The Cost of the Legal System and the Hidden Economy*

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Abstract

I propose a dynamic model of industry equilibrium to study the effect of the costs of access and participation to the legal system on the size of the hidden economy. The cost of access is related to the monetary expenses that are necessary to start a business and to the opportunity cost of the bureaucratic procedures involved. The cost of participation is related to tax payments and to labor market regulations. The model implies that, on average, two thirds of the observed cross sectional differentials in the size of the hidden economy can be accounted for by differences in the costs of access. Furthermore the model delivers a measure of the hidden economy that is highly correlated with all the available estimates. I also show that a regression analysis confirms all the results of the numerical analysis. (JEL O17, L51)

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1 Introduction

What explains the existence of an informal economy, operating outside the legal system, and why are countries characterized by a much bigger share of informal activities than others? One possible answer is that an informal economy is nothing but an optimal response to an adverse legal-institutional environment, so that its existence is ultimately related to the costs and incentives created by the legal systems in different countries.

From a theoretical perspective, it is possible to identify two different categories of cost associated to the legal system, respectively the costs of access to the system and the costs of participation to the system. The cost of access is related to the bureaucratic procedures that are necessary to start a business. The process always involves the payment of fees to the central and local government and often the payment of bribes. But it absorbs also a significative amount of working time, generating foregone revenue for the entrepreneur involved. The costs of participation are mainly related to the payment of taxes and to the compliance with labor market regulations that typically prescribe, in case of justified separation from the workers, advance notice requirements and severance payments.

Using a dynamic model of industry equilibrium, I will show that these different costs affect the hidden economy through different channels and that they have a significantly different quantitative impact. The main conclusion of the analysis is that the cost of access explains most of the cross country variability of the size of the hidden economy. The role played by taxes and labor market regulations appears to be only marginal.

The model that I propose is an extension of the Hopenhayn and Rogerson (1993) model of industry equilibrium to an economy composed by two sectors, the legal and the informal. Each of the two sectors behaves as in the Hopenhayn and Rogerson economy, but informal firms are allowed to legalize their activities and so to switch to the legal sector. While substantially complicating the analysis, this new features still deliver a tractable analytical framework that allows a rich characterization of the dynamic interactions between the two sectors and a clear, separate, identification of the costs of access from the costs of participation.

In the model, entrepreneurs operating in the legal sector must pay taxes and comply with labor market regulations that prescribe mandatory severance payments. Informal entrepreneurs, conversely, evade taxes and can freely destroy jobs, but are subject to random audits that result in the seizing of the entire production. Both legal and informal firms face idiosyncratic productivity shocks and are subject to fixed costs of production. In each period there are new entrants in both sectors and incumbents can leave the market. New entrants in the legal market, regardless if they are new productive establishments or informal firms legalizing their activity, must pay a fixed cost of access to the legal system.

With the help of the model, I can characterize the changes in the composition of output and the flows of businesses in and out of the hidden sector in response to changes in the fundamentals of the economy. A cost of access acts as a barrier that protects incumbent legal firms from the

outside competition, lowering the rate of entry in the legal sector while forcing more entrepreneurs to start informally. The decision of legalizing an existing informal firm is not influenced by the entry cost, providing that, as an effect of the higher profitability of the bigger protected legal businesses, the benefits of the legalization grow together with the costs, leaving the terms of the trade-off barely affected. Conversely the introduction of severance payments limits the flexibility of the legal firms, making less attractive for the informals to legalize. But, since the value of entry in both sectors does not depend on the firing cost, if not through the discounted continuation values, the rates of entry will be unaffected. Finally, an increased output tax has a depressionary effect on the legal sector without significantly incentivizing the production in the informal, inducing an increased relative size of the hidden economy just through a decrease of the legal output.

But which channel is related to the biggest quantitative effect? In the model there are many potential entrants in each sector, in fact a continuum of them, but the mass of informal firms switching to the legal sector is composed only by a small measure of highly productive informal businesses that can afford to pay the entry cost. Therefore the effects working through the entry channel are potentially much bigger than the effects working through the legalization channel. In fact the numerical analysis susbstantially confirms this claim, bringing to the quantitative contribution of the work: the model implies that, on average, two thirds of the cross sectional differentials in the size of the hidden economy can be accounted for by differences in the cost of access. Furthermore the cost of access accounts for a greater fraction of the variability of the bigger hidden economies, highlighting a tight link between widespread informal activities and cumbersome barriers to entry.

The next question is how reasonable is this quantitative result from an empirical perspective. In fact a systematic regression analysis is shown to drive to the same conclusions as the numerical analysis. The main findings are a positive and statistically significant effect of the entry cost on the size of the hidden economy, but a statistically insignificant effect of labor market regulations and tax rates. Moreover, looking at the regressions at different quantiles of the hidden economy, reveals a greater importance of the costs of access at explaining bigger hidden economies, in line with the prediction of the model. Finally, regressing the size of the hidden economy simulated from the model on the costs of the legal system delivers the same results as the regression with actual data. Since all of the variability of the simulated hidden economy is induced by the costs, the identification of this last model is perfect. Therefore I take the similarity of results as suggestive evidence of a correct identification of the empirical model, albeit with some caveats.

Overall the model implies a view of the informal sector as the "*Doorstep*" of the official. Facing high entry costs, small, less productive, firms can only start informally, waiting to become more productive and to grow before legalizing. The low productivity of the informal firms implied by the model, which is also a robust empirical evidence[1], is actually a consequence of the high costs

[1]See La Porta and Shleifer (2008) about the Informal Survey and the Micro Survey implemented by the World Bank. De Paula and Scheinkman (2008) and Dabla Norris et al. (2008) also report similar results.

associated to the legal system and of the dynamic behavior of the informals. This interpretation is indeed in sharp contrast with the conclusion by La Porta and Shleifer (2008). They consider the lower productivity of informal firms as evidence against the importance of regulations as determinants of informality and in favor of a "*Dual*" theory according to which informals are inherently different. If anything, the model shows that the empirical evidence is consistent with both theories.

One last comment concerns the use of the simulated model as a device to measure the hidden economy. While being possible in principle, an extensive cross country estimate is likely to be unfeasible. In particular, in order to have reliable figures, the model calibration must be based on country specific informations relative to the industrial structure and to the individual preferences that are unlikely to be available. Nevertheless I can interpret the size of the hidden economy simulated from the model as the cross section that would be observed if there were no other cross country variability except for the costs of the legal system. If we believe that these costs have an impact on the hidden economy, than a positive correlation between the model measure and the actual estimates of the hidden economy can be considered as a further assessment of the empirical performance of the model. Indeed the results from this exercise show a very high correlation.

Related Literature The analysis of the hidden economy is the subject of a rapidly spreading literature, following the *Rational Choice* tradition initiated by Becker (1978) and fundamentally inspired by the work of DeSoto (1989). Recent contributions include Sarte (2000), Azuma and Grossman (2002), Dessy and Pallage (2003), Fugazza and Jacques (2003), Busato and Chiarini (2004), Maloney (2004), Auriol and Wartlers (2005), Choi and Thum (2005), Straub (2005), Amaral and Quintin (2006), Dabla-Norris, Gradstein and Inchauste (2008), De Paula and Scheinkman (2008) and La Porta and Shleifer (2008).

The work that is more closely related to this one, but developed independently, is by Antunes and Cavalcanti (2007). By comparing the effects of contract enforcing and regulation costs on the hidden economy, in a model characterized by credit constraints for informal firms, they find that, although the former cost is more important from a theoretical standpoint, the latter accounts for most of the observed emprical differences between the U.S. and Europe. In a sense the results presented in this work can be considered as complementary, comparing the effect of the regulatory environment to the effect of taxation. Nevertheless, by taking into account a dynamic model of entry and exit, the framework proposed here is richer and allows for a clear separate identification of the regulation of entry from the labor market regulation.

The paper is also related to the literature that analyzes the effect of labor market regulations in general, and firing costs in particular, on economic performance. Examples include Lazear (1990), Bentolilla and Bertola (1990) and Alvarez and Veracierto (2001), together with Hopenhayn and Rogerson (1993), on which the present work builds. As far as the policy implications are concerned, the work goes in the direction of highlighting good market regulations and not labor market regulations as policy instruments to reach desirable targets in terms of employment, in line

with what Bertrand and Kramarz (2002) suggested. Also the results single out another positive effect induced by product market deregulations, specifically related to the informal productions, in addition to the ones discussed by Blanchard and Giavazzi (2003).

