

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

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Abstract

This paper analyses 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. We simulate two sets of policies: a reduction in payroll tax rates and an increase in enforcement on the informal sector. Both sets of policies are effective in reducing informality, but they also affect other variables in the economy. A payroll tax reduction on unskilled labor increase informality among medium-skilled workers. In spite of that, this type of policy is successful in reducing poverty and improving income distribution. On the other hand, enforcement policies have a negative impact on wages, especially for unskilled workers. As a consequence, poverty increases. Thus, this type of policies should be implemented carefully and in coordination with other policies.

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

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1. Introduction

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 national economy. Labor market was also affected: the sectoral distribution of employment changed, unemployment and informality rose, 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 from 1999.

Informality affects mainly 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. Besides, several studies for Uruguay find that informal workers earn on average less than formal workers (Cassoni, 2001; Amarante and Arim, 2005; Terra et al, 2006; Amarante and Espino, 2007). In all those studies the estimated wage gaps among formal and informal workers differ because they do not analyze the same time periods nor apply the same methodology. However, the conclusion is the same: there is a wage gap among formal and informal workers with identical characteristics. Besides, information from the Continuous Household Survey shows that the most vulnerable workers in terms of poverty are those less advantaged in the labor market. For this reason, implementing policies against unemployment and informality may indirectly contribute to the reduction of poverty.

Whereas there are several studies that evaluate policy options to fight unemployment in Uruguay and also studies that focus on informality and its evolution in 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 simulate a specific policy against it –a 10% subsidy on formal employment. They conclude that even when the policy is effective to reduce informality, is not feasible to be implemented, because it would have a long-run negative impact on investment, government expenditure and

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. Percentages presented were calculated using data from CHS 2004.

human capital accumulation. They suggest that there should be a deeper discussion about policies against informality among lower-skilled workers. With that in mind, in this paper we develop a discussion about specific policies 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, leading to multiple theoretical explanations and operational definitions about it. The ILO-PREALC traditional conception of informality is that of dual labor markets. It 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 (OIT, 1972; Hart, 1973; Sethuraman, 1976; Tokman; 1978). The operational definition applied to Uruguay that stems from this conception considers the following categories of employment: domestic service workers, non remunerated family work, workers employed in firms with less than five employees and self-employed, without considering professionals (Amarante y Espino, 2007).

On the other hand, the structuralist approach –developed by Moser (1978) and Portes, Castells and Benton (1989), among others–, considers that the informal sector is part of the structure of the economy –which explains the denomination of the approach. According to this approach, the informal sector comprises 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 the informal workers are defined as those workers that do not contribute to the social security system, regardless of the size of the firm in which they are employed². This definition of informality stresses the fact that it is more important the labor conditions of the jobs than the type of firm that offers the jobs³.

² “Social protection” includes more rights than social security alone. For Uruguay, access to social security is the only mandatory right, and for that reason is correct to associate “social des-protection” to lack of access to retirement rights.

³ 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 not a consensus in literature about the different approaches on informality and 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 regulations (informal sector). We assume that the wage differential among wages paid in the formal and the informal sector is an efficiency wage that firms in the formal sector pay in order to promote workers effort, which cannot be directly monitored because of monitoring costs⁴. The secondary or informal sector presents lower productivity levels, which are associated, among other factors, to credit and public services restriction (Braun y 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 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 of informality that combines the dual economy approach with structuralist and legalist approaches.

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

2. Literature review

The so called active labor market policies intend to explicitly tackle the problems in the labor market, such as the existence of an informal sector. 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 reviewed cause of informality in the labor market is the existence of high tax levels and other costs that the formal sector must face (Braun and Loayza, 1994; Fugazza and Jacques, 2003; Ihrig and Moe, 2004; Schneider and Klingmair, 2004; Sanches, 2005; among many others authors). Schneider and Enste (2000) and Gërkhani (2004) present reviews of literature about

⁴ There are other microeconomic fundamentals that explain the existence of efficiency wages: training costs, etc.

causes of informality in the labor market. Both reviews point out that the most mentioned cause of informality are the costs of being formal, which can be understood as high tax rates and heavy social security loads.

