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a general equilibrium analysis applied to Uruguay**

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Policies against informality in segmented labor markets: a general equilibrium analysis applied to Uruguay

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Abstract

In this paper we analyze the impact of some policies against informality on the labor market, poverty and income distribution in Uruguay, using a general equilibrium model that considers a dual labor market segmented by skill, and microsimulations. We simulate two sets of policies: payroll tax cuts and increased enforcement in the informal sector. Both sets of policies are effective in reducing informality. Payroll tax cuts on unskilled labor increase informality among medium-skilled workers, but in spite of that they are successful in reducing poverty and improving income distribution. Enforcement policies have a negative impact on wages, especially for unskilled workers. The net effect on poverty is two-sided: on the one hand this policy promotes an increase in poverty as a consequence of wages falling, but on the other hand poverty falls because the formal demand for labor increases.

Keywords: informality, labor market, general equilibrium, policies, poverty
JEL: D58, I32, J08, J42

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1. Introduction

The financial and trade openness of the Uruguayan economy, together with the creation of MERCOSUR in 1991 and the implementation of stabilization policies during the 1990s, deeply affected the country's economy. The labor market was also affected: the sectoral distribution of employment changed, unemployment and informality rose, the female labor supply increased and there were changes in relative factor remunerations. Unemployment and informality rose during the second half of the decade, and increased even more with the downturn of the economy that began in 1999.

Informality mainly affects lower skilled workers: in 2004, 55% of workers with less than eight years of schooling were employed in the informal sector, while 20% of skilled workers with 12 or more years of schooling were informal workers¹. Moreover, several studies of Uruguay have found that informal workers earn on average less than formal workers (Amarante and Arim, 2005; Amarante and Espino, 2007; Cassoni, 2001; Terra et al., 2006). In all these studies the estimated wage gaps between formal and informal workers differ because the studies do not analyze the same time periods nor apply the same methodology. However, the conclusion is the same: there is a wage gap between formal and informal workers with identical characteristics. Besides this, information from the Continuous Household Survey shows that the most vulnerable workers in terms of poverty are the more disadvantaged in the labor market. For this reason, implementing policies against unemployment and informality may indirectly contribute to the reduction of poverty.

While there are several studies that evaluate policy options to fight unemployment in Uruguay and also studies that focus on informality and its evolution in the Uruguayan labor market, there are few studies that focus on policy options against informality. Terra et al. (2006) work with a general equilibrium model that considers informality in the labor market and they simulate a specific policy against it – a 10% subsidy on formal employment. They conclude that even when the policy is effective in reducing informality, implementation is not feasible because it would have a long-run negative impact on investment, government expenditure and human

¹ The percentage of informal jobs for medium-skilled workers was 40% in the same year. Unemployment rates for the three categories of workers also differ substantially. The percentages presented were calculated using data from CHS 2004.

capital accumulation. They suggest that there should be deeper discussion about policies against informality among lower-skilled workers. With that in mind, in this paper we discuss specific policy options against informality in Uruguay, we design policy scenarios and we analyze their impact on labor market and the Uruguayan economy.

Informality is a complex concept, and there are numerous theoretical explanations and operational definitions about it. The ILO-PREALC traditional conception of informality is that of dual labor markets. This suggests that in the economy there is one sector that gathers all activities that are marginal to the main activity of the economy, and that it presents lower productivity levels (Hart, 1973; OIT, 1972; Sethuraman, 1976; Tokman, 1978). The operational definition applied to Uruguay that stems from this conception contains the following categories of employment: domestic service workers, non remunerated family work, workers employed in firms with less than five employees, and the self-employed (excluding professionals) (Amarante and Espino, 2007).

On the other hand, in the structuralist approach – developed by Moser (1978) and Portes et al. (1989), among others –, the informal sector is considered to be part of the structure of the economy – which explains the denomination of the approach. According to this approach, the informal sector consists of all remunerated activities that are not regulated by the State, and that coexist with other similar activities in the formal sector. Following this approach, the informal sector is measured by the percentage of jobs that does not comply the existing regulations, such as social security coverage or access to health services. In Uruguay, this would mean that informal workers are defined as those that do not contribute to the social security system, regardless of the size of the firm in which they are employed. This definition of informality stresses the fact that the labor conditions of the jobs are more important than the type of firm that offers the jobs².

² A third theoretical approach, called “legalist”, considers that informality is a consequence of excess of State regulation. According to Amarante and Espino (2007), there is no operational definition of informality related to this approach. The presentation of theoretical approaches on informality follows Portes and Shauffler (1997), although we must admit that there is no consensus in the literature about the different approaches to informality or the authors in each approach.

We apply this last definition of informality, but we also consider some aspects of the dual labor market theory. This theory states that in the labor market there are two sectors that coexist: the primary sector pays higher wages and offers better labor conditions (formal sector), while the secondary sector offers jobs that do not comply with regulations (informal sector). We assume that the wage differential between the wages paid in the formal and the informal sectors is an efficiency wage that firms in the formal sector pay in order to promote worker effort or to maintain workers in the firm once training costs have been assumed. The secondary or informal sector presents lower productivity levels, which are associated, among other factors, to credit and public services restriction (Braun and Loayza, 1994). We also assume that in the informal sector there are workers and firms that chose to be part of the informal sector in order to avoid the costs and regulations of the formal sector. This hypothesis follows Agénor and Aizenman (1999) and Fugazza and Jacques (2003), and corresponds to an integrated approach to informality that combines the dual economy approach with structuralist and legalist approaches.

In the next section we present a review of literature on the causes of informality and policies to fight it. Then we present the methodology applied in this paper. Finally, we present our results and draw some conclusions.

2. Informality: origin and policies to reduce it

In economic literature, there are many studies that suggest different policy options to fight informality. The policy suggestions will obviously rely on the theoretical approach adopted and the diagnosis about the causes of an informal sector in the labor market.

The most commonly-mentioned cause of informality in the labor market is the existence of high tax levels that the formal sector must bear (Braun and Loayza, 1994; Fugazza and Jacques, 2003; Ihrig and Moe, 2004; Sanches, 2005; Schneider and Klingmair, 2004; among many others authors). The costs of being formal can be understood as high tax rates and heavy social security loads, as reviewed in Gërxhani (2004) and Schneider and Enste (2000).

