the effects of the VAT on production and investment decisions may be less innocuous than usually assumed. VAT rate increases are associated with higher informality rates and with steep reductions in the relative wages of informal workers. The effects differ strongly by education groups, differences which may be enhanced by institutional features of the labor market, especially by wage rigidities. If capital is a substitute of unskilled labor but a complement to skilled labor, the impact of the VAT should be stronger for the latter, as our results indicate.

The effects of the corporate income tax, to which we now turn, will also suggest that differential effects by education level may be due to the fact that capital is a substitute of unskilled labor but a complement with skilled labor.

## **8. The Labor Effects of Corporate Income Taxes**

A corporate income tax that is paid by the formal firms only will reduce labor productivity in those firms because investment and the stock of capital in those firms will fall. As shown in Figure 7, this will shift formal labor demand to the left, with a consequent decline in wages and an increase in informality. The changes in wages and informality that are needed to restore equilibrium will depend on the elasticities of the labor demand curves. The more inelastic the curves, the larger the changes in wages needed to restore equilibrium (but the smaller the change in informality).

**Figure 7. Formal and Informal Segments of the Labor Market with a Corporate Income Tax**



*Explanation:* A corporate income tax shifts to the left the demand for labor in the formal segment because it reduces the stock of capital and therefore also labor productivity. Formal wages fall from  $w_{f0}$  to  $w_{f1}$ , and by the same amount in the informal segment so that equilibrium can be restored. Formal employment declines from  $L_{f0}$  to  $L_{f1}$ , which implies higher informality.

However, at least four additional effects may modify these basic results. First, with several skill levels, the size and even the direction of change of their specific labor market outcomes may differ from the general result. If skilled labor is a complement to capital but unskilled labor is a substitute, skilled formal labor demand will shift further to the left than unskilled labor demand, implying that the relative wages of the skilled will fall with respect to the unskilled, and that informality of the former will increase more than that of the latter. Under certain assumptions, informality rates of the unskilled may fall, as shown by Ahmad and Best (2012).

Second, some capital may move from the formal to the informal sector, attracted by the possibility of evading the tax, which will shift informal labor demand to the left (since it is drawn from right to left), reinforcing the increase in informality but attenuating the decline of wages. Since the ability of capital to escape the purview of the tax administration and move to the informal sector will depend on tax enforcement capabilities, the stronger the capabilities, the lesser the increase of informality. If skilled labor and capital are complements, the stronger the capabilities, the worse the impact of the tax on wages and employment of skilled workers.

Third, if there are downward wage rigidities in the formal segment of the labor market due, for instance, to a binding minimum wage, relative wages of informal workers will fall with respect to those in the formal segment when, and if, corporate income taxes increase informality. To what extent a higher corporate income tax rate may affect informality and wages may also depend on the degree of flexibility of the labor code. If labor mobility between the formal and the informal segment is facilitated by institutional factors such as a flexible labor code, corporate income tax changes will facilitate the reallocation of labor between the formal and the informal segment, and therefore will produce larger increases in informality but smaller reductions in wages (especially of informal workers, if there is some wage rigidity in the formal segment) when the tax rate is increased.

Fourth, labor supplies may react as wages and labor opportunities change. In particular, skilled labor supply may fall, especially if informal employment opportunities are limited. Labor supply changes will weaken the effect of the tax on relative wages and informality.

The maximum rate is the only observable dimension of corporate income tax regimes for which we have enough data to test these predictions. Since the effects may depend on several institutional factors and on the degree of substitutability between capital and the different types

of labor, it is not surprising that none of the aggregate labor variables considered has a statistically significant relation with the maximum corporate income tax rate (see base model, all groups in Table 8). However, some important effects become apparent when splitting the sample by education levels and when taking into consideration the heterogeneity resulting from institutional factors.