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

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

Which specific policies can be implemented to reduce informality? An important group of authors suggests fiscal policies to reduce informality that imply a cut on payroll tax rates or social security rates, which go together with the wide opinion that high costs in the formal sector lead to a more important informal sector. Related to the efficiency wage theory, several authors suggest that in order to increase formal employment and improve welfare, government should implement subsidies to wages paid in the primary (formal) sector (Thierfelder and Shiells, 1997). The relevant works that analyze the impact of fiscal policies on informality can be gathered in two groups: those that develop theoretical models and those that use empirical data from developed and/or developing countries.

Within 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 to the formal sector and a policy of increasing enforcement, associated to higher penalty taxes. They find that reducing the tax rate has a higher 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 to firms found in the informal sector.

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

Among the group of empirical works, Sanches (2005) analyzes the effect of a payroll tax cut on informality, using data from United States and Brazil and considering a neoclassic model with two sectors. In order to keep fiscal balance unmodified, the fall in payroll tax rates is compensated with an increase in value added tax rate. The author draws similar conclusions for both countries: the fall in the general level of taxes has a negative impact on informality in both economies and a positive impact on GDP, when making a short-term analysis. However, in the long run conclusions are the opposite: informality falls at the beginning when the initial level of taxes is high, and GDP falls in the long run, because of the major fall in capital stock. In spite of that, both in the short and long term 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 of 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 rate to firms in infraction, and they evaluate how a reduction of both tax rates, an increase in detection probability and a rise penalty rate affect informality in Italy and Canada. They find that even when the three policies -for each side- are effective in reducing informality

and increasing the size of the formal sector, the increase in detection probability reduces workers welfare, and thus worsening social welfare. Given this result, the tax rate reduction policy seems more effective to reduce informality.

Braun and Loayza (1994) consider that in order to reduce informality, authorities should apply higher penalty rates to 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 the incentives to stay informal, that is, not pay taxes, do not exist. 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 increases. In order to avoid that, the authors suggest an increase in penalty rate to firms in the informal sector and an increase in enforcement in order to avoid that those firms have access to 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 they can increase compliance to 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 building sector (Cassoni y Ferre, 1997). Therefore, a policy of tax reduction would reduce informality in Uruguayan labor market, although focalized policies on specific sectors may have a more significant impact on creating new formal jobs (Cassoni, 2005). Informality in Uruguay is also associated to weak control and enforcement of regulations (Forteza, 1999). Increasing enforcement and penalizing firms caught in the informal sector may also reduce informality. However, this type of policies may increase unemployment, because both problems affect the same segment of workers (Boeri y Garibaldi, 2006).

3. Methodology

In order to evaluate the impact of some policies against informality in the labor market and the economy, we chose to apply a computable general equilibrium analysis (CGE). General

equilibrium models are an adequate methodological tool for evaluating policy options, because they consider 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 paper specially considers informality in labor market. It is the same model as in Terra et al (2006), but it considers three categories of workers according to skills instead of two.

The model presents a conventional structure. It assumes perfect competition in good markets, although goods are not homogenous: they differentiate by geographical origin following 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 incidence on international price of exports, that is, it faces a downward sloping export demand curve. Demand of exports is a function of relative prices and real income of the trade partners, which is considered exogenous. The country has three trade partners: Argentina, Brazil and the Rest of the World. Trade balance is fixed.