On the empirical side, previous existing work, recently summarized by Straub (2005), already showed that higher costs of access to the legal system are robustly related to higher sizes of the hidden sector, but found only weak evidence relating labor market regulations and taxes to informality. The first stylized fact has been extensively documented by Djankov, LaPorta, Lopez de-Silanes and Shleifer (2002). Their data set, in which all the identifiable costs to start a business activity are collected for a large cross section of countries, consistently shows a positive correlation between all the measures of entry cost and the available estimates of the hidden economy. Using the same data, Auriol and Warlters (2005) similarly report a positive and significant effect of entry costs on the size of the hidden economy. The second fact emerges from the work by Botero, Djankov, LaPorta, Lopez de-Silanes and Shleifer (2004). After collecting a comprehensive data set about the extent of labor market regulations, they were unable to find any systematic relationship with the size of the hidden economy[2]. The relationship between taxes and informality is much more controversial. Among others[3], Johnson, Kaufmann and Zoido-Lobaton (1998) find evidence of a positive association between more cumbersome tax burdens and bigger sizes of the hidden economy, but Friedman, Johnson, Kaufmann and Zoido-Lobaton (2000), with a different empirical strategy, found a negative association. Lemieux, Fortin and Frechette (1994) and Davis and Henrekson (2004) also report ambiguous results.

Summary The rest of the paper is organized as follows: section (2) describes the model. Section (3) clarifies all the details of the implementation of the benchmark model simulation and describes all the properties of the simulated model. The key results are exposed in section (4), where comparative statics exercises are performed, and in section (5), where the analysis is centered around the cross country variability of the hidden economy that is consistent with the cross country observed variability of the costs of the legal system. Section (6) provides the empirical evidence about the relationship between the costs of the legal system and the hidden economy and implements the regression with data simulated from the model. Section (7) concludes. The robustenss of the results proposed in the paper is summarized in a companion appendix (available at **people.bu.edu/russoffr**), that also documents extensively the analitical properties of the model and the algorithm used to find the equilibrium in the numerical simulations.

[2]In particular their regression results show a positive impact on the hidden economy for an index of collective laws (regulating the relationships between employers and labor unions), but insignificant effects for indices of employment laws (regulating the individual employment relationships) and social security laws, with the latter also carachterized by a negative sign. In the present work the scope of the analaysis will be narrower, focusing only on employment laws.

[3]See Schneider and Enste (1999) for a survey.

2 The Model

The model is an extension of the framework developed by Hopenhayn (1992) and Hopenhayn and Rogerson (1993) to an economy composed by two sectors. The key new features are the inclusion of output taxation, enforced through random audits, and the modelling of the flows of productive establishments and workers across the two sectors. Other than that, each sector of the economy behaves exactly as in the Hopenhayn and Rogerson model.

The economy is populated by a set of productive establishments, a set of households and by the government. Productive activities can take place either in the legal sector, characterized by the respect of all the laws and regulations in place, or in the hidden sector, but they result in the same final product. Specifically, the goods produced in the two sectors share the same physical characteristics[4] (say shoes or handbags) but they are produced with different technologies (in a regular factory or in a residential basement) and, since they are sold in two different markets[5] (a regular shop or an occasional street vendor or a peddler), they are also associated to different prices. Importantly, the model completely abstracts from intrinsically illegal productions such as drugs: the good produced in the hidden sector is perfectly legal if produced within the official legal and regulatory environment. According to the terminology developed by the OECD (2003), the model specifies the non observed sector of the economy as composed by underground and informal production activities, abstracting from illegal activities and home production.

Firms operating in the legal sector must pay three different costs of participation to the legal system: a proportional tax rate τ^y on each unit of output produced, a fixed cost c^f that summarizes the loss of resources implied by the necessity of complying with all the regulations, and a proportional severance payment ϕ for each job destroyed. The per period profit function of the legal firms takes the following form:

$$p_t(1-\tau^y)f(n_t,a_t) - w_t n_t - c^f - \phi I_{\{n_{t-1}\geq n_t\}}(n_{t-1}-n_t) \tag{1}$$

where I is the indicator function, p_t is the price of the good in the legal market, w_t the wage rate and $f(n_t,a_t)$ the production function, that depends upon employment n_t an upon the level of an idiosyncratic technological shock a_t. To keep the model simple, I assume a Cobb-Douglas specification for the production function, with $f(n_t,a_t) = e^{a_t}n_t^{\alpha}$, and that the exogenous technological shocks follow a Markov process described by the transition function $F(a_t,a_{t+1})$. As in Hopenhayn and Rogerson (1993), the inclusion of the fixed cost c^f in the above expression is also fundamental to distinguish between firms exiting from the market and firms temporarily producing zero output, and thus to meaningfully talk about exit. The last term in expression (1) is the cost of job destruction, modeled as a proportional payment ϕ on the difference between

[4] In this respect the model is undoubtedly oversimplified. Strictly speaking the goods produced in the legal sector are intrinsically of higher quality, being subject to various quality and adequacy controls that assess if they meet certain standards.

[5] Evidence from the Informal Survey and from the Micro Survey implemented by the World Bank suggests that the markets for legal and informal goods are different. See La Porta and Shleifer (1998).

the previous period level of employment and the actual one, whenever this difference is positive. Notice that the model focuses primarily on firing costs as the most representative measures of labor market regulation, consistently with the greater attention reserved to them both in the literature and in policy debates. Examples in the literature include Bentolila and Bertola (1990), Lazear (1990), Hopenhayn and Rogerson (1993) and Alvarez and Veracierto (2001). For what concerns policy debates, an interesting example concerns the highly contested abolition of an article of the Italian collective employment law ("*Articolo 18*") that used to impose severe firing costs, up to 3 years of wage[6].

Informal firms do not pay taxes but are subject to random audits that, with exogenous probability π, result in all the production being confiscated[7]. Furthermore they are not subject to severance payments and thus they can costlessly destroy jobs. The per period profit of the informal firms is the following:

$$q_t(1-\pi)f^i(n_t^i, a_t) - w_t^i n_t^i - c^i \tag{2}$$

where q_t is the price in the informal market and $f^i(n_t^i, a_t)$ the production function for informal firms that depends upon the level of the idiosyncratic productivity shock a_t, that is the same as the one hitting the legal firms. The production function is again Cobb-Douglas, with $y_t^i = e^{a_t}(n_t^i)^\eta$.

Even if informal firms must not comply with any kind of regulation, they still face a fixed cost c^i for staying in the informal sector, the (fixed) "*Cost of Informality*". As first stressed by DeSoto (1989), informals employ a lot of resources to avoid detection, either explicitly, for instance in the form of direct bribe payments to the government officials that are supposed to audit, or implicitly, for instance in terms of forgone revenue due to the impossibility of reaching economies of scale (to avoid visibility) or to the impossibility of advertising the product. Informals also transfer resources to Mafia-like organizations that substitute for the government as providers of protection and contract enforcing[8].

Notice that, to keep the model as simple as possible, the production in the legal sector takes place using only a legal labor input n_t and the informal production only with an informal labor input n_t^i. In practice, it is often the case that firms operating in the legal sector employ part of their labor force informally, typically to keep a certain level of flexibility and to save on social

[6]In particular, a court could force the employer to reinstate a worker fired without a justifiable cause, but the worker could opt for a monetary severance payment that, summed to the other expenses, could raise the firing cost for the employer up to that amount.

[7]Alternatively, it can be assumed that, upon auditing, the informal firm is forced to pay the output tax relative to the current period production, perhaps with some proportional fine. The choice of just assuming the seizing of the production is dictated by the wish of distinguishing the present model of informal production from a pure model of tax evasion. The consequence of this alternative assumption for the model results are nevertheless discussed in the appendix.

[8]It is also the case that legal businesses transfer resources to such organizations. In fact the primary source of revenue for organizations like the Sicilian Mafia, the Camorra (based in Campania, a region in southern Italy) or the N'drangheta (mainly operating in Calabria, southern Italy) is exactly coming from extorsions on legal businesses, typically under the treat of violence.

security contributions. Indeed, as shown in appendix, it is possible to extend the model along this dimension without any significative change in the model set-up, but at the cost of complicating substantially the solution procedure.

Also the model completely abstracts from an explicit modelling of the benefits of producing in the legal sector such as contract enforcing or easier access to outside finance, at least in its benchmark version. In fact the only reward for producing legally is the endogenously determined higher price of the good in the legal market, that is nevertheless a significative engine of reallocation across sectors. In the appendix, the framework is extended to take into account also a productivity enhancing public good enjoyed by legal producers, but the modification is showed to lead to the exact same results.