**Table 8. The Labor Effects of Corporate Income Taxes**

Corporate Income Taxes	Participation Rate	Employment to Population Rate	Unemployment Rate	Informality Rate	Log of Monthly Wage (2000 prices)	Log of Monthly Wage, Informal Workers (2000 prices)	Log of Monthly Wage, Formal Workers (2000 prices)	Log of Informal/Formal Real Monthly Wage
a. Base Model								
i. All groups	0.048	0.008	0.079	-0.078	0.113	-0.218	0.099	-0.317*
ii. By Educational Group								
-Low	0.041	0.006	0.065	-0.115**	0.207	1.113	-0.049	1.161
-Medium	0.080	0.041	0.079	-0.097	0.113	-0.134	-0.074	-0.060
-High	-0.089	-0.104	0.045	-0.131**	0.113	-0.456	0.375	-0.832*
b. Interaction with Institutional Variables (all groups)								
Maximum Businesses' Tax Rate	0.024	-0.061	0.161*	-0.194**	0.567	0.170	0.332	-0.162
x Government Effectiveness	-0.028	-0.158	0.225*	-0.274**	0.955	0.771	0.554	0.217
Maximum Businesses' Tax Rate	0.157**	0.111	0.064	-0.156***	-0.733	-1.096*	-0.941	-0.155
x Minimum Wage / Mean Wage	-0.250	0.516**	-1.047***	-0.542**	0.044	-1.104	-0.368	-0.736
Maximum Businesses' Tax Rate	-0.158**	-0.038	-0.114	0.133	1.804**	1.659**	0.827	0.833**
x Labor Reform Index	0.402**	0.092	0.373	-0.392	-3.358*	-3.703**	-1.463	-2.240***
b.1 Valuing Effects								
At the Mean of Government Effectiveness	0.029	-0.034	0.122	-0.146	0.401	0.036	0.236	-0.200
+1 Std. Dev. of Government Effectiveness	0.014	-0.117	0.241	-0.292	0.908	0.445	0.530	-0.085
At the Mean of Minimum Wage / Mean Wage	0.146	0.134	0.018	-0.180	-0.731	-1.145	-0.957	-0.188
+1 Std. Dev. of Minimum Wage / Mean Wage	0.088	0.254	-0.226	-0.306	-0.721	-1.402	-1.043	-0.359
At the Mean of Labor Reform Index	-0.108	-0.027	-0.068	0.084	1.387	1.199	0.645	0.555
+1 Std. Dev. of Labor Reform Index	-0.075	-0.019	-0.037	0.052	1.113	0.897	0.526	0.372

Significant variable at: \*\*\* 1%, \*\* 5%, \* 10%

Notes:

- Base Model: Fixed effects model with robust standard errors clustered at the country-level. The specification includes tax variables lagged one period as well as one lag of the log of the GDP per capita (2000 constant dollars) and the log of Terms of Trade.
- We have six robustness checks. In each one, we include one of the following controls: 1. Population ages 25-54 (% of total WAP) and Population ages 55-64 (% of total WAP) 2. USA real lending interest rate. 3. World GDP growth (annual %) 4. Real Effective Exchange Rate, Consumer Price Index. 2000=100 5. Country's GDP growth (annual %) 6. Country's Terms of Trade growth (annual %).
- In red color, a cross (+) represents a significant and positive coefficient and a minus (-) a significant and negative coefficient of the variable of interest in one of the robustness checks.