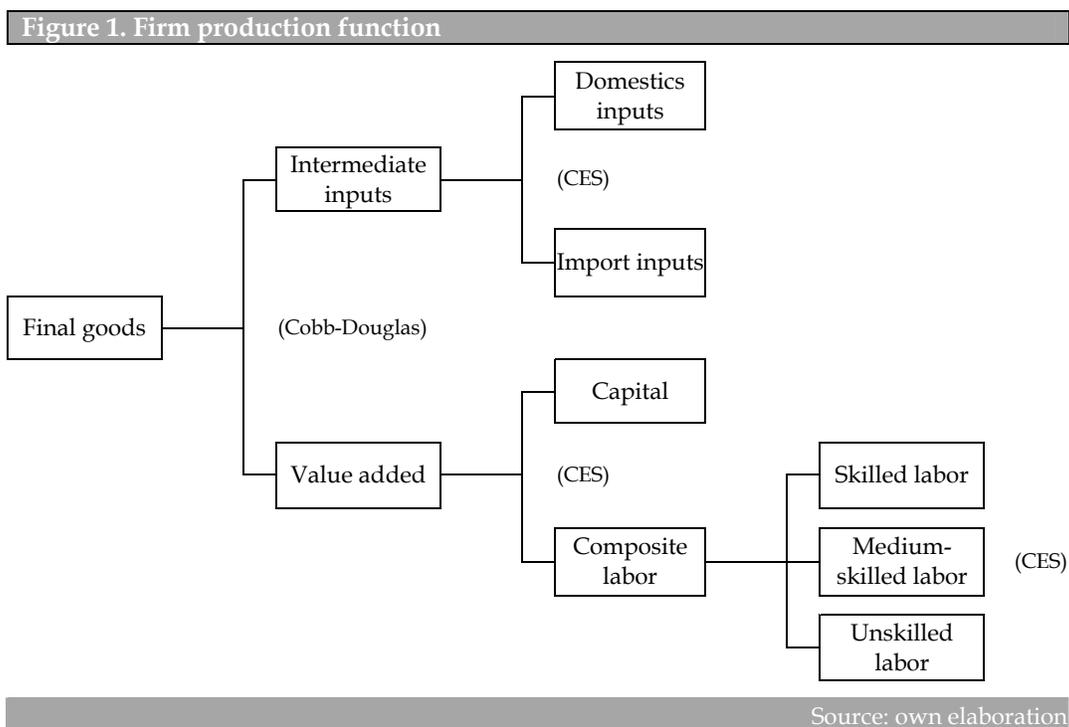
There are 23 sectors. One of them is the public sector with fixed employment, that is, it does not hire nor dismiss workers. Another sector is the informal sector, which gathers all the informal activities in the economy. The informal sector produces one good destined to final consumption and hires only unskilled and medium-skilled workers.

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 implies an imperfect substitution among different types of labor by skills.

In this paper we consider an extra category of labor with respect to Terra et al (2006), where labor was differentiated in two categories: unskilled labor and skilled labor. In this paper, we consider 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 affects mainly lower-skilled workers, especially workers with less than eight years of schooling. Besides, many authors suggest working with three categories of labor when studying labor markets in Latin American countries (Wood, 1994; PNUD, 2001).

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



As already mentioned, the model considers the existence of an informal sector in the economy. We consider the dual labor market hypothesis to introduce the existence of an informal sector in the labor market, under 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 a low-skilled worker is dismissed from the formal sector, it goes 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:

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

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 $lu_{labnc,i}$ to labor demand by sector i for each type of labor $labnc$. It should be noticed that i are all the efficiency wage sector, that is, all the formal sectors in the economy without considering the public sector, and $labnc$ considers unskilled labor and medium skilled labor. 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 according to deciles of income. Government collects taxes, buys goods and services and makes transfers to households. The investment level of the economy is determined by savings, composed by 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 the 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, Pastori y Katz (2004) with some minor changes. In our model there are three types of labor according to skill level of workers, and thus we needed to introduce this change in the

SAM. We separated unskilled labor in unskilled and medium-skilled labor, using data from the Continuous Household Survey (CHS) for year 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 both taxes in the model and in the SAM is extremely important, because changes in the tax rate on labor may affect labor demand and thus employment, whereas changes in direct taxes to factors have no incidence on employment, because of our fixed labor supply assumption. Therefore, a second modification of the SAM was to differentiate taxes to factors and taxes to firms. For doing so, we used data from the Central Bank of Uruguay (National Accounts, 2005) and the Social Prevision Bank (2005).

3.3 Microsimulations

General equilibrium models may capture the effects of simulated policies on income distribution through changes in relative price of production factors and changes in relative households' 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 labor market is the main transmitting channel of labor market policies to poverty and inequity.

In this paper we apply the microsimulation technique suggested by Ganuza, Paes de Barro y Vos (2002) and also applied in Terra et al (2006). The procedure starts from the results on labor market obtain at a macro level through the CGE model. We consider specifically the following change in parameters: share of informal workers by category of education, wage in the formal and informal sector and by category of education, average wage in the economy and share of workers by skill by sector of activity.