At the beginning of each period, incumbent firms in the legal sector must decide whether to stay in the sector or exit. Incumbent informal firms, conversely, must decide whether to stay in the informal sector, exit from the market or legalize their activities, switching to the legal sector upon the payment of a fixed entry cost c^e. The cost of access to the legal system, c^e, summarizes both the monetary payments required by the law to start an economic activity and the eventual bribe payments to government officials. It also includes the opportunity cost of complying with all the mandatory bureaucratic procedures. Informal firms that are audited face a more restricted choice set and must either legalize the activity or exit from the market. Official firm that exit must pay the proportional cost of job destruction, while no payment is due by exiting informal firms. Realistically, the choice of legalizing an informal activity is irreversible: legal firms are not allowed to disappear from the official market and to start producing in the informal sector[9]. Firms that stay in each market pay the corresponding fixed cost, observe the productivity shock and decide the optimal level of labor input and so of production.

Denoting with $W(a_t, n_t; p_t)$ the value function of the legal firms and with $V(a_t; q_t, p_t)$ the value function of the informals and remembering that the analysis is focused on a stationary equilibrium with constant prices, we have:

$$W(a_t, n_t; p_t) = \max_{n_{t+1}} \Big\{ p_t(1-\tau^y) f(n_{t+1}, a_t) - w_t n_{t+1} - c^f - \phi I_{\{n_t \geq n_{t+1}\}}(n_t - n_{t+1}) + \beta \max\left[-\phi n_{t+1}; E_a W(a_{t+1}, n_{t+1}; p_t)\right] \Big\}$$

$$V(a_t; q_t, p_t) = \max_{n^i_{t+1}} \Big\{ q_t(1-\pi) f^i(n^i_{t+1}, a_t) - w^i_t n^i_{t+1} - c^i + \pi\beta \max\left[0; E_a W(a_{t+1}, n^i_{t+1}; p_t) - c^e\right] + (1-\pi)\beta \max\left[0; E_a V(a_{t+1}; q_t, p_t); E_a W(a_{t+1}, n^i_{t+1}; p_t) - c^e\right] \Big\}$$

The value function of the legal firms is similar to the value function in Hopenhayn and Rogerson, but the value function of the informals firms requires a little more explanation. In particular,

[9] In the context of the present model this is not really an assumption: for many realistic parameterizations, legal firms never find it optimal to switch to the informal sector, even if they are allowed to do so upon the payment of the cost of job destruction.

if the informal establishment is not audited (with probability $1-\pi$), than the entrepreneur chooses to switch to the legal sector if the expected present value of a legal business, net of entry cost, is greater than the expected present value of an informal business ($E_aW - c^e > E_aV$). If the opposite is true, than the establishment stays in the hidden sector. If none of the two expected values is positive ($0 > E_aW - c^e$ and $0 > E_aV$) than the choice is exiting from the market. Audited establishment (with probability π) do not have the option of staying in the hidden sector. It is easy to show (see appendix), using standard dynamc programming arguments, that the value functions are unique, continuous, bounded and increasing in a and p and that W is decreasing in n and V increasing in q.

In each period there is a large number of potential entrants in both sectors. Entry in the informal sector is free, while entry in the legal is subject to the payment of the cost of access c^e. The current value of the productivity shock for entrants is drawn from the pdf $\nu(a)$, whether they are entrants in the official or in the informal sector. The values of entering can be expressed as follows:

$$W^e(p_t) = \int W(a_t, 0; p_t) d\nu(a_t)$$
$$V^e(q_t, p_t) = \int V(a_t; q_t, p_t) d\nu(a_t)$$

The economy is also populated by a set of identical households that own both legal and informal firms, supply legal or informal indivisible labor and buy goods in both markets. Households choose employment lotteries and have access to markets to diverisfy the idiosyncratic risk, so that the economy is equivalent to another economy with a representative household and the following intratemporal utility function:

$$\sum_{t=0}^{\infty} \beta^t u(\hat{c}_t, l_t)$$

The per period utility function is $u(\hat{c}_t, l_t) = \log \hat{c}_t + H l_t$ and it is defined over leisure $l_t = 1 - N_t - N_t^i$ and over the composite consumption good $\hat{c}_t$. The latter is determined by the following CES aggregator over the consumption of the legal good c_t and of the informal good c_t^i:

$$\hat{c}_t = \left[\psi c_t^z + (1-\psi) c_t^{i\,z}\right]^{\frac{1}{z}}$$

The budget constraint of the household is the following:

$$p_t c_t + q_t c_t^i = w_t N_t + w_t^i N_t^i + \Pi_t + \Pi_t^i + T_t$$

where Π_t are the aggregate profits from the legal firms, Π_t^i the aggregate profits from the informal firms and T_t the lump sum transfers from the government, assumed to be equal to the total amount of tax proceedings. Importantly, T_t does not include the payments of the costs of

access, following a *Public Choice* view of the entry regulation process. According to this interpretation, the real beneficiaries of the regulation are the politicians/bureaucrats that monetize the rents, together with the incumbent firms in the market that enjoy higher profits. But this assumption can be also motivated from a different theoretical perspective, simply acknowledging that the entry costs are also associated to the opportunity costs of the long bureaucratic procedures involved, that waste resources for the entire economy.

Providing that the analysis is focused on a stationary equilibrium with constant prices, the consumer optimization problem can be reduced to a simple static one. Furhermore, given the lack of extra disutility for working in the informal sector and the absence of taxation on labor on the worker side, the first order conditions of the household optimization problem implies $w = w^i$[10]. The optimal levels of consumption obtained by solving the household problem will be denoted by $C(p_t, q_t, \Pi_t, \Pi_t^i, T_t)$ and $C^i(p_t, q_t, \Pi_t, \Pi_t^i, T_t)$, while the optimal labor supplies by $N(p_t, q_t, \Pi_t, \Pi_t^i, T_t)$ and $N^i(p_t, q_t, \Pi_t, \Pi_t^i, T_t)$.

This model delivers a ratio of informal to formal consumption (or output) that depends upon the relative price and upon the preference parameters ψ and z. Specifically:

$$\frac{C_t^i}{C_t} = \left(\frac{1-\psi}{\psi}\frac{p_t}{q_t}\right)^{\frac{1}{1-z}} \tag{3}$$

Essentially consumers buy goods from the informal market because it is *Customary*. The extent of the custom (or habit) is determined by the parameter ψ, whith a lower value associated to societies where informal goods or services are widespread and easily accessible. Depending on the relative price in the informal market and on the elasticity of substitution z, the fraction of goods purchased in the informal market in any given period can be bigger or smaller, but, as long as $\psi \neq 1$, it will never be equal to zero. The best possible example to justify this modelling choice refers to particular kinds of services like gardening, plumbing or baby-sitting: while it is possible to find legally entitled providers, it is much easier to find informal ones and thus part of the household expenditure is oriented by custom to the informal market. Similarly, in many countries, it is more common to buy food or clothing from informal street vendors than in regularly registered shops.

In each period the state of the economy is summarized by two measures $\mu_t(a_t, n_t)$ and $\mu_t^i(a_t, n_t^i)$ that represent, respectively, the number of legal and informal firms with a given level of employment and a given productivity. Given the optimal decision rules determined by the solution to the optimization problems of the firms, it is possible to characterize the dynamic behaviour of these two measures.

Note that the optimal exit decision of a legal firm is characterized by a simple cut-off rule: if the level of productivity is below some treshold a^* they exit from the market, while they stay and

[10]This feature of the model, although inconsistent with a dual view of the informal sector, is consistent with survey evidence from Latin America. Maloney (2004) shows that the distributions of earnings in the informal and legal sector are not so different and that the averages are both similar and above the legally mandated minimum wage.

produce if the productivity is higher. The choice of an informal firm, conversely, is characterized by 2 tresholds levels: if the productivity is below some value a_i^* they exit from the market, if it is between a_i^* and some other value $\hat{a}_i$ they stay in the informal sector, while if it is higher they switch to the legal sector. Now let's define the following indicator function that summarizes the optimal entry-exit choice of an official firm:

$$X(a_t, n_t; p_t) = \begin{cases} 1 & \text{if } a \geq a^* \\ 0 & \text{otherwise} \end{cases}$$

And let's similarly define the following indicator functions for an informal firm:

$$X^i(a_t; q_t, p_t) = \begin{cases} 1 & \text{if } a_i^* \leq a \leq \hat{a}_i \\ 0 & \text{otherwise} \end{cases} \qquad \chi(a_t; q_t, p_t) = \begin{cases} 1 & \text{if } a > \hat{a}_i \\ 0 & \text{otherwise} \end{cases}$$