Both reviews also agree that the second cause of informality is overregulation in the labor market. Overregulation can be measured through the existence of high minimum wage levels (Loayza, 1994), high entry costs to the formal sector –the number of licenses required and how easy they are to obtain (Braun and Loayza, 1994; Friedman et al., 2000), or labor restrictions on foreigners (Schneider and Enste, 2000). The way that the government controls overregulation is also important. Therefore, the way in which the government controls, enforces and penalizes firms that do not comply with regulations is also associated with informality levels (Ihrig and Moe, 2004). According to Schneider and Enste (2000), the studies tend to show that instead of the quantity or quality of regulations, what matters is the way that they are enforced. There might be cases where many regulations are not complied with. Thus corruption becomes a factor associated with informality (Braun and Loayza, 1994; Friedman et al., 2000).

Other factors that are mentioned less in the literature are social plans for unemployed or precarious workers; changes in labor market regulations, such as the reduction of working hours and incentives for early retirement; the deterioration of public services from which the formal sector benefits (Schneider and Enste, 2000); the presence of strong unions that firms and workers prefer to avoid; and the impact of international competition (Gërkhani, 2004).

Which specific policies can be implemented to reduce informality? Many authors suggest tax cut policies, and this goes with the opinion that high costs in the formal sector lead to a bigger informal sector. Related to the efficiency wage theory, several authors suggest that in order to increase formal employment and improve welfare, government should subsidize wages paid in the primary (formal) sector (Thierfelder and Shiells, 1997). The studies that analyze the impact of fiscal policies on informality fall into two groups: those that develop theoretical models and those that use empirical data from developed and/or developing countries.

In the first group, Ihrig and Moe (2004) work with a dynamic model and consider two main causes of informality: high taxes (positive relation) and regulation compliance (negative relation). The authors evaluate different policies to reduce the size of the informal sector: tax cuts in the formal sector and a policy of increasing enforcement, associated with higher penalties. They find that reducing the tax rate has a greater impact on the size of the informal

sector, although in order to keep government revenue unchanged there should be better enforcement and higher penalty rates for firms found to be operating informally.

Albrecht et al. (2006), using a search and matching model that considers a large informal sector, simulate an increase in tax rates: severance tax and payroll taxes. Their results show that increasing the rates of these two taxes reduces the rate at which workers find formal jobs, but when payroll taxes increase there is a worse impact on informality; the duration of remaining in formal jobs falls and unemployment increases.

Among second group, Sanches (2005) analyzes the effect of a payroll tax cut on informality, using data from the United States and Brazil and employing a neoclassic model with two sectors. In order to keep the fiscal balance unchanged, the fall in payroll tax rates is compensated for an increase in the value added tax rate. The author draws similar conclusions for the two countries. In the short term, the fall in the general level of taxes has a negative impact on informality in both economies and a positive impact on GDP. In the long term the conclusions are the opposite: informality falls at the beginning when the initial level of taxes is high, and GDP falls in the long term because of the major fall in capital stock. In spite of that, both in the short and long term, general welfare increases as a consequence of substituting taxes.

Fugazza and Jacques (2003) analyze the impact of fiscal policies on informality in Italy and Canada using a dual labor market approach that considers unemployment for both segments of workers. They simulate a reduction in payroll taxes in the formal sector. They consider different tax rates: payroll taxes imposed on firms, and taxes imposed on workers (social contributions). They also consider other parameters related to taxes: informality detection probability and penalty rates for firms in infraction, and they evaluate how a reduction in both tax rates, an increase in detection probability and a higher penalty rate affect informality in Italy and Canada. They find that even when each of the three policies is effective in reducing informality and increasing the size of the formal sector, the increase in detection probability reduces worker welfare, and thus worsens social welfare. Given this result, the tax rate reduction policy seems more effective in reducing informality.

Braun and Loayza (1994) consider that in order to reduce informality, authorities should impose higher penalty rates on firms caught in the informal sector. The authors develop a dynamic model with endogenous growth in which there is an optimum tax rate for the production of public services. If the tax rate is below the optimum, and at a sufficiently low level, the informal sector might not exist, because there might be no incentives to stay informal, that is, not to pay taxes. However, a low tax rate also determines low-quality public services. When the tax rate is increased, social welfare rises, but there is a risk that informality may increase. In order to avoid that, the authors suggest an increase in penalty rates for firms in the informal sector and greater enforcement in order to prevent those firms from accessing public services. Very similarly, Schneider and Enste (2000) conclude that governments should pay more attention to the density of regulations and to the way in which authorities can increase compliance with regulations in order to tackle informality.

There are some studies for Uruguay that conclude that there are high hiring costs in the Uruguayan labor market, particularly in some sectors such as domestic service and the building sector (Cassoni and Ferre, 1997). Therefore, a policy of tax reduction would reduce informality in the Uruguayan labor market, although policies focalized on specific sectors may have a greater impact on creating new formal jobs (Cassoni, 2005). Informality in Uruguay is also associated with a low enforcement level of current regulations (Forteza, 1999). Increasing enforcement and penalizing firms caught in the informal sector may also reduce informality. However, this type of policy may increase unemployment, because both problems affect the same segment of workers (Boeri and Garibaldi, 2006).

3. Methodology

In order to evaluate the impact on the labor market and the economy of some policies against informality, we chose to apply a computable general equilibrium analysis (CGE). General equilibrium models are a suitable methodological tool for evaluating policy options, because they take account of direct and indirect effects on the economy. In order to capture the effect of the simulated policies on poverty and income distribution, we also run microsimulations.

3.1. Theoretical model

The CGE model applied in this study especially considers informality in labor market. It is the same model as in Terra et al. (2006), but it involves three categories of workers classified by skills instead of two. In this section we present the main characteristics of the model. The full model and its equations are available from the authors on request.

The model has a conventional structure. It assumes perfect competition in good markets, although goods are not homogenous: they differentiate by geographical origin in line with an Armington specification. The Uruguayan economy is explicitly modeled, following the quasi-small open economy assumption. This assumption means that the country faces a perfectly elastic supply of imports but has an influence on the international price of exports, that is to say it faces a downward sloping export demand curve. The demand for exports is a function of relative prices and the real income of Uruguay's trade partners, which is considered exogenous. The country has three trade partners: Argentina, Brazil and the Rest of the World. The trade balance is fixed.