The labor market is modeled in a rudimentary way, assuming segments according to these parameters. Workers may move randomly from one segment to another, where they receive

different wages. Changes in the labor market parameters are simulated following an accumulated sequence. We simulate the sequence a high number of times in a Monte Carlo fashion using CHS database for year 2001⁵, and we obtain the average value and confidence intervals for the relevant indicators. Specifically, we obtain the most usual poverty and inequality indicators: poverty index (percentage of households under the poverty line), taking as reference the poverty line suggested by National Institute of Statistics for year 2001; extreme poverty index (percentage of households under the extreme poverty line); and Gini coefficient, calculated with per capita income by household. Comparing the average level of the indicators with their value at the benchmark, we can conclude about the impact of the simulated policies on poverty and income distribution. The microsimulation was run using software STATA and 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 against informality and to analyze their impact on the labor market and the economy. As we have presented, there are two sets of policies mentioned in literature: on one side, informality may be a consequence of high tax rates, and therefore a policy against it would be a tax rate reduction or a subsidy on formal employment; on the other hand, we may fight informality through enforcement policies that increase control to informal sector, forcing them to pay taxes and comply regulations.

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

The first scenario (TAX1) is the most restrictive one: it simulates a 20% tax cut to unskilled labor that benefits only those sectors intensive in this factor. Specifically, the sectors are: agriculture, husbandry, other primary sectors, rice, ceramics and the building sector. The second scenario

⁵ We run 35 iterations. Cicowiez (2006) suggests to run at least 30 iterations.

(TAX2) simulates a tax cut to both unskilled and medium-skilled labor, benefiting unskilled labor intensive sectors as well. Third, TAX3 scenario simulates a 20% tax cut to unskilled labor, but benefiting all efficiency wage sectors. Lastly, we simulate a 20% tax cut to unskilled and medium-skilled labor in all efficiency wage sectors (TAX4). This last policy may have a strong impact on government revenue and therefore on public investment, and in the long run on investment and human capital accumulation (Terra et al, 2006). Thus, we simulate a fifth policy scenario of fiscal neutrality (TAX5). In order to maintain fiscal deficit unchanged, we simulate the imposition of a 0.75% tax on capital income, which did not exist before.

The second set of simulations considers an enforcement policy in the informal sector. In this case, three alternative scenarios are simulated. The first one considers a less effective enforcement policy and the second one 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 enforced to pay taxes, assuming 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 turn into the formal sector. Therefore, we simulate an increase of taxes specific to 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 would be:

$R = t \cdot W$, that is, tax rate (t) times the tax base, which in this case is conformed by wages paid to workers.

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

$$R = t \cdot W_f + p \cdot \tau (t \cdot W_{inf}),$$

where p is the probability of catching an infracting firm and force 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 adapts 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 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 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 for unskilled labor is 4.0% and for medium-skilled labor 4.1%. In the second scenario (ENF2) tax rates are 6.8% and 7.0% respectively. In the third scenario (ENF3), only tax rate for unskilled labor rises, and it takes value 7.2%, which represents a 90% effective enforcement policy.

The following table presents the eight simulation scenarios:

Table 2. Simulation scenarios					
Scenario	Name	Factors affected	Sectors affected	Variable	Variable variation
TAX1	Decrease in taxes to unskilled labor	Unskilled labor	Unskilled labor intensive sectors (agriculture, husbandry, other primary activities, diary products, rice, ceramics and construction)	tfac	-20%
TAX2	Decrease in taxes to unskilled and medium-skilled labor	Medium-skilled and unskilled labor	Unskilled labor intensive sectors (agriculture, husbandry, other primary activities, diary products, rice, ceramics and construction)	tfac	-20%
TAX3	Decrease in taxes to unskilled labor	Unskilled labor	Efficiency wage sectors (all sectors except public sector and informal sector)	tfac	-20%
TAX4	Decrease in taxes to unskilled and medium-skilled labor	Medium-skilled and unskilled labor	Efficiency wage sectors (all sectors except public sector and informal sector)	tfac	-20%
TAX5	Decrease in taxes to unskilled and medium-skilled labor. Increase in capital tax.	Medium-skilled and unskilled labor. Capital	Efficiency wage sectors (all sectors except public sector and informal sector)	tfac tcap	-20% 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 85% increase in enforcement
to informal firms (only to
unskilled workers) Unskilled labor Informal sector tfac (tnca1) 7,2%

Source: own elaboration

4. Results

This section presents 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. Then, we analyze the effect of both sets of policies on macroeconomic variables, households' 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 3 presents the impact of a reduction of 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) make informality among medium-skilled workers increase. This is due to a substitution effect among workers in the sectors that are benefited with the tax cuts.