## The Labor Effects of Corporate Income Taxes by Educational Level

### a. Low Level of Education

Corporate Income Taxes - Low Education Groups	Participation Rate	Employment to Population Rate	Unemployment Rate	Informality Rate	Log of Monthly Wage (2000 prices)	Log of Monthly Wage, Informal Workers (2000 prices)	Log of Monthly Wage, Formal Workers (2000 prices)	Log of Informal/Formal Real Monthly Wage
a. Base Model	0.041	0.006	0.065	-0.115** -----	0.207	1.113	-0.049	1.161
b. Interaction with Institutional Variables (all groups)								
Maximum Businesses' Tax Rate	0.015	-0.055	0.132	-0.117 -	0.810	8.311	0.025	8.285
x Government Effectiveness	-0.014	-0.112	0.179	0.016	1.134	17.063*	0.103	16.959
Maximum Businesses' Tax Rate	-0.018	-0.043	0.050	-0.089* --	0.477	0.130	0.399	-0.269
x Minimum Wage / Mean Wage	-0.669*** -----	-0.203	-0.752	0.006	0.705	-29.055*	2.106	-31.162*
Maximum Businesses' Tax Rate	0.134 +	0.215* ++	-0.136	-0.016	3.579*** ++++	-4.791	1.907** ++++	-6.697
x Labor Reform Index	-0.172	-0.399* --	0.391	-0.181	-6.652** -----	10.900	-3.883** -----	14.784
b.1 Valuing Effects								
At the Mean of Government Effectiveness	0.017	-0.036	0.101	-0.120	0.613	5.342	0.007	5.335
+1 Std. Dev. of Government Effectiveness	0.010	-0.095	0.196	-0.111	1.215	14.403	0.062	14.340
At the Mean of Minimum Wage / Mean Wage	-0.048	-0.052	0.017	-0.089	0.508	-1.159	0.492	-1.651
+1 Std. Dev. of Minimum Wage / Mean Wage	-0.203	-0.099	-0.158	-0.087	0.672	-7.920	0.982	-8.902
At the Mean of Labor Reform Index	0.113	0.165	-0.087	-0.039	2.752	-3.436	1.424	-4.859
+1 Std. Dev. of Labor Reform Index	0.099	0.133	-0.056	-0.053	2.211	-2.549	1.108	-3.656

Significant variable at: \*\*\* 1%, \*\* 5%, \* 10%

Notes:

- Base Model: Fixed effects model with robust standard errors clustered at the country-level. The specification includes tax variables lagged one period as well as one lag of the log of the GDP per capita (2000 constant dollars) and the log of Terms of Trade.
- We have six robustness checks. In each one, we include one of the following controls: 1. Population ages 25-54 (% of total WAP) and Population ages 55-64 (% of total WAP) 2. USA real lending interest rate. 3. World GDP growth (annual %) 4. Real Effective Exchange Rate, Consumer Price Index. 2000=100 5. Country's GDP growth (annual %) 6. Country's Terms of Trade growth (annual %).
- In red color, a cross (+) represents a significant and positive coefficient and a minus (-) a significant and negative coefficient of the variable of interest in one of the robustness checks.

## b. Medium Level of Education

Corporate Income Taxes - Medium Education Groups	Participation Rate	Employment to Population Rate	Unemployment Rate	Informality Rate	Log of Monthly Wage (2000 prices)	Log of Monthly Wage, Informal Workers (2000 prices)	Log of Monthly Wage, Formal Workers (2000 prices)	Log of Informal/Formal Real Monthly Wage
a. Base Model	0.080	0.041	0.079	-0.097	0.113	-0.134	-0.074	-0.060
b. Interaction with Institutional Variables (all groups)								
Maximum Businesses' Tax Rate	0.055	-0.059	0.216** ++++	-0.097	0.567	0.515	0.083	0.432
x Government Effectiveness	-0.035	-0.230* -	0.350** ++++	0.111	0.955	1.310	0.261	1.049* ++++
Maximum Businesses' Tax Rate	0.031	-0.012	0.094* ++++	-0.017	0.629* ++	0.317	0.717	-0.401*** -----
x Minimum Wage / Mean Wage	-0.245	0.286	-0.884* +	-0.418	1.729 +	-2.033	2.079 +	-4.112*** -----
Maximum Businesses' Tax Rate	-0.160	-0.006	-0.116	0.147	1.804** ++	2.708*** +++++	1.163	1.544* ++++
x Labor Reform Index	0.464** +++++	0.092	0.376	-0.442	-3.358* +	-5.597** -----	-2.493	-3.104** -----
b.1 Valuing Effects								
At the Mean of Government Effectiveness	0.061	-0.019	0.155	-0.116	0.401	0.287	0.038	0.250
+1 Std. Dev. of Government Effectiveness	0.043	-0.141	0.341	-0.057	0.908	0.983	0.176	0.807
At the Mean of Minimum Wage / Mean Wage	0.020	0.001	0.055	-0.036	0.706	0.227	0.809	-0.583
+1 Std. Dev. of Minimum Wage / Mean Wage	-0.037	0.067	-0.151	-0.133	1.108	-0.246	1.293	-1.540
At the Mean of Labor Reform Index	-0.102	0.005	-0.069	0.092	1.387	2.012	0.853	1.158
+1 Std. Dev. of Labor Reform Index	-0.065	0.013	-0.039	0.056	1.113	1.557	0.650	0.906