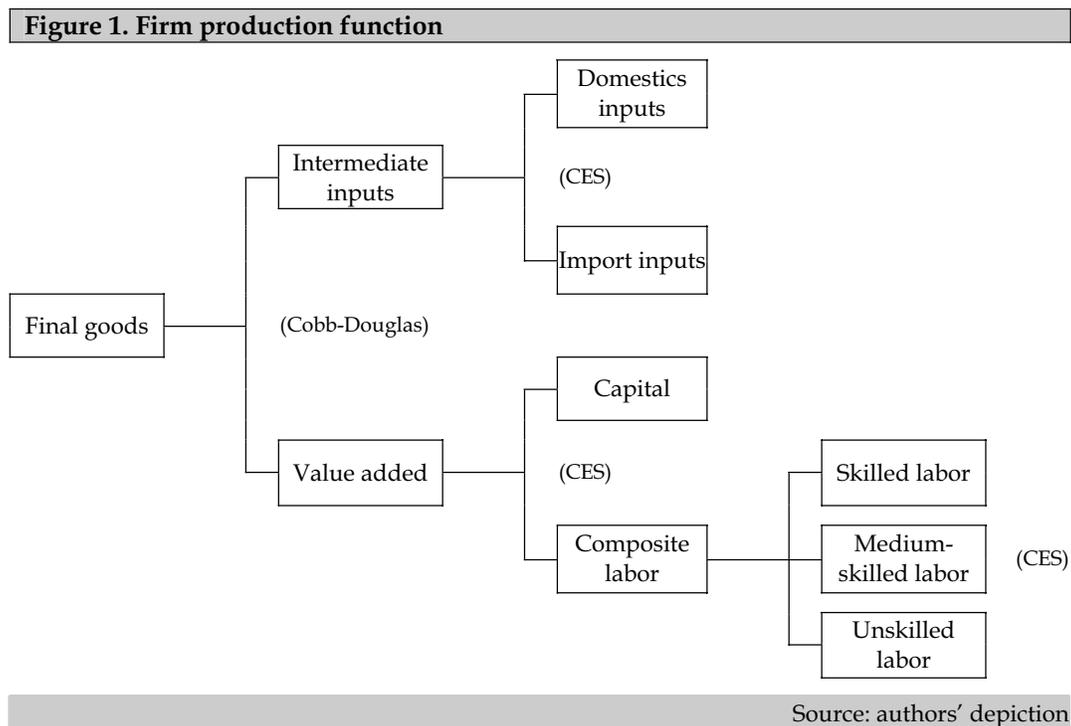
There are 23 sectors. One of them is the public sector with fixed employment (it does not hire or dismiss workers). Another is the informal sector, which covers all the informal activities in the economy. The informal sector produces one good for final consumption and hires only unskilled and medium-skilled workers.

The production function of firms is nested in three levels. At the upper level, firms combine intermediate inputs and value added following a Cobb-Douglas function. Value added is obtained through two nested CES (Constant Elasticity of Substitution) functions: at the upper level the firm combines composite labor and capital, and at the lower level it combines labor by different skills, which means there is imperfect substitution among different types of labor by skills.

In this paper we employ an extra category of labor in addition to those of Terra et al (2006), where labor was differentiated in two categories: unskilled labor and skilled labor. In this paper, we have three categories: unskilled labor (eight or less years of schooling), medium-skilled labor (between nine and eleven years of schooling) and skilled labor (12 or more years of schooling).

As we have seen, informality mainly affects lower-skilled workers, especially workers with less than eight years of schooling. Many authors suggest working with three categories of labor when studying labor markets in Latin American countries (UNDP, 2001; Wood, 1994).

There is a tax on labor (t_{fac}) that negatively affects factor demand. There is also an income tax that households pay (t_{lab}). This tax does not affect labor demand. It could affect labor supply, but in our model this is assumed to be constant. The firm production function is shown in Figure 1.



As mentioned above, the model takes account of an informal sector in the economy. We consider the dual labor market hypothesis so as to introduce an informal sector in the labor market, on the assumption that informality affects only unskilled and medium-skilled workers, whereas skilled workers are fully employed in the formal sector. Unskilled and medium-skilled workers are employed in the informal sector, which works under perfect competition, or in the formal sector, where they earn an efficiency wage because of monitoring or training costs. If low-skilled workers are dismissed from the formal sector, they go to the informal sector, where no efficiency wages are paid and the equilibrium is reached through wages.

Wage differentials are endogenously determined in the model. Following Thierfelder and Shiells (1997), the wage differential is specified through the following equation:

$$\frac{wd_{labnc,i} - 1}{wd_{labnc,i}} = \frac{\kappa \cdot rd}{(D2 - D1)} + \frac{\kappa(D1 + S)\overline{LU}_{labnc}}{(D2 - D1)(\overline{LU}_{labnc} - \sum_i lu_{labnc,i})}, \quad i = \{1, \dots, I\}$$

where κ is the utility of shirking, rd is the discount rate, $D1$ is the probability of firing workers that were not shirking, $D2$ is the probability of being found shirking and therefore fired and S is the quitting rate in the formal sector. \overline{LU}_{labnc} refers to labor supply by category of labor (fixed) and $lu_{labnc,i}$ represents labor demand by sector i for each type of labor $labnc$. Note that i are all the efficiency wage sectors, that is all the formal sectors in the economy without considering the public sector, and $labnc$ covers unskilled labor and medium-skilled labor. The wage differential is set at 60% for both types of workers, following estimations by Terra et al (2006).

Final goods demand functions are derived from maximizing the households' utility function (Cobb-Douglas function) subject to their income constraints. There are ten types of households in line with income deciles. The government collects taxes, buys goods and services and makes transfers to households. The investment level of the economy is determined by savings, which are made up of private savings, public savings and external savings. The equilibrium in the model is reached through simultaneous equilibrium in the good market, in the factor market and in the external sector. In all simulations the numerary of the model is the consumer price index of the economy. We run the model using software GAMS.

3.2. Data and calibration

Data used in a general equilibrium model is assumed to reflect equilibrium for the economy at the benchmark, and it is represented in a Social Accounting Matrix (SAM). In this paper we use the same SAM as in Terra et al. (2006), which is a modified version of the one built by Barrenechea et al. (2004) with some minor changes. In our model there are three types of labor according to the skill level of workers, and thus we needed to introduce this change in the SAM. We separated unskilled labor into unskilled and medium-skilled labor, using data from the Continuous Household Survey (CHS) for 2001.

Second, we differentiated taxes on labor in two types: taxes on labor demand, which are paid by firms, and taxes on workers income, paid by households. Even when in the model both taxes are considered, in the original SAM they were gathered in one single payment by factors. In this paper the differentiation of the two taxes in the model and in the SAM is extremely important because, as the model assumes fixed labor supply, changes in the tax rate applied to labor supply do not affect labor demand and have no impact on employment. Therefore in the SAM there was a second modification differentiating taxes on factors and taxes on firms. To do this we used data from the Central Bank of Uruguay (National Accounts, 2005) and the Banco de Previsión Social (2005).