The sectors benefited with the tax cuts increase 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, firms may also substitute different categories of labor, without creating new jobs. When the firms substitute highly and medium-skilled workers for unskilled workers, informality among this last group of workers is reduced, but it increases for medium-skilled workers.

Table 3. 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

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 of doing so, 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 contrary, a reduction of tax rates on unskilled and medium-skilled labor that benefit unskilled labor intensive sectors (TAX2) generates a fall in informality among all types of workers. Obviously, the fall in informality among unskilled workers is smaller because there is a lower 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 the one that reduces payroll taxes in all efficiency wage sectors and to both type 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 strong negative impact on fiscal deficit, we simulate it combined with an increase in taxes to capital income, in order to keep the fiscal deficit constant (TAX5). In this scenario, informality falls even more: 0.7%. This fact is associated to the behavior of the building sector, which highly depends on the investment level of the economy⁶. As we will present later and as table 8 shows, the fiscal deficit increases in the four previous scenarios analyzed, but scenario TAX5 avoids this increase. When the fiscal deficit increases, public investment falls, and that determines a fall in total investment, thus affecting the building sector, which is intensive in unskilled labor. In fact, under TAX4 scenario, which is the one that affects investment more, formal employment in the building sector falls 1.07% for unskilled workers and 1.34% for medium-skilled workers, even when the sector is benefited with the tax reduction. Formal employment in the rest of the 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. On the

⁶ Building represents almost 60% of investment at the benchmark.

contrary, under TAX5 scenario public investment does not fall and labor demand in the building sector increases. Thus, informality falls more.

Table 4 presents 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 the demand for this type of workers, which makes wages increase, because labor supply is fixed. This happens in the five tax cut scenarios.

Skilled wage variation depends on the possibility of firms of substituting workers with different skills. Because skilled employment is fixed, when firms substitute skilled workers informality cannot increase, as it 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 are benefited. With the value of the elasticity of substitution assumed in the model, the positive production effect on highly-skilled wage prevails over the negative effect derived from the substitution effect. As the substitution among workers becomes more imperfect, highly-skilled wages increase more.

Table 4. 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

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

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

Wage gap among highly-skilled and medium-skilled and unskilled workers reduces in tax cuts scenarios. Even when in some scenarios highly-skilled wages increase, medium-skilled and unskilled wages increase more. This fact may imply a more equitable income distribution.

However, wage gap among formal and informal workers increase, because wage differentials rise. The wage differential paid in the formal sector depends negatively in the difference among labor supply and labor demand in the formal sector. Therefore, when informality falls, wage differentials increase. When the informal sector reduces, the probability of being fired of 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 fact explains the increase of the wage differential paid to unskilled workers in the five scenarios considered. Lower-skilled wages present the higher 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 take into account that efficiency wages imply an efficiency loss for the economy, which increases when wage differentials are higher. If wage differentials were exogenous and would not depend on employment, the efficiency loss would be lower and the formal labor demand would increase more (Thierfelder and Shiells, 1997).

The average wage increases in the five policy scenarios, improving welfare.

4.2. Effects of enforcement policies on labor market

Enforcement policies in the informal sector are even more effective to reduce informality, because they are aimed to attack the problem directly –informal sectors must pay taxes once they are found in infraction- and not indirectly as tax cuts –informality reduces because tax cuts promote an increase in labor demand. Table 5 presents the effect of enforcement policies on informality and formal employment for unskilled and medium-skilled workers. We can see that a 50%effectivity enforcement policy reduces 2.2% total informality. A more efficient enforcement policy impacts even more: total informality falls 3.6% under ENF2 scenario. Promoting

enforcement only among unskilled workers has also an important impact on total informality, and reduces very significantly 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 5. 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

With these results, we may conclude that the enforcement policies are the most effective to reduce informality. However, as table 6 presents, enforcement policies affect negatively wages, especially among unskilled workers. Under the three scenarios that simulate enforcement policies wages for unskilled workers in the informal sector fall strongly and wage differentials increase significantly. In spite of this, wages for unskilled and medium-skilled workers paid in the formal sector also fall, although less. Skilled wages and public wages fall even less, and there is a fall in the average wage of the economy.