In both cases I assume that if a firm is indifferent between stay and exit or stay and switching it stays. Than the evolution of the state of the economy can be represented by the following mappings defined over the measures μ and μ^i:

$$\begin{aligned} \mu_{t+1}(a_{t+1}, n_{t+1}) = &\int \mu_t(a_t, n_t) I_{\{N(a_t, n_t; p_t) = n_{t+1}\}} X(a_t, n_t; p_t) dF(a_t, a_{t+1}) + B \int I_{\{N(a_t, 0; p_t) = n_{t+1}\}} d\nu(a_t) \\ &+ \int \mu_t^i(a_t, n_t^i) I_{\{N^i(a_t; q_t, p_t) = n_{t+1}\}} \chi(a_t; q_t, p_t) dF(a_t, a_{t+1}) \end{aligned}$$

$$\mu_{t+1}^i(a_{t+1}, n_{t+1}^i) = \int \mu_t^i(a_t, n_t^i) I_{\{N^i(a_t; q_t, p_t) = n_{t+1}^i\}} X^i(a_t; q_t, p_t) dF(a_t, a_{t+1}) + B^i \int I_{\{N^i(a_t; q_t, p_t) = n_{t+1}^i\}} d\nu(a_t)$$

where B and B^i are the effective mass of entrants in the official and informal sectors and $N(a_t, n_t; p_t)$ and $N^i(a_t; q_t, p_t)$ are, respectively, the optimal choices of labor input by official and informal firms in period t. In each of the above expressions the first term represents the contribution of incumbent firms that decide to stay in the market and the second term the contribution of new entrants. The third term in the first expression is the contribution of informal firms switching to the legal sector. With a slight abuse of notation let's define, for each period, $\Theta_t = \{p_t, B\}$. $\Theta_t^i = \{q_t, B^i\}$. Then it is possible to write the transition function in the following more compact way:

$$\begin{aligned} \mu_{t+1} &= \Psi(\Theta_t, \Theta_t^i, \mu_t, \mu_t^i) \\ \mu_{t+1}^i &= \Psi^i(\Theta_t^i, p_t, \mu_t^i) \end{aligned} \tag{4}$$

Once the measures have been determined, it is straightforward to compute all the supply side aggregate variables. For instance the output of the legal sector is determined as follows:

$$Y(\Theta_t, \Theta_t^i, \mu_t, \mu_t^i) = \int \left[(1-\tau^y) f(a_t, N(a_t, n_t; p_t)) - c^f\right] X(a_t, n_t; p_t) d\mu_t(a_t, n_t) + B \int f(a_t, N(a_t, 0; p_t)) d\nu(a_t)$$
$$+ \int \left[(1-\pi) f^i(a_t, N^i(a_t; q_t, p_t)) - c^u\right] \chi(a_t; q_t, p_t) d\mu_t^i(a_t, n_t^i) \tag{5}$$

where, again, the first integral is the output produced by incumbent legal firms, the second one the output produced by new entrants in the legal market and the last one the output produced by informal firms that switched to the legal sector. Conversely the aggregate output in the informal sector is determined as follows:

$$Y^i(\Theta_t^i, p_t, \mu_t^i) = \int \left[(1-\pi) f^i(a_t, N^i(a_t; q_t, p_t)) - c^u\right] X^i(a_t; q_t, p_t) d\mu_t^i(a_t, n_t^i)$$
$$+ B^i \int (1-\pi) f^i(a_t, N^i(a_t; q_t, p_t)) d\nu(a_t) \tag{6}$$

In a similar fashion it is possible to determine the aggregate profits Π and Π^i, the aggregate labor demands L_d and L_d^i and the total tax receipts T (remember that the government simply rebates all the tax proceedings to the households on a balanced budget basis). For simplicity the wage rates are normalized as in Hopenhayn and Rogerson, so that $w = w^i = 1$.

A stationary equilibrium of the model is an allocation $\{Y^*, Y^{i*}, C^*, C^{i*}, L_d^*, L_d^{i*}, N^*, N^{i*}\}$, a set of prices $\{p^*, q^*\}$, a set of entry sizes $\{B^*, B^{i*}\}$ and a set of distributions $\{\mu^*, \mu^{i*}\}$ such that:

- $L_d^*(\Theta^*, \Theta^{i*}, \mu^*, \mu^{i*}) = N^*(p^*, q^*, \Pi^*, \Pi^{i*}, T^*)$ and $L_d^{i*}(\Theta^{i*}, p^*, \mu^{i*}) = N^{i*}(p^*, q^*, \Pi^*, \Pi^{i*}, T^*)$
- $Y^*(\Theta^*, \Theta^{i*}, \mu^*, \mu^{i*}) = C^*(p^*, q^*, \Pi^*, \Pi^{i*}, T^*)$ and $Y^{i*}(\Theta^{i*}, p^*, \mu^{i*}) = C^{i*}(p^*, q^*, \Pi^*, \Pi^{i*}, T^*)$
- $W^e(p^*) \leq c^e$ and $V^e(q^*, p^*) \leq 0$
- $\mu^* = \Psi(\Theta^*, \Theta^{i*}, \mu^*, \mu^{i*})$ and $\mu^{i*} = \Psi^i(\Theta^*, p^*, \mu^{i*})$

where $\Theta^* = \{p^*, B^*\}$, $\Theta^{i*} = \{q^*, B^{i*}\}$ and Π^*, Π^{i*} and T^* are all computed according to the equilibrium values. The first two relationships states that, respectively, labor and good markets must clear in both the informal and the legal sector. The third line states the free entry conditions: providing the assumption of an unlimited supply of potential entrants, in equilibrium the value of entry must be at most equal to the cost of entry, with equality if entry is positive. The last two conditions simply state that the economy is in a stationary equilibrium, with the distribution over the state reproducing itself every period at the equilibrium values. The following proposition establishes existence and uniqueness of the equilibrium. A list of regularity conditions needed for the result and an algorithmic proof are provided in appendix. Also in appendix it is possible to find a detailed description of the actual algorithm used for the computation of the model equilibrium.

Proposition. *Under regularity conditions a unique equilibrium of the model exists for* $\beta\phi \neq 1$

Note that the model can exhibit different types of equilibria. As in Hopenhayn (1992) there can be equilibria with entry and exit in both sectors and equilibria without. In addition, an equilibrium can involve entry and exit in both sectors and a measure of firms switching from the informal to the legal sector, but it can as well involve no switch. Furthermore it is also possible to have mixed situations with, for instance, positive entry in the informal sector, switching and positive exit in the legal sector, but without entry in the legal sector and without exit in the informal. In what follows, I will focus on the interesting case of an equilibrium with entry and exit in both sectors and switch. A set of sufficient conditions for the existence of such an equilibrium can be found in appendix. Given the structure of the model, it is intuitive that, in equilibrium, there will always be entry and exit in both sectors as long as the demand for both goods in non-degenerate. Thus a sufficient condition to have $B \neq 0$ and $B^i \neq 0$ is that the price must be bounded and that $\psi \neq 0$ and $\psi \neq 1$. For what concerns the switching equilibrium, what is needed is that the equilibrium price in the legal market is high enough so that the most productive informal firms will find it profitable to switch.

3 Model Simulation

3.1 Parameters and Calibration

The benchmark simulation is targeted to the U.S. economy. The strategy employed to parameterize the model is to fix as many parameters as possible using outside information and then calibrating the remaining ones to match firm level statistics computed from the Census of Manufacturers, as in Hopenhayn and Rogerson (1993). The goal of the calibration will be to have a characterization of the legal sector that is in line with both the empirical evidence and the literature on dynamic models of industry equilibrium. At the same time, I also want to avoid positing too many asymmetries across the two sectors, in order to model the choice of producing informally versus legally as dependent upon entry costs, labor market regulations and taxes and not upon other dimensions of the economy.

According to the time span of the census, I set the time period to 5 years. The discount rate β is fixed at a value that implies, in steady state, an interest rate of 4% a year. The labor share of income α is set to 0.65, consistently with the U.S. empirical evidence. The assumption of equal technologies across sectors translates into $\eta = \alpha$. The output tax τ^y is fixed at 29%, which is the average value of the ratio between tax receipts on corporate income and corporate income in the period 1960-2003 for the U.S.

In the benchmark simulation, I set the cost of entry c^e and the parameter ϕ that determines the extent of severance payments to zero. The idea is starting from a frictionless economic environment, with free entry in the legal sector and that allows from costless job destruction, to then analyze the quantitative effects of policy changes. Notice that, in the data, the value

of c^e for the U.S. is indeed very close to zero, but ϕ is not. Nevertheless, as it will be showed later, the extent of severance payments affects only marginally the equilibrium quantities, so that the results discussed in this section are very similar to the ones that will be delivered by the parameterization of the model according to the actual value of ϕ.