3.3 Microsimulations

General equilibrium models may capture the effects of simulated policies on income distribution through changes in the relative price of production factors and changes in relative household income. However, it is a partial distribution and does not measure the impact on poverty and income distribution at a micro level. In order to analyze the effect of the simulated policies on poverty and inequity, the CGE analysis can be complemented with microsimulations. One of the assumptions of this methodology is that the position of a worker in the labor market determines his/her income and social status, in a way that the labor market is the main transmission channel through which labor market policies affect poverty and inequity.

In this paper we apply the microsimulation technique suggested by Ganuza et al. (2002) and applied in Terra et al. (2006). The procedure starts from the results on the labor market obtained at a macro level through the CGE model. We introduce changes in some variables in the model as variations in some microsimulation parameters. We specifically consider the following parameters: the share of informal workers by category of education, wages in the formal and informal sector and by category of education, the average wage in the economy and the share of workers by skill by sector of activity.

The labor market is modeled in a rudimentary way and segments are assumed in accordance with these parameters. Workers may move randomly from one segment to another, where they receive different wages. Changes in labor market parameters are simulated following an accumulated sequence. We simulate the sequence a large number of times in a Monte Carlo

fashion using the CHS database for 2001³, and we obtain the average value and confidence intervals for the relevant indicators. Specifically, we obtain the most usual poverty and inequality indicators: the poverty index (the percentage of households below the poverty line), taking as a reference the poverty line suggested by the National Institute of Statistics for the year 2001; the extreme poverty index (the percentage of households below the extreme poverty line); and the Gini coefficient, calculated with per capita income by household. Comparing the average level of the indicators with their value at the benchmark, we can draw conclusions about the impact of the simulated policies on poverty and income distribution. Microsimulations were run using STATA software and the do-files are from Cicowiez (2006).

3.4. Simulation of policy scenarios

We design simulations taking into account the main objective of this paper: to evaluate policy options to combat informality and to analyze their impact on the labor market and the economy. As we have noted, there are two sets of policies mentioned in the literature. On the one hand, informality may be a consequence of high tax rates, and therefore a policy to combat it would be a tax rate reduction or a subsidy on formal employment; on the other hand, the government may fight informality through enforcement policies that increase control in the informal sector and force these firms/individuals to pay taxes and comply with regulations.

In the first place we simulate five policy scenarios involving payroll tax rate reductions. We should remember that in our model this tax is paid by the firm that demands formal labor, although firms are able to transmit costs to the workers through wages. In the five scenarios the tax reduction simulated is the same, a 20% decrease with respect to the level at the benchmark. However, the scenarios differ in two aspects, namely the sectors that benefit from the tax reduction and the type of labor affected.

The first scenario (TAX1) is the most restrictive in that it simulates a 20% tax cut for unskilled labor, and it benefits only those sectors intensive in this factor. Specifically, the sectors are agriculture, livestock rearing, other primary sectors, rice, ceramics and the building sector. The second scenario (TAX2) simulates a tax cut for both unskilled and medium-skilled labor, which benefits unskilled labor intensive sectors as well. Third, TAX3 scenario simulates a 20% tax cut

³ We run 35 iterations. Cicowiez (2006) suggests running at least 30 iterations.

for unskilled labor, but which benefits all efficiency wage sectors. Lastly, we simulate a 20% tax cut for unskilled and medium-skilled labor in all efficiency wage sectors (TAX4). This last policy may have a big impact on government revenue and therefore on public investment, and in the long term on investment and human capital accumulation (Terra et al., 2006). Thus, we simulate a fifth policy scenario (TAX5) that adds a new tax on capital income of 0.75% in order to maintain the fiscal deficit unchanged.

The second set of simulations considers an enforcement policy in the informal sector. In this case, three alternative scenarios are simulated. The first considers a less effective enforcement policy and the second a more effective enforcement policy. Both of them assume that the enforcement policies are applied to both unskilled and medium-skilled workers. The third scenario assumes that only unskilled workers are compelled to pay taxes, on the assumption that the enforcement policy is applied only in those sectors that hire unskilled labor. The enforcement policies mean that informal sectors must start paying taxes, and therefore they become part of the formal sector. Therefore, we simulate an increase in taxes specific for the informal sector. If the probability of catching firms in the informal sector increases, the tax rate increases as well.

The theoretical revenue from labor tax (R) would be:

$R = t * W$, that is tax rate (t) times the tax base, which in this case is made up of wages paid to workers (W).

In fact, there are two types of wages: those paid in the formal sector and those paid in the informal sector. In the latter, revenue is zero because we assume no government enforcement at the benchmark:

$R = t * W_f + p * \tau (t * W_{inf})$, where p is the probability of catching an infracting firm and forcing it to pay taxes, W_f and W_{inf} are wages in the formal and informal sector respectively and τ is the penalization rate paid by the infracting firm.

At the benchmark $p=0$. If government increases enforcement in the informal sector, then p adopts a positive value. In the first simulation scenario (ENF1), p is 50%, that is enforcement on

the informal sector is 50% effective, while the second scenario is 85% effective (ENF2). Firms in the informal sector that are caught not only have to pay taxes, but also a fine, which is simulated by increasing tax rates by a few percentage points that differ according to the type of worker and the scenario simulated.

As a consequence, the payroll tax rate in the informal sector is now positive, but has a lower value than the tax rate paid in the formal sector, because not all firms and workers are caught infringing regulations. In the first scenario (ENF1), the tax rate in the informal sector is 4.0% for unskilled labor and 4.1% for medium-skilled labor. In the second scenario (ENF2) tax rates are 6.8% and 7.0% respectively. In the third scenario (ENF3), only the tax rate for unskilled labor rises to 7.2%, which represents a 90% effective enforcement policy.

The following table presents the eight simulation scenarios:

Table 1. Simulation scenarios					
Scenario	Policy	Factors affected	Sectors affected	Parameter	New parameter value
TAX1	20% decrease in tax on labor	Unskilled labor	Unskilled labor intensive sectors*	tfac	Depends on sector
TAX2	20% decrease in tax on labor	Medium-skilled and unskilled labor	Unskilled labor intensive sectors*	tfac	Depends on sector
TAX3	20% decrease in tax on labor	Unskilled labor	Efficiency wage sectors	tfac	Depends on sector
TAX4	20% decrease in tax on labor	Medium-skilled and unskilled labor	Efficiency wage sectors	tfac	Depends on sector
TAX5	20% decrease in tax on labor. Increase in capital tax.	Medium-skilled and unskilled labor. Capital	Efficiency wage sectors	tfac tcap	Depends on sector 0,75%
ENF1	50% increase in enforcement to informal firms	Medium-skilled and unskilled labor	Informal sector	tfac (tncal) tfac (tpcal)	4,0% 4,1%
ENF2	85% increase in enforcement to informal firms	Medium-skilled and unskilled labor	Informal sector	tfac (tncal) tfac (tpcal)	6,8% 7,0%
ENF3	90% increase in enforcement to informal firms	Unskilled labor	Informal sector	tfac (tncal)	7,2%

Source: authors' construction

*Agriculture, livestock rearing, other primary activities, diary products, rice, ceramics and building

4. Results

In this section we present the results of the simulations. In the first place, we present the results of tax cut policies on the labor market, and then the effect of enforcement policies on the labor market. Next we analyze the effect of the two sets of policies on macroeconomic variables, household income and poverty, and income distribution. Finally, we present a sensitivity analysis of the value of the elasticity of substitution among workers by skills.