Significant variable at: \*\*\* 1%, \*\* 5%, \* 10%

Notes:

- Base Model: Fixed effects model with robust standard errors clustered at the country-level. The specification includes tax variables lagged one period as well as one lag of the log of the GDP per capita (2000 constant dollars) and the log of Terms of Trade.
  - We have six robustness checks. In each one, we include one of the following controls: 1. Population ages 25-54 (% of total WAP) and Population ages 55-64 (% of total WAP) 2. USA real lending interest rate. 3. World GDP growth (annual %) 4. Real Effective Exchange Rate, Consumer Price Index. 2000=100 5. Country's GDP growth (annual %) 6. Country's Terms of Trade growth (annual %).
- In red color, a cross (+) represents a significant and positive coefficient and a minus (-) a significant and negativ

### c. High Level of Education

Corporate Income Taxes - High Education Groups	Participation Rate	Employment to Population Rate	Unemployment Rate	Informality Rate	Log of Monthly Wage (2000 prices)	Log of Monthly Wage, Informal Workers (2000 prices)	Log of Monthly Wage, Formal Workers (2000 prices)	Log of Informal/Formal Real Monthly Wage
a. Base Model	-0.089	-0.104	0.045	-0.131**	0.113	-0.456	0.375	-0.832*
				---				-
b. Interaction with Institutional Variables (all groups)								
Maximum Businesses' Tax Rate	-0.215*	-0.282**	0.127**	-0.044	0.567	0.500	0.412	0.087
x Government Effectiveness	-0.290**	-0.440***	0.227*	0.258	0.955	2.180	0.014	2.166***
	---	-----	+++++	-				+++++
Maximum Businesses' Tax Rate	-0.053	-0.074*	0.057*	-0.076	0.629*	0.519	1.063*	-0.544
		-	+++		++			
x Minimum Wage / Mean Wage	0.501	1.073***	-0.725**	-0.026	1.729	-2.151	0.481	-2.632
		+++++	-----		+			
Maximum Businesses' Tax Rate	-0.569***	-0.531*	0.049	-0.097	1.804**	1.753	1.152	0.601
	-----	---			+++			
x Labor Reform Index	0.934***	0.827*	-0.003	-0.049	-3.358*	-4.364	-1.557	-2.807*
	+++++							--
b.1 Valuing Effects								
At the Mean of Government Effectiveness	-0.165	-0.205	0.088	-0.089	0.401	0.121	0.410	-0.290
+1 Std. Dev. of Government Effectiveness	-0.319	-0.439	0.208	0.048	0.908	1.278	0.417	0.860
At the Mean of Minimum Wage / Mean Wage	-0.031	-0.026	0.025	-0.077	0.706	0.424	1.084	-0.661
+1 Std. Dev. of Minimum Wage / Mean Wage	0.086	0.223	-0.144	-0.083	1.108	-0.077	1.196	-1.273
At the Mean of Labor Reform Index	-0.453	-0.428	0.049	-0.103	1.387	1.210	0.958	0.252
+1 Std. Dev. of Labor Reform Index	-0.377	-0.361	0.048	-0.107	1.113	0.855	0.832	0.024

Significant variable at: \*\*\* 1%, \*\* 5%, \* 10%

Notes:

- Base Model: Fixed effects model with robust standard errors clustered at the country-level. The specification includes tax variables lagged one period as well as one lag of the log of the GDP per capita (2000 constant dollars) and the log of Terms of Trade.
- We have six robustness checks. In each one, we include one of the following controls: 1. Population ages 25-54 (% of total WAP) and Population ages 55-64 (% of total WAP) 2. USA real lending interest rate. 3. World GDP growth (annual %) 4. Real Effective Exchange Rate, Consumer Price Index. 2000=100 5. Country's GDP growth (annual %) 6. Country's Terms of Trade growth (annual %).
- In red color, a cross (+) represents a significant and positive coefficient and a minus (-) a significant and negative coefficient of the variable of interest in one of the robustness checks.