I assume that the exogenous technological shock for incumbents evolves according to the following autoregressive process:

$$a_t = \rho a_{t-1} + \varepsilon_t$$

where $\varepsilon_t \sim i.i.d.(0, \sigma^2)$ and normally distributed. As far as new entrants are concerned, the pdf $\nu(a)$ is simply uniform on the same support on which a is defined.

The two preference parameters ψ and z map relative price differences into a relative size of the hidden economy and therefore they are ultimately responsible for the scale of the hidden activities. It follows that, consistently with the calibration strategy, it is important to set them at a value that will deliver a reasonable size of the hidden economy in the U.S. The natural candidate values for them are the estimates in Russo (2008), which are time series estimates of the same preference parameters in the context of a structural model of the hidden economy. According to that estimates, I set $\psi = 0.95$ and $z = 0.25$. Notice that, although these two parameters determine the size of the hidden economy in the model, their influence on the comparative statics results, that are central to this paper, is just marginal: changes in the costs of the legal system translate into relative price changes, but, as long as the preference parameters are fixed, the ordering of the relative magnitudes of the changes will be preserved. The remaining preference parameter H is calibrated to 1.9 to deliver a share of workers in the population of 60%.

The monitoring probability π affects the productivity differential across sectors and thus the relative price of the good in the informal market. Its real world counterpart is the probability of discovering a business in the hidden economy, which should reflect both the probability of a tax audit and the probability of discoverying an unregistered/illegal business. Data from the IRS indicate that, on average, slightly less than 1% of the taxpayers are subject to inspections. Nevertheless there is no available information about the efficiency of the police in detecting not authorized production that can help pinning down the value of the second probability. But Russo (2008) provides an empirical estimate of the auditing probability in the context of a structural model of the U.S. economy that is very similar to the model proposed here. I set π to 0.14 according to that estimate.

For what concerns the fixed costs c^f and c^u, there are a priori reasons to believe that the fixed cost is higher in the legal sector, for instance because of the cumbersome regulatory environment or the complex tax system. Nevertheless there are also a priori reasons to believe that the fixed cost is higher in the informal sector, because of the costs of informality previously discussed. Nevertheless, providing that one of the main background assumptions of the model is that the legal system is indeed costly, I assume that the fixed cost to stay in the legal sector c^f is higher than its illegal counterpart c^u, but, in order to avoid an important asymmetry between the

two sectors, only by a small amount (10%). For practical purposes, this assumption entails placing a linear restriction in the calibration exercise. Importantly, this choice is also sensible from an empirical perspective, albeit conservatively. Data from the Informal Survey and from the Micro Survey implemented by the World Bank (see La Porta and Shleifer (1998)) indicate that informals and legal firms spend the same amount of money in protection and security, but legal firms devote more resources to comply with regulations. It is important to stress that this asymmetry postulated in the model is almost inconsequential for the bulk of the results: even remaining agnostic about the relative magnitude of the two fixed costs, setting them as equal, would result in the same model properties and in the same counterfactual results. But this choice of slightly different costs significantly eases the computational burden, making faster to find an equilibrium with switch for a wide range of model parameters.

The two fixed costs c^f and c^u, together with the two technology parameters ρ and σ, are then calibrated to reach 3 targets: an exit rate of 40%, a job turnover rate of 30% and a coefficient of serial correlation of employment of 0.93. The resulting parameters value are $c^f = 0.03$, $c^u = 0.027$, $\rho = 0.82$ and $\sigma = 0.11$.

Perhaps the persistency of the technology shock might seem high, especially as compared to what was obtained by Hopenhayn and Rogerson (1993) or by Gomes (2001) in the context of a, broadly speaking, similar model of industry equilibrium. Nevertheless it is quite difficult to obtain a plausible exit rate from the model without appealing to persistent technology shocks. Moreover, as shown in the companion appendix, this high persistence does not influence significantly the model results and thus should not be viewed as a limitation of the analysis.

3.2 Quantitative Results

Table (3) reports some of the properties of the stationary equilibrium of the model and the first column of table (4) several summary statistics. Overall the model implies a characterization of the informal sector that is consistent with the survey evidence reported by Maloney (2004), La Porta and Shleifer (2008), De Paula and Scheinkman (2008) and Dabla-Norris et al (2008): small establishments, less productive, exposed to market whims and thus characterized by an high death rate.

First of all the relative size of the hidden sector implied by the benchmark calibration is 2.7% if measured in terms of output (Y^i/Y) and 1.3% if measured in terms of employment (N^i/N). The number of informal firms is equal to 4% of the number of official firms (Q^i/Q). Informal firms are significantly smaller than their legal counterparts, both in terms of output and in terms of employment. Consistently with the survey evidence from the Informal Survey and the Micro Survey summarized by La Porta and Shleifer (2008), the productivity is also much smaller in the informal sector. A smaller size of informals and a lower productivity translate into an higher exit rate in the informal market.

The price of the good in the informal market is lower than the price in the legal, providing a significative incentive for informal firms to switch. Nevertheless the measure of switching informal

firms is somehow small. In the stationary equilibrium roughly 30% of the informals legalize, which means that, in each period, only 1.5% of the legal firms were previously operating informally. This feature is indeed consistent with the survey evidence. La Porta and Shleifer (2008) report that, in their sample, 91.2% of legal firms started as legal (on average). If we consider that the survey was implemented for developing countries, characterized by an higher cost of access and, therefore, by a bigger number of informal firms, than it is not difficult to reconcile the evidence with the model.

In the five years period, informal firms that experience favorable productivity shocks legalize their business, while less productive informals optimally decide to exit[11]. In this respect the model implies a vision of the informal sector as a *Doorstep* of the official: many firms start informally on a small scale, then waiting to become more productive and to grow before legalizing. This pattern is indeed consistent with the survey evidence reported by Maloney (2004), showing that, in Mexico, informal firms tend to become formal with age and size. The evidence is also consistent with De Paula and Scheinkman (2008) who report that, in Brazil, only bigger and more productive informals find it profitable to legalize. A further implication is that informal firms that want to legalize do it quickly, in line with the survey evidence reported by LaPorta and Shleifer (2008). In their sample, 2/3 of the firms legalize within 5 years and 80% within 10 years, which is roughly consistent with a version of the model parameterized for the developing countries where the surveys were conducted.

Importantly the *Doorstep* theory explains the lower productivity of the firms in the informal sector as dependent upon the costs of the legal system. Basically for low productivity firms it is only profitable to start informally, so that the observed low productivity in the hidden sector is indeed a consequence of the dynamics associated to the hidden economy. In other words, the low productivity of the informals cannot be taken as definitive evidence against the importance of these costs, as in La Porta and Shleifer (2008).

As the the second part of table (3) shows, most informal firms are small or very small, and they account for most of the hiring in the informal sector, while bigger informal firms account for the bulk of the employment and for the firing. There are not big firms in the informal sector simply because more productive establishments find it optimal to switch to the legal sector. The cohort of firms that switches to the legal sector has a size distribution that is stochastically increasing in age, inheriting that property from the size distribution of the legal firms.

The first part of table (3) shows also some of the properties of the legal sector that are in line with the empirical evidence summarized, among others[12], by Evans (1987), Davis and Haltiwanger (1988) and Dunne, Roberts and Samuelson (1989). In particular the size distribution of the firms is stochastically increasing in age and the exiting probability is decreasing in firms' age. Also

[11] Notice that, in the benchmark simulation, the measure of informal firms that optimally decides to stay is equal to zero. Although this result is a peculiarity delivered by the calibration, the overall picture is unchanged under different model parameterizations, that typically deliver a measure of staying informals that is smaller than the measure of exiting or legalizing ones.

[12] See the references in Hopenhayn and Rogerson (1993)

small firms account for most of the hiring rate, while large firms account for most of the firing. With respect to the quantitative results obtained by Hopenhayn and Rogerson (1993), the actual model exhibits both a lower exit probability and an higher decaying rate, induced by the higher shock persistency. Furthermore the actual model exhibits a more even stationary distribution of legal firms, with a smaller measure of small firms and an higher measure of big ones, an effect that is induced by the presence of more productive big informal firms that switch to the legal sector.

4 Comparative Statics

In this section I propose an analysis of the effects of increased costs of the legal system on the model equilibrium, holding all the remaining model parameters fixed at their benchmark values.