Table 6. 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	-1,4
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	-0,3

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 fire

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 the economy and welfare

Solely taking into account the effect of simulated policies on the labor market, the policies that benefit unskilled workers most are those that simulate a tax cut, because they lead to a fall in informality and an increase in wages at the same time. However, these policies have a strong impact on public finances and public investment. Table 8 presents the effects of the simulated policies on macroeconomic variables. We can see that tax cut policies actually increase fiscal deficit and reduce government income, whereas enforcement policies increase government income as a consequence of a higher tax collection⁷. Under the fiscal neutrality scenario, government income increases 0.28%, also because government collects more payroll taxes and taxes to capital income.

Investment reacts to fiscal deficit: when the latter increases, the former falls (first four tax cut scenarios), and when government income increases, investment rises as well, because public savings increase, as table 7 shows. Under the fiscal neutrality scenario, investment falls slightly, due to a fall in private investment, which reacts negatively to the increase in capital income tax rate.

Table 7. 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

The effect of the simulated policies on real GDP, absorption and private consumption is less important. Real GDP increases in all scenarios considered. In fact, policies simulated may have

⁷ The decrease in the fiscal deficit from the enforcement policies is overestimated, because we are not simulating the cost of implementing these policies, which increase government expenditure.

contradictory effects on GDP. On one hand, they have a positive effect because they increase efficiency of the economy by incrementing employment in formal sectors, which work with higher productivity levels. On the other side, they have a negative effect derived from the efficiency loss that wage differentials imply.

Total absorption does not change significantly in the simulated scenarios, while private consumption falls when enforcement policies are carried out. This is a consequence of the fall in wages previously analyzed, that means a decrease of income in all types of households, as presented in table 8. The fall in income is higher among poorer households, because the most harmed workers by the application of enforcement policies are unskilled workers, which concentrate in poorer households.

Table 8 shows that under the fiscal neutrality scenario income for poorer households increase, while this policy affects negatively income of richest households –ninth and tenth decile- that receive a higher income from capital. The policy that has the highest impact on households' income in general and on poorer households in particular is the one that cuts payroll taxes to all types of workers and benefits all efficiency wage sectors (TAX4).

Table 8. Effect of simulated policies on households income. Percentage change								
	TAX1	TAX2	TAX3	TAX4	TAX5	ENF1	ENF2	ENF3
Poorest decil	0,09	0,15	0,26	0,60	0,49	-0,34	-0,57	-0,33
Second decil	0,08	0,14	0,25	0,58	0,42	-0,32	-0,54	-0,31
Third decil	0,09	0,15	0,26	0,61	0,48	-0,34	-0,57	-0,33
Forth decil	0,07	0,12	0,22	0,50	0,28	-0,28	-0,46	-0,27
Fifth decil	0,06	0,10	0,20	0,45	0,21	-0,25	-0,41	-0,24
Sixth decil	0,06	0,10	0,19	0,43	0,20	-0,24	-0,40	-0,23
Seventh decil	0,06	0,10	0,19	0,43	0,23	-0,24	-0,40	-0,24
Eighth decil	0,05	0,08	0,16	0,38	0,16	-0,21	-0,36	-0,21
Ninth decil	0,03	0,05	0,11	0,25	-0,05	-0,14	-0,23	-0,14
Richest decil	0,01	0,01	0,05	0,11	-0,31	-0,05	-0,08	-0,06

Source: own results

In principle, we could expect a fall in poverty and in inequity derived from tax cut policies, because they mean an increase in wages for unskilled and medium-skilled workers and a fall in informality, which affects mainly unskilled workers. Enforcement policies, on their side, 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 9 shows the impact of the simulated policies on poverty and income distribution. Results were obtained through microsimulations⁸. We present results on three indicators: poverty index (percentage of population under the poverty line), extreme poverty index (percentage of population under the extreme poverty line) and Gini coefficient. We also present the value of the indicators at the benchmark (year 2000).

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

Table 9. 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

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 an informality fall is more important than the negative effect of a decrease in wages.

⁸ Results are significant at a 95% confidence level.