Corporate income taxes do affect workers of different skills in a different way. Low education workers tend to do better, as reflected in higher wages, especially those in the informal segment, and in lower informality rates. In contrast, high and medium education workers tend to become worse off. Those in the informal segment see their relative wages fall, and while informality rates go down, especially among the high education group, participation and employment falls. While some of these effects are not significant in the base models by educational groups presented in Table 8.a, they become clearer when institutional factors are brought into the picture.

For low education groups (see Table 8.b for details), higher corporate income tax rates are associated with statistically significant *reductions* in informality (independently of other institutional factors). When the heterogeneity in labor market flexibility is controlled for, higher corporate income taxes are also associated with higher wages (overall and in the formal segment). In more flexible labor markets, wage increases are somewhat smaller than in less flexible ones. However, the ability of the government to enforce the tax regime does not seem to alter the labor opportunities of this group of workers.

In contrast, for medium and high education groups (Tables 8.c and 8.d), higher government effectiveness is associated with a significant impact of corporate income taxes on unemployment (in both groups), on labor participation and on the relative wages of informal workers (in the case of high education groups). In a country where government effectiveness is at the average level of the region, an increase in the corporate income tax rate is associated with changes of these variables that are much smaller (and even of the opposite sign, in the case of relative wages) than in a country where government effectiveness is one standard deviation higher. Consider the discouragement effect of high education worker: in a country where government effectiveness is equal to the average in the region, an increase of 10 points in the CIT rate reduces the employment rate of the highly skilled by 2 percent, while in a country where government effectiveness is one standard deviation higher, the same CIT increase reduces the employment rate of the highly skilled by 4.4 percentage points. In the former country the wages of the skilled workers operating independently or in small firms fall slightly with respect to their peers in larger firms, while in the latter country their wages *increase* 13 percent, or 8 percent more than those of their peers, reflecting the decline in supply and the higher operating costs for those remaining in the informal segment. The reduction in the informality rate of the

high education workers when the CIT rate goes down, a result that is mildly robust statistically, and which seems an anomaly in view of our analytical framework, probably is a result of the discouragement effect.

## **9. Conclusion**

Knowledge on the effects that taxes produce on labor outcomes in the Latin American economies is very scant and focused mainly on trade taxes and payroll taxes. This paper is a first attempt to fill this vacuum. Using national-level data on labor variables for 15 Latin American countries, it has empirically explored the effects of payroll taxes, value-added taxes and corporate income taxes on labor participation, employment, unemployment, informality, and wages.

Three main general conclusions emerge from this paper. First, the results indicate that each tax produces different effects, as should be expected on the basis of previous theoretical and empirical work, mostly for developed countries. Second, the empirical findings lend strong support to the hypothesis that the labor effects of taxes differ markedly across skill groups. And third, the results also uncover the importance of several aspects of labor and tax institutions that are specific to developing countries, especially those associated with the presence of informality, such as the weak enforcement of labor and tax codes.

More specifically, this paper contributes to understanding the effects of each tax. In the case of payroll taxes, the labor impacts differ strongly by type of tax, with those not valued by workers inducing the greatest increases of labor costs and losses of employment, in contrast with those more valued by workers, which increase labor participation and do not raise labor costs for firms.

Value-added taxes are often assumed to generate more homogenous effects on all sectors and factors than other, supposedly, more distortive taxes. However, our results indicate that the presence of informality renders these assumptions invalid. Since a VAT makes informal activities more competitive vis-à-vis their formal competitors, but informal activities are less skill-intensive than formal ones, skilled workers tend to be more affected than unskilled ones.

Corporate income taxes also fall more on skilled than unskilled workers because of the complementarity between capital and skilled labor. However, unlike VAT, corporate income taxes encourage unskilled workers to move from the informal to the formal segment of the economy, where they become more attractive as a substitute to capital. At the same time, and

also unlike VAT, higher corporate income taxes are associated with lower labor participation and employment of high education workers, especially in countries where tax enforcement capabilities are stronger.