The main result is that c^e, ϕ and τ^y affect the hidden economy through different channels. A barrier to entry raises contemporaneously the cost and the benefit of legalizing an informal activity, leaving the terms of the trade-off, and so the switching rate, barely affected. But will significantly raise the entry rate in the informal sector and reduce the entry rate in the legal. Severance payments, conversely, reduce the flexibility of the legal firms, making the legal sector less attractive and therefore reducing the propensity of informal firms to legalize. Since the value of entry in both sectors does not depend on the firing cost, if not through the discounted continuation values, the rates of entry will be unaffected. Tax rates, viceversa, have only a limited incentive effect on informal productions and influence the relative size of the hidden economy only through their depressionary effect on the legal output.

4.1 Cost of Access

The first experiment entails raising the cost of access to the legal system above its benchmark value. As already stressed by Hopenhayn (1992) and, although in the context of a different model, by Blanchard and Giavazzi (2003), the cost of entry acts as a barrier that protects incumbent (legal) firms, reducing both the rate of entry and the rate of exit, lowering output and raising its price[13]. Overall an higher entry cost translates into higher profits and into an higher average size for the legal firms. This feature of the model highlights an underlying *Public Choice* vision of the regulation process: entry regulations create rents for big incumbent firms isolating them from the threat of potential competition. But the cost of entry is not effective at insulating incumbent firms from the competition of informals that legalize their activities. Namely an higher cost of entry, by raising the profitability of the legal firms, and in particular of the bigger and most productive legal establishments, is associated to a contemporaneous increase of both the costs and the benefits of operating legally, leaving the terms of the trade-off barely affected.

[13]Bertrand and Kramarz (2002) found also empirical evidence that, in a sample of French manufacturing establishments, more strict entry regulations are associated to lower sales, lower rates of employment, higher concentration (and so size) and higher prices.

Essentially the higher cost of access is associated to a substantial increase of the rate of entry in the informal sector. The higher optimal entry size in the legal sector, induced by the higher entry cost, displaces the low-productivity small entrants that were previously choosing the legal sector, for which it is now profitable only to enter in the informal sector. In fact the profits of small legal incumbents are still very close to zero after the introduction of entry barriers, as in Hopenhayn (1992). Consistently with the interpretation of informality as the *Doorstep* of the legal system, more firms will now find optimal to start their activity informally and wait to become more productive before they can afford to start legally.

Also the higher profitability of the legal firms translates into an higher opportunity value of switching, which delivers an higher expected future profitability of informals that is consistent with free entry only if the price in the informal market lowers. The lower relative price of the good in the informal market, determined both by the price increase in the legal market and by the decrease in the informal, triggers an increase in the demand for informal production that is accomodated through an increased entry. Part of the consumers that were previously buying on the legal market find now more convenient to buy from the informal, attracting more potential producers.

Clearly the cost of entry in the legal sector determines an increase of the relative size of the hidden economy, through an increase of the hidden output, delivered by the higher demand, and a simultaneous decrease of the legal. Figure (1) gives also a graphical idea of the changes in the distributions of firms that follow the introduction of costs of entry: the size distribution of legal firms is increasing, with a clear increased measure of bigger firms. The distribution of informal firms moves towards a bigger concentration in the lower tail, substantially driven by the increased informal entry.

4.2 Labor Market Regulation and Output Taxes

Increased severance payments induce a lower switching rate without significantly changing the entry rates. In fact the value of entry in both sectors is not affected by firing costs if not through the discounted value of future profits, since new entrants in the legal sector are assumed to start with a zero labor force and since informals do not comply with labor market regulations. Viceversa the firing costs, by reducing the flexibility of legal firms, induce lower profits in the legal sector and a decreased present value of legal firms [14] (increasing the relative price in the legal market), therefore making the option to switch less attractive and thus lowering the switching rate.

The economy is also characterized by a more stable labor force, with a lower hiring and firing rates, a lower job turnover and an higher serial correlation of employment. The firms will be less incline to dismiss workers because they have to sustain an extra cost, but they will be also

[14] This result is in line with the empirical evidence summarized by Almeida and Carneiro (2005). They report that, in Brazil, increasing the enforcement of labor market regulations is associated not only to a decrease of the informal labor force, but also to a decreases value added per worker and sales per worker.

more reluctant to hire new workers, given the higher cost of layoff in case of a bad productivity shock. In line with the unisectorial model by Hopenhayn and Rogerson (1993), there is also a reduction of aggregate employment and a lower labor productivity. As compared to their result, the proposed model delivers a much sharper reduction of legal employment, that was actually unexpected given the higher shock persistency, that should be associated, everything else equal, to a smaller reduction of the propensity to hire workers. The result is indeed a consequence of the effect of the severance payments on the informal sector, given that the lower switching rate triggers a further depression of the legal production and thus a magnified effect.

An increased output tax induces a sharp decrease of legal output that, by itself, determines a sensible increase in the relative size of the hidden economy. Both the average size and the average productivity of the legal firms decline and the price level in the legal market increases. The higher taxes induce also a reduction of the expected benefits of switching, that is nevertheless compensated by the price increase without influencing significantly the switching rate. Finally the simultaneous reduction of supply and demand for the legal good, the latter induced by the higher relative price, together with the unchanged switching rate, imply an almost unchanged entry in the legal sector.

5 Empirical Evidence: Numerical Analysis

The quantitative experiment performed entails plugging in the model the observed costs of the legal system, to then analyze the implied cross country differences in the size of the hidden economy. Three main results stand out: first, the cross country variability in the extent of labor market regulations and taxation can account only for a small fraction of the cross sectional variability of the size of the hidden economy, while the costs of access accounts for most it. According to the model, the median contribution of the entry cost is between 73% and 78%, while the median contribution of the output tax rate is between 8% and 20% and the one of severance payments between 3% and 12%. Second, the cost of access accounts for a greater fraction of the hidden economy in countries characterized by an higher size of the hidden economy, establishing a tight link between big hidden economies and cumbersome entry regulations. Third, the cross sections of the hidden output and employment delivered by the model are highly correlated with all the available empirical estimates.

5.1 Data

Two measures of the cost of access to the legal system are taken from Djankov et al (2002): the first (*ce*) simply takes into account "All identifiable official expenses" necessary to get all the authorizations required to start a business, thus excluding eventual bribes that must be paid during the process[15]. The second (*cetime*) takes into account "All identifiable official expenses

[15]For some quantitative idea of the magnitudes of the bribe payments see the information reported on the Transparency International website www.transparency.org

and a monetized value of the entrepreneurs' time", basically considering also the time necessary to complete all the mandatory bureaucratic procedures, quantifying the related opportunity cost and adding it to the first measure. Both variables are measured as a percentage of the GDP per capita of the country. A third measure of the cost of access ($wbce$) is from the World Bank Development Indicators, and it refers to the cost of starting a business expressed as a percentage of the GNI per capita.

Two measures of labor market regulations, related to the firing cost, are taken from Botero et al (2004). The first measure (sev) is the weeks of "Legally mandated severance payment requirements in case of redundancy dismissal". The second ($sevadv$) adds to the first measure also the "Legally mandated advance notice requirements", basically assuming that an additonal monetary cost for the firm willing to lay-off a redundant worker is the wage that must be paid during the notice period. A third measure of labor market regulation ($wbsev$) is the cross section of firing cost reported by the World Bank Development Indicators, measured in days of wages and converted in weeks considering 5 business days per week. The measure of tax pressure (tax) is from the World Bank Development Indicators and it is a measure of the tax rate on income profits and capital gains.

Two data sets are then constructed: the first (Mixed Sample) with the data from Djankov et al and from Botero et al, together with the tax rates from the WB; the second (WB Sample) using only data from the WB, averaged over the period 2002-2006. In both cases the data are collected for the biggest sample of countries for which information is available for all variables used, which means 78 countries in the first case and 90 in the second (note that not all the countries in the Mixed sample are included in the WB sample). These numbers do not include the countries with extremely high values of the cost of entry in excess of 150% of the GDP per capita (not taking into account the opportunity cost of time), that I excluded from the analysis. A full description of the sample can be found in Appendix. Overall there is evidence of a significantly dispersed cost of access and of a modest cross country variability of labor market regulations and tax rates.

5.2 Cost Decomposition

The top panel of Figure (2) plots[16] the relative size of the hidden economy as a function of c^e and ϕ. The visual impression substantially highlights the quantitative implications of the model: labor market regulations have a tiny impact on the relative size of the hidden economy, while entry costs have quantitatively large effects. The bottom panel of Figure (2) implements the same graph for c^e and τ^y, showing a large effect of τ^y on the hidden economy but still outperformed by the effect of the cost of entry c^e.