4.1. Effects of payroll tax cuts on labor market

Table 2 shows the impact of a reduction in payroll tax rates on informality and formal employment for unskilled and medium-skilled workers, since highly-skilled employment and public employment is fixed. First, we can see that the five policies simulated are effective in reducing total informality and informality among unskilled workers. However, the policies that simulate a tax cut only for unskilled workers (TAX1 AND TAX3) cause informality among medium-skilled workers to increase. This is due to a substitution effect among workers in the sectors that benefited from the tax cuts.

Table 2. Effects of tax-cut policies on employment and informality. Percentage change

	TAX1	TAX2	TAX3	TAX4	TAX5
Informal employment	-0,09	-0,15	-0,25	-0,53	-0,74
Unskilled informal employment	-0,26	-0,21	-0,69	-0,46	-0,69
Medium-skilled informal employment	0,08	-0,09	0,19	-0,60	-0,79
Unskilled formal employment	0,15	0,12	0,39	0,26	0,39
Medium-skilled formal employment	-0,03	0,04	-0,07	0,23	0,30

Source: own results

The sectors that benefit from the tax cuts increase their labor demand. In scenario TAX1, they are the unskilled labor intensive sectors, whereas in scenario TAX3 they are the efficiency wage sectors. When the cost of hiring formal workers is reduced, there are two possible effects. First, firms may increase labor demand, creating new formal jobs. Nevertheless, a second effect is that firms may also substitute different categories of labor, without creating new jobs. When the firms substitute high- and medium-skilled workers for unskilled workers, informality among this last group of workers is reduced, but it increases for medium-skilled workers.

Therefore, reducing payroll tax rates on one type of labor generates substitution among different types of workers and has an unwanted effect on medium-skilled informality. Even though the policy reduces total informality, it harms medium-skilled workers. The magnitude of the substitution depends on the possibility of the firm to make the substitution, which in our model is represented by the value of the elasticity of substitution in the firm production function. In the last section of this paper we analyze how sensitive the results are when the value of this parameter is modified.

On the other hand, a reduction in tax rates on unskilled and medium-skilled labor that benefits unskilled labor intensive sectors (TAX2) generates a fall in informality among all types of workers. Obviously, the fall in informality among unskilled workers is less because there is less substitution among different types of workers. Under this scenario, informality falls because labor demand increases for both categories of workers.

The most effective policy against informality is that which reduces payroll taxes in all efficiency wage sectors and for both types of workers (TAX4). Under this scenario, informality falls for both types of workers, leading to a total informality fall of 0.5%. However, since this policy may have a big negative impact on the fiscal deficit, we simulate it combined with an increase in taxes on capital income, in order to keep the fiscal deficit constant (TAX5). In this scenario, informality falls even more: 0.7%. This outcome is associated with the behavior of the building sector, which is highly dependent on the investment level of the economy⁴. As we will show below and as can be seen in table 6, the fiscal deficit increases in the four previous scenarios analyzed, but scenario TAX5 avoids this increase. When the fiscal deficit increases public investment falls, making total investment fall as well, and this has a negative effect on the building sector, which is intensive in unskilled labor. In fact, under the TAX4 scenario, in which investment falls the most, formal employment in the building sector falls 1.07% for unskilled workers and 1.34% for medium-skilled workers, even when the sector is favored with the tax reduction. Formal employment in the other sectors still rises when labor demand from the building sector falls, but this result shows that those policies that negatively affect the fiscal deficit may have a negative effect on informality. In contrast, under the TAX5 scenario public

⁴ Building accounts for almost 60% of investment at the benchmark.

investment does not fall and labor demand in the building sector increases. Thus, informality falls more.

Table 3 shows the effect of tax policies on wages. In the model, the consumer price index is fixed as the numeraire, so variation in wages is expressed in real terms. When firms see their hiring costs for unskilled workers reduced, they increase their demand for this type of worker, which makes wages increase, because the labor supply is fixed. This happens in the five tax cut scenarios.

Table 3. Effect of tax cuts on wages. Percentage change					
	TAX1	TAX2	TAX3	TAX4	TAX5
Unskilled wage in the informal sector	0,25	0,26	0,70	0,81	0,76
Medium-skilled wage in the informal sector	0,03	0,18	0,11	0,91	0,83
Unskilled wage differential	0,41	0,32	1,08	0,72	1,09
Medium-skilled wage differential	-0,12	0,15	-0,30	0,95	1,26
Unskilled wage in the formal sector	0,41	0,38	1,11	1,08	1,17
Medium-skilled wage in the formal sector	-0,02	0,24	-0,01	1,26	1,31
Skilled wage	0,00	-0,01	0,00	0,01	-0,02
Public wage	-0,01	-0,01	0,02	0,04	0,00
Average wage	0,08	0,13	0,23	0,52	0,53

Source: own results

Skilled wage variation depends on the possibility of firms substituting workers with different skills. Because skilled employment is fixed, when firms substitute skilled workers informality cannot increase, as was the case of medium-skilled workers in scenarios TAX1 and TAX3, but wages are negatively affected. As table 4 shows, in the scenarios that simulate tax cuts for all the efficiency wage sectors (TAX3 and TAX4), highly-skilled wages increase slightly because as labor costs for efficiency wage sectors are reduced production increases and all types of workers benefit. With the value of the elasticity of substitution assumed in the model, the positive production effect on highly-skilled wages prevails over the negative effect derived from the substitution effect. As substitution among workers becomes more imperfect, highly-skilled wages increase more.

On the other hand, highly-skilled wages fall slightly under the TAX1 and TAX2 scenarios. In these cases, the substitution effect prevails. We should remember that under these scenarios

only unskilled intensive sectors benefit, and some of these do not employ highly-skilled workers at all. Thus, an increase in their production does not benefit highly-skilled workers.