The increase in the level of enforcement to sectors intensive in unskilled labor raises poverty and extreme poverty. Under this scenario, the important 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

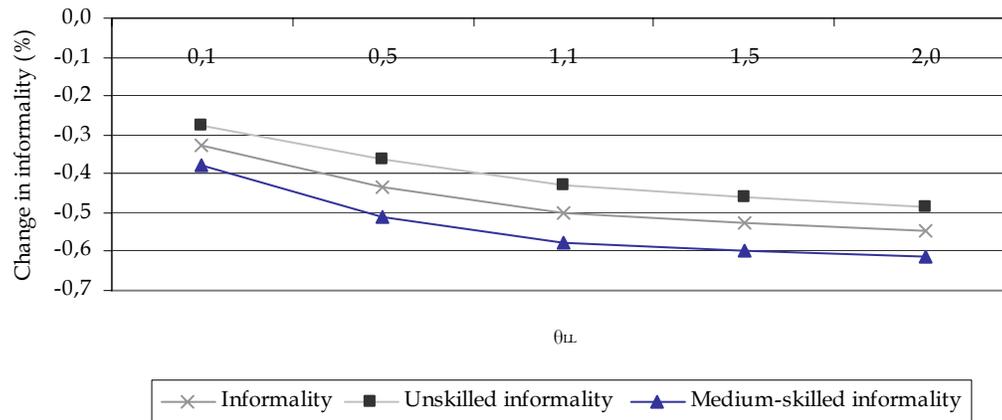
In the production function, firms combine different categories of workers by skills, following a CES function. The substitution elasticity among skill categories (θ_i) is the same for all sectors in the model, taking value 1.5.

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 presented, under some of the scenarios simulated sectors substitute skilled labor with unskilled and medium-skilled labor, leading to an increase in informality among medium-skilled workers. It would be more 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 paper⁹. Therefore, we carry out the sensitivity analysis using arbitrary values, which range 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.

We may expect that the higher 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 incentives firms to substitute workers from other skill categories, and thus labor demand for unskilled workers increases more and informality fall more. This is what actually happens under scenario TAX4 for unskilled and medium-skilled workers, as figure 2 shows.

⁹ Cassoni (1999) has estimations of the elasticity of substitution among white collar workers and blue collar workers. The workers categories used in this paper are quite different.

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

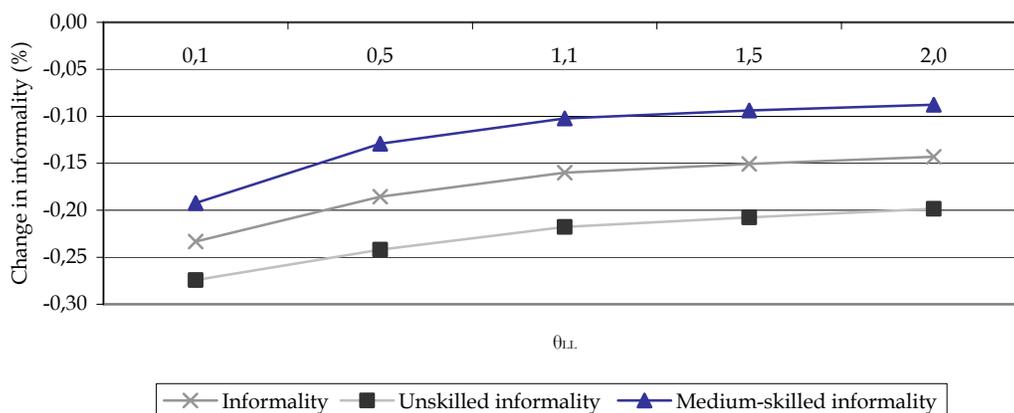


Source: own elaboration

Under this scenario, firms in the formal sector face lower hiring costs and substitute skilled workers with unskilled and medium-skilled workers, which 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 of lower-skilled workers and the higher the fall in informality.