Quantitatively speaking, imposing severance payments requirements of 9 months, starting from an unregulated process of job destruction, implies a 2.5% increase in Y^i/Y. Even raising

[16]The graph is smoothed to account for small computational errors that arised because the model is solved for a small state-space that is feasible to handle on a normal desktop computer.

the requirement to 78 weeks (more than one and half year), that is actually twice as large as the maximum value found in the data for the sum of severance payments and advance notice, implies a modest 5% increase. Even more strikingly, the relative size measured in terms of total labor force N^i/N goes up by, respectively, 7.5% and 15%. Raising the tax rate implies stronger effects on the hidden sector: a 40% increase determines a 27% increase of Y^i/Y but a modest 2.9% increase of N^i/N. A 70% increase of τ^y (up to a value of 0.5 that is close to the highest sample observation) induces an increase of, respectively, 56% and 8%. Translating these results into level estimates of the hidden economy, the conclusion is that it is impossible to explain a size that is more than double of the one in the U.S. only appealing to tax rates differentials or to different extents of labor market regulations across countries. Viceversa imposing a cost of access to the legal sector as high as 30% of the GDP per capita, starting from a value of zero, can increase the relative size of the hidden output by 136% and the hidden employment by 85%. For a cost equal to 50%, that is still far below the biggest values found in the data, the factors become, respectively, 370% and 250%.

Indeed these results are not surprising at all, given the different channels through which the costs affect the hidden economy in the model. Specifically, in the model there is an infinite mass of potential entrants for each sector, so that decreasing the cost of entry will affect the decision of many entrepreneurs that will now find it profitable to start their activities legally. Conversely a labor market deregulation will mostly affect the legalization choices of a more restricted mass of highly productive informals that, as a consequence of the better profitability available in the legal sector, find now profitable to switch.

Looking more closely at the sample, the model implies that the observed cross sectional differentials in the costs of entry account, on average, for 74.9% of the cross sectional variability of the relative size of the hidden economy, while labor market regulations and tax rates for, respectively, 10.9% and 14.2%. Using the alternative set of data from the WB, the fraction become, 63.9%, 5.2% and 30.9%. The first row of Table (5) summarizes the results and provides also information regarding the median values and the standard deviations of the individual relative contributions. The procedure behind the decomposition entails fist feeding in the model all the three observed costs of the legal system to simulate the size of the hidden economy and then excluding the costs one at a time. The difference between the simulated value with all the costs and the simulated value without one of the costs is the contribution of the latter to the simulated hidden economy. The relative contribution of a costs is simply obtained dividing the absolute value of the individual contribution by the sum of the absolute values of the contributions. It is necessary to compute an absolute value since the benchmark level of tax rate used in the simulation is 29%, while many countries are characterized by a lower tax level and so by a negative contribution of taxes.

Further decomposing the contributions of the different costs by quartiles of the hidden economy reveals an additional result: the cost of access is a more important determinant of the hidden economy for countries characterized by a bigger size of the hidden economy. The second part of

table (5) reports the average and median contributions of the costs in the four quartiles of the distribution of the hidden economy, together with the standard deviations of the contributions. Clearly both the contribution of the cost of access in the top quartile is higher than in the bottom one and the variability of the contribution is sensibly lower. In greater detail, the cost of access, in the mixed sample, accounts for 61% of the hidden economy in the bottom quartile of the distribution but for 80% in the top quartile. Even more striking is the difference in the WB sample, with just 40% in the lower quartile and 80% in the top. Also the standard deviation drops from around 27% in the bottom quartile to 4% in the top one. The specular result is that the contribution of the tax rate is much smaller in the top quartile, with a value that drops from the 56% to the 9% in the WB sample and from 32% to 7% in the mixed sample. Also the standard deviation of the contribution of the tax rates significantly drops in the top quartile, from around 30% to 4%.

5.3 Estimates of the Hidden Economy: Output

A natural question that arises is how reasonable the measures of the hidden economy delivered by the model are as compared to the available cross country evidence. Importantly, we can interpret the model based measures only in relative terms, identifying the cross sectional differences in the sizes as the ones that would be observed if there were no other cross country variation except for the costs of the legal system. But we cannot interpret them as estimates of the hidden economy. To have correct estimates, the calibration procedure and the model parameters, especially the preference parametres ψ and z which are mostly responsible for the size of the hidden economy in the model, must be tailored to the different economies in the sample and not just assumed to be fixed. Indeed also the available estimation methods suffer from severe limitations and thus it is necessary to be extremely careful at using them as benchmarks. But it is also the case that all methods are based on indicators, like the consumption of electricity or the demand for cash, that are likely to be correlated with the extent of the informal activities. If the costs of the legal system have an impact on the size of the hidden economy, than also these independent indicators will be affected. It follows that a positive correlation between the model based measures and the estimates can be interpreted as a further evidence in favor of the model.

Schneider and Enste (2000) provide the most extensive cross country empirical analysis of the size of the hidden economy. They report estimates, for various years, based on four main methods: the Currency Demand method (Tanzi (1983)), the Aggregate Electricity Consumption method (Johnson et al. (1997) and (1998)), the Household Electricity Consumption method (Lacko' (1999)) and the MIMIC (Loayza (1996) and Giles (1999)). The estimates used here are just simple averages of all the available estimates for each country.

Figure (3) shows a scatter plot of the size of the hidden economy delivered by the model against the average estimates by Schneider and Enste. The model measures are obtained feeding in the model the upper bound measure of labor market regulation ($sevadv$) and the upper bound measure of the cost of access ($cetime$), along with the measure of tax pressure (tax). The results

obtained feeding in the lower bound measures, or combinations of lower bound and upper bound measures for different costs, are very similar to the one reported, with the only difference of a systematically lower simulated value. The comparison is restricted to a sample of 76 countries given the unavailability of estimates of the hidden economy for all the countries in the sample. As the plot shows, the correlation between the two estimates is considerably high, in particular equal to 59%.

It can be argued that just an high correlation of the model measures with the average estimates is not very informative, given the often different estimates delivered by different estimation methods. But breaking down the estimates according to the estimation methods reveals similar results: the correlation between the model measures and the average estimates delivered by the currency demand method is 82%, the correlation with the Lacko' electricity method 50% and with the Johnson et al. electricity method 47%. Nevertheless the correlation with the MIMIC estimates is actually negative and very small (-0.015), suggesting no association at all. In greater detail, the high correlation of the model values with the currency demand estimates is likely to be driven by the fact that this estimation method makes use of some information about the fiscal pressure. But the association with the electricity consumption measures is striking: in this case the estimation method does not use any information used in the simulations and it is therefore a pretty strong empirical assessment of the model. The result of no correlation with the MIMIC estimates must not be a source of concern: first because there is an estimate available for only 10 developing countries, thus raising the issue of potential measurement errors for the variables used in the estimation process; second because, as widely documented by Breusch (2005), the MIMIC estimates are the less reliable of all. Looking at a different breakdown of the cross country sample by stages of the development highlights similar results: the correlation of the model measures with the average estimates for the OECD countries is 75%, for the transition countries 41% and for the developing countries -0.01%.

Feeding in the model the cost measures from the World Bank (*wbce*, *wbsev* and *wbtax*) and restricting the sample to the 51 countries for which an estimate is available, reveals similar results. The correlation of the model based measures with the actual estimates is equal to 56%, while disaggregating the measures by estimation method results into a 50% correlation with the currency demand estimates, a 60% correlation with the Johnson et al. electricity consumption estimates and a 28% correlation with the Lacko' electricity consumption estimates. Since the MIMIC estimates are available for just 3 countries, the results are omitted. Disaggregating the estimates by OECD, transition and developing countries results into a correlation coefficient of, respectively, 62%, 12% and -6%.

5.4 Estimates of the Hidden Economy: Employment

It is also possible to evaluate the performance of the model as a predictor of the fraction of workers engaged in the hidden economy. The natural benchmark is the information published by

Table 1: **Workers in the Hidden Economy, Correlations Model-Data**

	Harmonized Measures		Non Harmonized Measures		
	Employment	Micro Firms	Employment	Micro Firms	Related Concepts
Mixed Sample	42.8	60.3	14.4	23.2	57.8
	(5)	(11)	(25)	(14)	(7)
WB Sample	78.9	72.2	46.1	43.4	57.3
	(5)	(11)	(21)	(15)	(10)

Notes: Correlations between the model based relative size of the labor force in the hidden economy, measured as a fraction of the labor force in the official economy, and corresponding figures from the International Labour Organization (ILO). In the mixed sample the model based measures are obtained feeding the upper bound measures of the cost of the legal system. The ILO data are averages over all the reported years and, within each year, over all the reported figures with different statistical coverage. Harmonized values refer to a common definition of the informal economy while non harmonized values to national definitions. The category related concepts entails national definitions of the informal economy that are not referable to the two categoires of employment as informal worker or employment in micro enterprises. A full description of the data can be found in the statistical annex KILM 7 available at www.ilo.org. The number of observations on which the correlations are computed is reported in brackets.

the International Labour Organization (ILO) on the informal economy labor force[17]. In general these data refer to workers employed in small, non registered, productive establishments and to self employed workers with non-incorporated businesses. Importantly, the informal workers' status in the official labor force is ignored, so that the data adhere to my model assumptions.