The wage gap between highly-skilled and medium-skilled and unskilled workers falls in all five tax reduction scenarios. Even when in some scenarios highly-skilled wages increase, medium-skilled and unskilled wages increase more. This may make for more equitable income distribution.

However, the wage gap between formal and informal workers increases. The wage differential paid in the formal sector depends negatively in the difference between labor supply and labor demand in the formal sector. Therefore, when informality falls, wage differentials increase. When the informal sector is reduced, the probability of being dismissed in the formal sector falls, and workers shirk more. Thus, firms in the formal sector are willing to pay a higher wage differential to promote effort among employees.

This explains the increase in the wage differential paid to unskilled workers in the five scenarios considered. Lower-skilled wages present the highest increase in scenario TAX4, where unskilled wages increase 0.8%, medium-skilled wages increase 0.9% and wage differentials increase for both types of workers. We should bear in mind that efficiency wages mean an efficiency loss for the economy, which increases when wage differentials are higher. If wage differentials were exogenous and did not depend on employment, the efficiency loss would be less and formal labor demand would increase more (Thierfelder and Shiells, 1997).

The average wage increases in all five policy scenarios, which improves general welfare.

4.2. Effects of enforcement policies on labor market

Enforcement policies against informal firms are even more effective in reducing informality because they are designed to attack the problem directly –informal sectors must pay taxes once they are found in infraction- and not indirectly as tax cuts, and informality decreases because tax cuts promote an increase in labor demand. Table 4 shows the effect of enforcement policies on informality and formal employment for unskilled and medium-skilled workers. We can see that a 50% effective enforcement policy reduces total informality by 2.2%. A more efficient

enforcement policy impacts even more: total informality falls 3.6% under the ENF2 scenario. Promoting enforcement only among unskilled workers also has a big impact on total informality, and makes for a very significant fall in informality among unskilled workers: 3.9%. In the first two scenarios, the fall in informality comes together with a rise in formal employment for both unskilled and medium-skilled workers.

Table 4. Effects of enforcement policies on employment and informality. Percentage change			
	ENF1	ENF2	ENF3
Informal employment	-2,17	-3,61	-1,78
Unskilled informal employment	-2,08	-3,46	-3,90
Medium-skilled informal employment	-2,26	-3,76	0,34
Unskilled formal employment	1,17	1,95	2,20
Medium-skilled formal employment	0,85	1,42	-0,13

Source: own results

However, as can be seen in table 5, enforcement policies negatively affect wages, especially for unskilled workers. Under the three scenarios wages for unskilled workers in the informal sector fall sharply and wage differentials increase significantly. In spite of this, wages for unskilled and medium-skilled workers in the formal sector also fall, although less. Skilled wages and public wages fall even less, and there is a fall in average wages in the economy.

Table 5. Effect of enforcement policies on wages. Percentage change			
	ENF1	ENF2	ENF3
Unskilled wage in the informal sector	-1,95	-3,26	-3,73
Medium-skilled wage in the informal sector	-1,93	-3,24	0,27
Unskilled wage differential	3,34	5,69	6,46
Medium-skilled wage differential	3,66	6,26	-0,53
Unskilled wage in the formal sector	-0,72	-1,19	-1,40
Medium-skilled wage in the formal sector	-0,58	-0,96	0,07
Skilled wage	-0,09	-0,14	-0,08
Public wage	-0,03	-0,06	-0,04
Average wage	-0,31	-0,51	-0,30

Source: own results

When firms in the informal sector are found evading and are forced to pay taxes, their costs increase substantially. Because the model does not consider unemployment, firms cannot dismiss workers and the adjustment is made through wages. If there were unemployment, we

may expect that enforcement policies would lead to an increase in unemployment among lower-skilled workers (Boeri and Garibaldi, 2006).

4.3. Effect of simulated policies on macroeconomic variables and welfare

Taking account only of the effect of simulated policies on the labor market, the policies that benefit unskilled workers most are those that simulate a tax reduction, because they lead to a fall in informality and an increase in wages at the same time. However, these policies have a big impact on public finances and public investment, as is shown in table 6. Tax cut policies actually increase the fiscal deficit and reduce government income, whereas enforcement policies increase government income as a consequence of higher tax collection⁵. Under the TAX5 scenario, government income increases 0.28% because government collects higher payroll taxes and also taxes on capital income.

Table 6. Effect on macroeconomic variables. Percentage change.								
	TAX1	TAX2	TAX3	TAX4	TAX5	ENF1	ENF2	ENF3
Absorption	0,00	0,00	0,01	0,02	0,03	0,08	0,13	0,07
Private consumption	0,04	0,07	0,14	0,33	0,05	-0,18	-0,30	-0,18
Investment	-0,24	-0,41	-0,75	-1,78	-0,07	1,67	2,77	1,58
Real GDP	0,00	0,00	0,01	0,02	0,03	0,08	0,14	0,08
Government income	-0,14	-0,24	-0,33	-0,77	0,28	0,63	1,04	0,59
Fiscal deficit	3,05	5,18	7,63	17,70	0,00	-14,16	-23,45	-13,26

Source: own results

Investment reacts to the fiscal deficit: when the latter increases, the former falls (the first four tax cut scenarios), and when government income increases, investment rises as well, because public savings increase, as table 6 shows. Under the TAX5 scenario, investment falls slightly, due to a fall in private investment, which reacts negatively to the increase in the capital income tax rate.

The effect of the simulated policies on real GDP, absorption and private consumption is less marked. Real GDP increases in all the scenarios considered. In fact, the policies simulated may have two opposite effects on GDP. On the one hand, they have a positive effect because they increase efficiency in the economy by raising employment in formal sectors, which work with

⁵ The fall in the fiscal deficit caused by the enforcement policies is overestimated because we are not simulating the cost of implementing these policies, which increases government expenditure.

higher productivity levels. On the other hand, they have a negative effect derived from the efficiency loss that is implicit in wage differentials.

Total absorption does not change significantly in the simulated scenarios, while private consumption falls when enforcement policies are implemented. This is a consequence of the fall in wages previously analyzed, which means a decrease of income in all types of households.

In principle, we would expect a fall in poverty and in inequity derived from tax cut policies, because these policies mean an increase in wages for unskilled and medium-skilled workers and a fall in informality, which mainly affects unskilled workers. Enforcement policies, on the other hand, may have an ambiguous effect on poverty and inequality: under these scenarios, informality falls, but at the same time wages for unskilled workers also fall.