These findings open new avenues for further research. From a theoretical perspective, they provide important stylized facts that should be taken into consideration in general equilibrium models aimed at understanding the effects of taxes in developing economies. In particular, the separation of the labor market by skills and the inclusion of an informal segment should be considered essential elements of such models. From an empirical point of view, much work remains to be done to test the validity of the finding and the interpretations we have provided. Our database is too aggregated and our measures of taxes too crude to provide final answers to the effects of tax reforms that are always more nuanced than just a change in the basic tax rate. By exploiting the different treatment of sectors and goods in most tax reforms, future empirical work could provide more robust findings on their effects on employment and wages (in a way similar to the abundant research on the labor effects of import tariff reductions in the 1990s in Latin America). Another area of empirical research that our findings should encourage is the effects of taxes on labor income inequality. Most analyses on tax incidence rely on extremely crude incidence assumptions with total disregard to the effects that taxes have on wages and employment. Since, as we have shown, those effects can be quite large and are not homogenous across education groups, taxes may have more important distributional effects through the labor market than directly on disposable real incomes.

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## **Appendix 1. The Labor Flexibility Index**

In order to measure the degree of labor flexibility allowed by the labor code in each country, three indices are constructed and combined in a single index, using annual data for the 15 countries. This index is an updated and modified version of the labor reform index included in the set of structural reform indices presented in Lora (2001).

Each of the three sub-indices may move in a range of 0 to 1, where 0 corresponds to the worst reading for any year and any country in the period and the countries considered, and 1 to the best. The index of labor flexibility is the simple average of the three sub-indices, which are calculated as follows:

(i) The first component is an indicator of flexibility of legislation on hiring. This indicator takes the value of 1 when the legislation does not impose restrictions on temporary contracts, the value of 0.5 when only contracts with a limited duration and renewability are allowed, and 0 when temporary contracts are limited to temporary functions. The basis is the legislation of countries as reported in IDB (1996), and complemented for subsequent years with information from Labor Ministries.

(ii) The second indicator is the expected cost of dismissal of a permanent worker employed by a formal firm. It is calculated following Heckman and Pagés (2000), who assume that workers face a profile of probabilities of being laid off, which is the same in all countries. The same methodology was applied to the other years not covered by these authors, using the legal information on the countries according to the IDB (1996) and Ministries of Labor.

(iii) The last component is an indicator of work-day flexibility, which takes a value of 1 when extra charges for overtime are not over 50 percent and for holidays are not over 100 percent, a value of 0 when both overtime and holidays have extra charges of over 100 percent, and a value of 0.5 in remaining cases. The sources are the same as the previous point. Table A.1 presents the results of the computations.

The index does not seek to measure the quality of the labor code or of labor policies in general. It only attempts to provide a simple measure of the flexibility allowed by the labor code, disregarding other objectives of labor legislation, such as providing protection and stability to workers.