Under TAX2 scenario, which simulates a fall in hiring costs for a small group of formal sector, the opposite happens. In this case, as shown in figure 3, the higher the possibility of substituting workers, the lower the fall in informality. The unskilled labor intensive sectors that are benefited from a tax rate reduction act as all the sectors in the previous scenario: they substitute skilled labor with lower-skilled labor and 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 from the informal sector but also from others formal sectors of the economy. This is possible as long as those sectors that are not benefited with the tax reduction policy can substitute labor as well. When the substitution is less imperfect, those sectors demand more skilled labor, increasing their wages. When the firms face an imperfect substitution among workers, those sectors cannot substitute unskilled labor with skilled labor, and the sectors that are benefited and demand more unskilled labor must hire unskilled workers that come from the informal sector. Thus, informality fall more when substitution among workers with different skills is lower.

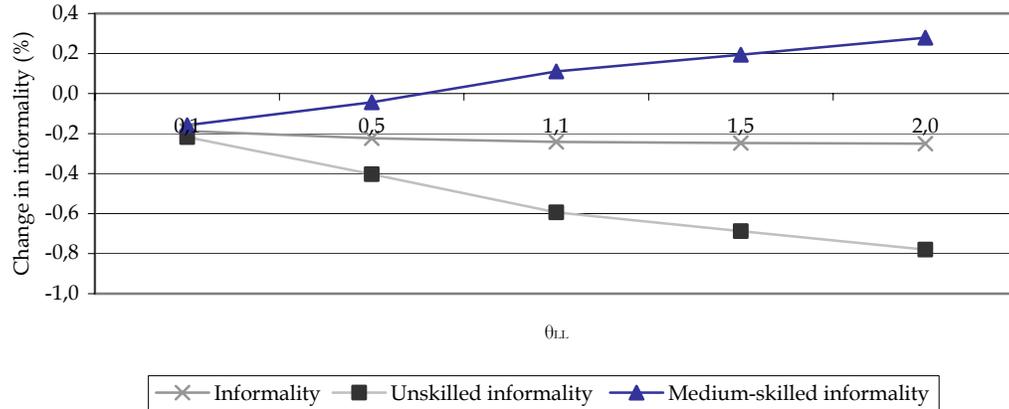
Figure 3. Changes in informality by changes in θ_i under TAX2 scenario



Source: own elaboration

In figure 4 we present 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 practically are the same whichever the value of the substitution elasticity is: the tax rate reduction to unskilled labor that benefit all the formal sectors leads to an increase in unskilled labor demand and to a fall in informality. When firms have restrictions to substitute 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 rise. The higher the value of the substitution elasticity, the more informality among unskilled workers fall 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 a problem by generating a similar one.

Figure 4. Changes in informality by changes in θ_i under TAX3 scenario



Source: own elaboration

5. Final remarks

In the last years informal employment among lower-skilled workers has increased in Uruguay. This paper analyzes the impact of some policies against informality on the labor market and the economy in Uruguay. For doing so, we apply a general equilibrium model that considers a dual labor market, segmented by skills. We simulate two sets of policies: payroll tax reduction on formal employment and enforcement policies on informal firms.

Results show that the design of policies against informality must take into account their effects on other variables in the labor market and the economy in general. The set of policies that simulate a fall in the tax rate is effective in reducing informal employment. However, they significantly affect government revenue.

A reduction in the tax rate on a specific segment of workers has a non-wanted effect on other segments of workers. This happens when we simulate a reduction in taxes on unskilled workers, which increases informality among medium-skilled workers and reduces wages among skilled workers. These results depend on the possibility of firms of substituting labor of different skills. When the substitution among workers is more imperfect, it is more efficient to implement focalized policies and minimize the government expenditure. Therefore, counting with

appropriate estimations of the substitution elasticity for Uruguayan firms may provide richer results.

If a capital income tax is implemented in order to avoid an increase in the fiscal deficit, informality falls even more and the impact on poverty and inequity is higher. However, this policy should be implemented carefully in order to avoid strong falls in private investment, which may affect growth in the long run.

On the other hand, the policies that simulate an increase in the enforcement levels to firms in the informal sector makes informality fall strongly, because they tackle the problem directly. However, this type of policies has a negative impact on wages paid to low-skilled workers, because firms face higher hiring costs. For this reason, enforcement policies have a negative impact on poorer households' income, while richer households' income fall but not so pronouncedly. As a consequence, poverty increases and income distribution becomes less equitable. We may assume 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 they avoid an administrator's misuse, results show that they should be implemented in coordination with other policies that counterbalance its negative effects.

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