Table 7 shows the impact of the simulated policies on poverty and income distribution. The results were obtained through microsimulations. We present the changes in three indicators: the poverty index (percentage of population below the poverty line), the extreme poverty index (percentage of population below the extreme poverty line) and the Gini coefficient. We also present the value of the indicators at the benchmark (year 2000).

Table 7. Effects of policies simulated on poverty and income distribution. Percentage change									
	Benchmark value	TAX1	TAX2	TAX3	TAX4	TAX5	ENF1	ENF2	ENF3
Poverty index	19,2	-0,32	-0,56	-0,79	-1,37	-1,39	0,36	-1,53	0,77
Extreme poverty index	1,4	-0,20	-0,34	-1,49	-1,16	-1,55	-0,86	-1,82	0,90
Gini coefficient	0,4426	-0,04	-0,05	-0,14	-0,16	-0,20	0,02	-0,21	0,07

Source: own results

The five payroll tax cut policies generate a fall of poverty and extreme poverty. The effect is greater when the tax cut benefits more sectors and workers: under the TAX5 scenario, poverty falls 1.4% and extreme poverty 1.6%. The same happens with inequality: under the same scenario, the Gini coefficient falls 0.2%. The income concentration fall in this case is associated not only with the improvement in poorer household income but also with lower income in richer households, derived from the fall in wages paid to skilled workers. Microsimulations only incorporate changes in the labor market, and therefore the impact on income distribution is

underestimated. We could expect a greater fall in income concentration derived from the imposition of a tax on capital income.

Enforcement policies have different effects on poverty and income distribution. A 50% efficient enforcement policy increases poverty, whereas an 85% efficient policy generates a fall in poverty indexes. The less efficient policy leads to a decrease in poorer households' income and does not have a big impact on informality, which does happen under the 85% efficient policy scenario. Under this policy, the positive effect of a fall in informality is greater than the negative effect of a decrease in wages.

The increase in the level of enforcement for sectors intensive in unskilled labor raises poverty and extreme poverty. Under this scenario, the big fall in wages leads to a worsening of workers conditions, and the effect is not reverted with the fall in informality that the policy promotes. Even though under this scenario wages paid to skilled workers also fall, inequality increases.

4.4. Sensitivity analysis of θ_i

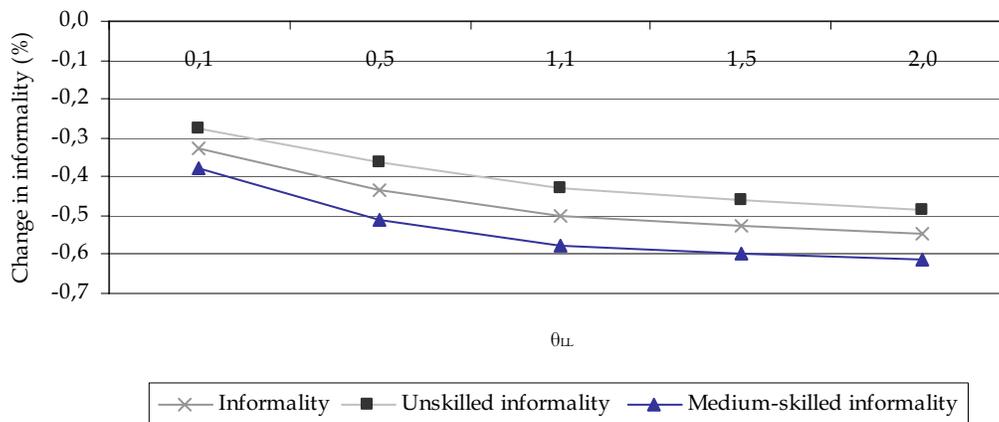
In the production function, firms combine different categories of workers by skills, following a CES function. The substitution elasticity among skill categories (θ_i) is the same for all sectors in the model, taking the value 1.5.

It is very important to carry out a sensitivity analysis of the results of the CGE model to this parameter because, as we have already indicated, under some of the scenarios simulated sectors replace skilled and medium-skilled labor with unskilled labor, leading to an increase in informality among medium-skilled workers. It would be pertinent to carry out the sensitivity analysis using estimated values of the parameter. However, there are no estimations for Uruguay of the elasticity of substitution among workers with the skill categories considered in this paper⁶. Therefore we carry out the sensitivity analysis using arbitrary values, which are between 0.1 and 2. These two extreme values represent a very imperfect substitution (0.1) and a very perfect substitution (2). We present results from the sensitivity analysis under some of the policy scenarios simulated.

⁶ Cassoni (1999) has estimations of the elasticity of substitution among white collar workers and blue collar workers. The worker categories used in this paper are quite different.

We may expect that the greater the possibility of substitution among workers, the more informality falls. Effectively, a decrease in payroll tax rates reduces the cost of hiring unskilled workers in the formal sector and stimulates firms to replace workers from other skill categories, and thus the labor demand for unskilled workers increases more and informality falls more. This is what actually happens under scenario TAX4 for unskilled and medium-skilled workers, as figure 2 shows.

Figure 2. Changes in informality by changes in θ_i under TAX4 scenario



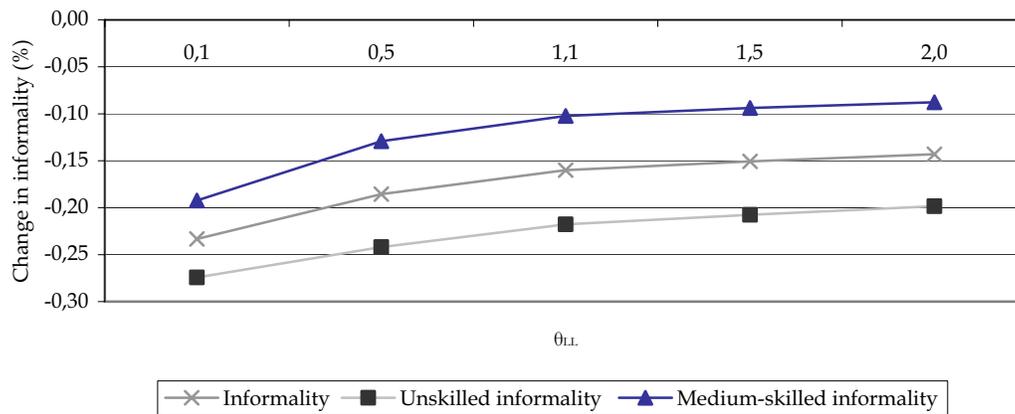
Source: own elaboration

Under this scenario, firms in the formal sector face lower hiring costs and substitute skilled workers with unskilled and medium-skilled workers, who come from the informal sector. In this case, the higher the possibility of substituting workers from different labor categories, the higher the increase in labor demand for lower-skilled workers and the higher the fall in informality.