## Labor Flexibility Index: 1985-2009

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Argentina	0.757	0.757	0.757	0.757	0.757	0.757	0.757	0.757	0.757	0.757	0.757	0.757	0.757	0.757
Bolivia	0.296	0.296	0.296	0.296	0.296	0.296	0.296	0.296	0.296	0.296	0.296	0.296	0.296	0.296
Brazil	0.833	0.833	0.833	0.833	0.621	0.621	0.621	0.621	0.621	0.621	0.621	0.621	0.621	0.621
Chile	0.742	0.742	0.742	0.742	0.742	0.742	0.702	0.702	0.702	0.702	0.702	0.702	0.702	0.702
Colombia	0.716	0.716	0.716	0.716	0.716	0.716	0.697	0.697	0.697	0.697	0.697	0.697	0.697	0.697
Costa Rica	0.715	0.715	0.715	0.715	0.715	0.715	0.715	0.715	0.715	0.715	0.715	0.715	0.715	0.715
Dominican Republic	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.569	0.569	0.569	0.569	0.569	0.569
Ecuador	0.485	0.485	0.485	0.485	0.485	0.485	0.485	0.499	0.499	0.499	0.499	0.499	0.499	0.499
El Salvador	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377
Guatemala	0.557	0.557	0.557	0.557	0.557	0.557	0.557	0.557	0.557	0.557	0.557	0.557	0.557	0.557
Honduras	0.546	0.546	0.546	0.546	0.546	0.525	0.525	0.525	0.525	0.525	0.525	0.525	0.525	0.525
Jamaica	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935
Mexico	0.182	0.182	0.182	0.182	0.182	0.182	0.182	0.182	0.182	0.182	0.182	0.182	0.182	0.182
Nicaragua	0.353	0.353	0.353	0.353	0.353	0.353	0.353	0.353	0.353	0.353	0.353	0.571	0.571	0.571
Paraguay	0.632	0.632	0.632	0.632	0.632	0.632	0.632	0.632	0.632	0.580	0.580	0.580	0.580	0.580
Peru	0.426	0.426	0.426	0.426	0.426	0.426	0.426	0.564	0.564	0.564	0.564	0.564	0.513	0.680
Trinidad & Tobago	0.892	0.892	0.892	0.892	0.892	0.892	0.892	0.892	0.892	0.892	0.892	0.892	0.892	0.892
Uruguay	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231
Venezuela	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
<i>LAC Average</i>	<i>0.55</i>	<i>0.55</i>	<i>0.55</i>	<i>0.55</i>	<i>0.54</i>	<i>0.54</i>	<i>0.53</i>	<i>0.54</i>	<i>0.54</i>	<i>0.54</i>	<i>0.54</i>	<i>0.55</i>	<i>0.55</i>	<i>0.57</i>

Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Argentina	0.757	0.757	0.757	0.757	0.757	0.757	0.760	0.760	0.760	0.760	0.760
Bolivia	0.296	0.296	0.296	0.296	0.296	0.296	0.296	0.296	0.296	0.296	0.296
Brazil	0.621	0.621	0.621	0.606	0.606	0.606	0.606	0.606	0.606	0.606	0.606
Chile	0.702	0.702	0.702	0.702	0.702	0.702	0.702	0.702	0.702	0.702	0.702
Colombia	0.697	0.697	0.697	0.697	0.744	0.744	0.744	0.744	0.744	0.744	0.744
Costa Rica	0.715	0.739	0.739	0.739	0.739	0.739	0.739	0.739	0.739	0.739	0.739
Dominican Republic	0.569	0.569	0.569	0.569	0.569	0.569	0.569	0.569	0.569	0.569	0.569
Ecuador	0.499	0.499	0.499	0.499	0.499	0.499	0.499	0.499	0.499	0.499	0.499
El Salvador	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377
Guatemala	0.557	0.557	0.557	0.557	0.557	0.557	0.557	0.557	0.557	0.557	0.557
Honduras	0.525	0.525	0.525	0.525	0.525	0.525	0.525	0.525	0.525	0.525	0.525
Jamaica	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935
Mexico	0.182	0.182	0.182	0.182	0.182	0.182	0.182	0.182	0.182	0.182	0.182
Nicaragua	0.571	0.571	0.571	0.571	0.571	0.571	0.571	0.571	0.571	0.571	0.571
Paraguay	0.580	0.580	0.580	0.580	0.580	0.580	0.580	0.580	0.580	0.580	0.580
Peru	0.680	0.680	0.680	0.680	0.680	0.680	0.680	0.680	0.680	0.680	0.680
Trinidad & Tobago	0.892	0.892	0.892	0.892	0.892	0.892	0.892	0.892	0.892	0.892	0.892
Uruguay	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231
Venezuela	0.376	0.376	0.376	0.376	0.376	0.376	0.376	0.376	0.376	0.376	0.376
<i>LAC Average</i>	<i>0.57</i>	<i>0.57</i>	<i>0.57</i>	<i>0.57</i>	<i>0.57</i>	<i>0.57</i>	<i>0.57</i>	<i>0.57</i>	<i>0.57</i>	<i>0.57</i>	<i>0.57</i>

Source: Authors' calculations.