Under the TAX2 scenario, which simulates a fall in hiring costs for a small group of formal sector firms, the opposite happens. In this case, as shown in figure 3, the greater the possibility of substituting workers, the lower the fall in informality. The unskilled labor-intensive sectors that benefited from a tax rate reduction act like all the sectors in the previous scenario: they substitute skilled labor with lower-skilled labor, and the labor demand for unskilled and medium-skilled labor increases more. In this case, however, the rise in labor demand is restricted to a few sectors, and the new workers that they hire come not only from the informal sector but also from other formal sectors in the economy. This is possible as long as the sectors

that do not benefit from the tax reduction policy can substitute labor as well. When the substitution is less imperfect, those sectors demand more skilled labor, and so increase their wages. When firms face imperfect substitution among workers, those sectors cannot substitute unskilled labor with skilled labor, and the sectors that benefit and demand more unskilled labor must hire unskilled workers that come from the informal sector. Thus, informality falls more when substitution among workers with different skills is more imperfect.

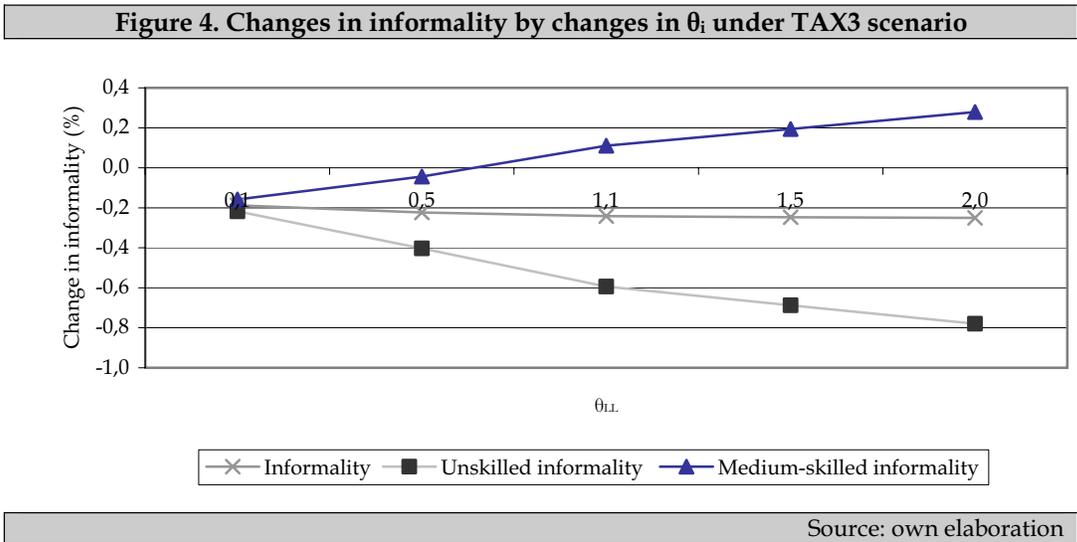
Figure 3. Changes in informality by changes in θ_i under TAX2 scenario



Source: own elaboration

In figure 4 we show what happens when the tax rate is reduced only for hiring unskilled workers. In this case, the value of the substitution elasticity is crucial to determine the fall in informality for each group of workers, although not to determine the fall in total informality. Changes in total informality are practically the same whatever the value of the substitution elasticity is: the tax rate reduction on unskilled labor that benefits all the formal sectors leads to an increase in unskilled labor demand and to a fall in informality. When firms have restrictions on substituting workers from different skill categories, unskilled formal employment increases less and informality falls little, while informality among medium-skilled workers rises slightly. However, when the substitution becomes more perfect, firms substitute medium-skilled labor with unskilled labor, and informality among medium-skilled workers rises. The higher the value of the substitution elasticity, the more informality among unskilled workers falls and the more informality among medium-workers increases. Hence, this type of policy should be carefully implemented, because if firms can substitute workers with different skills, the effect of the

policy on medium-skilled workers may be very negative, and government may fight one problem but generate a similar one as they do so.



5. Final remarks

Informality in Uruguay mainly affects lower-skilled workers, who are also more vulnerable to poverty. This paper analyzes the impact of some policies against informality on the labor market, on macroeconomic variables, on poverty and on income distribution in Uruguay. To do this we apply a general equilibrium model that involves a dual labor market, segmented by skills. We simulate two sets of policies: reducing the payroll tax on formal employment, and enforcement policies on informal firms. We also apply microsimulations in order to analyze the impact of the policies on poverty and income distribution.

Our results show that policies to reduce taxes on labor are effective in reducing informal employment because they reduce the cost of hiring lower-skilled workers and increase the demand. However, they may significantly affect government revenue. In order to minimize the cost of these policies, they may be focused on one specific group of workers or on specific sectors. They may also be implemented jointly with a rise in other tax rates in order to compensate for the government revenue loss.

A reduction in the tax rate on a specific segment of workers has an unwanted effect on other segments of workers. This happens when we simulate a reduction in taxes on unskilled workers:

informality among medium-skilled workers increases and wages among skilled workers fall. These results depend on the possibility of firms being able to substitute labor with different skills. When the substitution among workers is more imperfect, it is more efficient to implement focalized policies and thus minimize government expenditure. Therefore, having appropriate estimations of the substitution elasticity for Uruguayan firms may provide richer results.

We simulated an increase in the tax on capital in order to avoid an increase in the fiscal deficit. Although it is tax that distorts the economy, negatively affects investment and discriminates in favor of labor, in the current Uruguayan tax system there is no margin to increase other taxes. A policy that combines a reduction in the tax on labor with an increase in capital tax makes informality fall even more and has a greater impact on poverty and inequity because it reverts the negative effect of fiscal deficit on public investment. Investment in Uruguay is concentrated in the building sector, which is unskilled-labor intensive. Therefore, the implementation of policies that negatively affect investment may increase inequity.

On the other hand, policies that simulate an increase in enforcement levels for firms in the informal sector make informality fall considerably because they tackle the problem directly. However, these types of policies have a negative impact on the wages paid to low-skilled workers because firms face higher hiring costs. For this reason, enforcement policies have a negative impact on poorer household income, while richer household income falls but not so markedly. As a consequence, poverty increases and income distribution becomes less equitable. We may expect that these policies would also have a negative impact on unemployment if we considered it in the model. Even when enforcement policies cannot be avoided because they make the pension system better and rule out administrator abuse, results show that they should not be implemented as policies to reduce informality.

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