The ILO reports 5 different measures according to the criteria used to define the informal economy. Two of these measures refer to internationally harmonized definitions and evaluate, respectively, the fraction of workers employed in the informal sector and the fraction of workers employed in micro (non registered) enterprises. The same two fractions are reported also according to national, non harmonized, definitions. The last measure, labeled related concepts, entails other national definitions of the informal economy that are not referable to the former two categories. Since all the measures are typically available for more than one year, I simply compute averages. I also compute averages whenever more than one figure is available for a single year (i.e. national versus urban coverage of the measures). There is a total of 25 countries with at least one ILO measure and a corresponding model based figure and they are all developing or transition countries.

The exercise that I implement is again a simple assessment of the correlation between the model based measures of informal employment and the available estimates. The results are summarized in Table (1). Overall there is evidence that the model provides an empirically reasonable

[17] A full description of the data can be found in the statistical annex KILM 7 published on the ILO website www.ilo.org

characterization of the cross sectional differentials of the size of the informal employment. Looking at the harmonized measures, there is a 79% correlation between the model measure computed with WB data and the informal labor employment measure from the ILO. The correlation between this same model measure and the micro enterprises measure is equal to 72.2%. In the Mixed sample, with upper bound cost measures, the values of these correlations are, respectively, 42.8% and 60%. Non harmonized measures, available for a bigger set of countries, deliver, in general, lower correlations. But, in the WB sample, the correlation values are still significantly high.

6 Empirical Evidence: Regression Analysis

The model highlights the cost of access to the legal system as the most important driving force behind the hidden economy, substantially downplaying the role of labor market regulations and taxation. The question, then, is if there is empirical evidence that can endorse this finding, beyond the one proposed in the previous section that, although showing the plausibility of the model based measures of the hidden economy, did not specifically address the plausibility of the numerical results. In this section I will show that, in fact, the same conclusions reached with the numerical analysis on the model can be also reached with a cross country regression analysis. But I will also show that running the regressions with actual data and with data simulated from the model leads to very similar results, endorsing the conclusion of the theoretical model and the identification of the empirical equation altogether.

6.1 Cross Correlations

Before proceeding to the regression analysis, it is useful to first look at the correlation pattern between the costs of the legal system and both the Schneider and Enste estimates and the model based simulated sizes of the hidden economy. If anything, this will provide some preliminary information to assess the model results.

The first row of table (2) reports the correlation for both samples. The first important evidence is a positive and strong correlation between the costs of access and the size of the hidden economy and a positive but weaker association between firing costs and the hidden economy. The second evidence is the negative correlation between the size of the hidden economy and the GDP per capita, which is likely to be a consequence of the better institutional environment that richer countries have. The third evidence is a counterintuitive negative correlation between the measure of tax pressure and the size of the hidden economy. Friedman et al. (2000) interpreted this empirical evidence as follows: an increase in the tax rate, by raising the government revenue, can also improve the quality of the public services provided, thus raising the incentives to produce legally and lowering the size of the informal sector.

The second row of table (2) reports the correlations between the simulated size of the hidden economy delivered by the model and the cost measures. As far as the mixed sample is concerned,

Table 2: **Correlations Costs of the Legal System- Size of the Hidden Economy**

	Mixed Sample				WB sample			
	ce	*sev*	*tax*	*gdppc*	*wbce*	*wbsev*	*wbtax*	*gdppc*
$Y^i/Y(Data)$	0.618	0.284	-0.138	-0.675	0.579	0.304	-0.340	-0.702
$Y^i/Y(Model)$	0.942	0.274	-0.082	-0.344	0.934	0.318	-0.087	-0.257

Notes: $Y^i/Y(Data)$ is the relative size of the hidden economy reported by Schneider and Enste (1999) and averaged whenever more than one estimate is available. $Y^i/Y(Model)$ is the relative size of the hidden economy simulated from the model. The mixed sample is simulated using the lower bound measures of the costs. The mixed sample consists of 76 countries and the WB sample of 51 countries. *ce* is the cost of access to the legal system relative to the GDP per capita computed by Djankov et al. (2002). *sev* is the weeks of severance payments reported by Botero et al. (2004). *tax* is the tax rate on income, profits and capital gains from the World Bank Development Indicators (WBDI). *wbce* is the cost of starting a business as a percentage of the GNI per capita from the WBDI. *wbsev* is the weeks of severance payments from the WBDI. *wbtax* is the tax rate on income, profits and capital gains from the WBDI. *gdppc* is the GDP per capita.

the values refer to the simulation obtained with the upper bound measures of the costs (*cetime*, *sevadv*), but they are very similar to the one that would be obtained with the alternative lower bounds. In both samples the correlations are very close to the pattern found in the actual data, with the only exceptions of an higher correlation of the simulated size of the hidden economy with the cost of access and a lower correlation with the GDP per capita. If anything, the first evidence seems to suggest that the model overpredicts the cross country impact of the cost of entry, assigning to it more explanatory power than the one it has. The low correlation with the GDP per capita depends mostly on the simulation design, that limits the cross country variability only to the costs of the legal system. The only notable difference across the two samples is the worse performance of the model at capturing the correlation of the hidden economy with the tax rate in the World Bank sample. But this discrepancy is a direct consequence of the much higher negative correlation between these two variables found in the sample, which is actually driven by few outliers rich contries with very high values of the tax rates.

6.2 Regression with Actual Data

The next step of the empirical analysis entails running a regression of the relative size of the hidden economy on the costs of the legal system, controlling for the level of GDP per capita. The inclusion of the control is important because richer countries are characterized by a better law enforcement (LaPorta, Lopez De Silanes, Shleifer and Vishny (1998)) and by a better quality of government (LaPorta et al. (1999)), which can potentially influence both the size of the hidden sector and the level of its determinants included in the regression equation. Richer countries are also characterized by less credit constraints and so, potentially, by a less severe influence of entry costs on the size of the hidden economy (see appendix for further documentation). The regression

model is the following:

$$\frac{Y_j^i}{Y_j} = \gamma_1 + \gamma_2\, c_j^e + \gamma_3\, \phi_j + \gamma_4\, \tau_j^y + \gamma_5\, x_j + \epsilon_j \tag{7}$$

Where Y_j^i/Y_j is the ratio of informal to legal GDP, c_j^e the cost of entry in the legal sector, ϕ_j the extent of labor market regulation, τ_j^y the tax rate on output, x_j the GDP per capita and ϵ_j the error term. One concern with the above specification is the potential endogeneity of the cost measures. Namely countries with big informal economies are characterized, by definition, by low tax revenues and so by a limited government budget, that is typically associated to inefficient bureaucracies and thus to slow and lengthy procedures. Countries with big informal sectors can also develop labor market regulations that are dictated by the wish to control the phenomenon. Also the measure of tax pressure is computed dividing a measure of tax revenue by a measure of tax liability, and the size of the hidden economy is likely to influence both the numerator and the denominator of the quantity.

The simple strategy to cope with the endogeneity consists in the use of legal origins (English common law, French civil law, German civil law, Scandinavian and Socialist), religious prevalence (Catholic, Muslims, Protestants, and other religions) and ethnolinguistic fractionalization as instrumental variables[18]. This choice is justified by the empirical evidence reported by LaPorta et al. (1998), Djankov et al. (2002) and Botero et al.(2004): legal origins, as well as religion and ethnic eterogeneity, are found to be, broadly speaking, good exogenous predictors of the "Quality of Government". The quality of goverment, in turns, is a good predictor of the degree of interventionism in the economy, which is directly related to the tax burden, but also of the efficiency of the bureaucracy and of the extent of market regulation. In fact common law countries, of british legal traditions, are characterized, in the sample, by a lower average enty cost (21% and 33% for *ce* and *cetime* as compared to, respectively, 29% and 48% of the full sample), and a lower average labor market regulation (4 and 6 weeks versus 7 or 11 in the full sample). Conversely French civil law countries are characterized by an higher average entry cost (41% and 66%) and by higher firing costs (10 and 14 weeks). For what concerns religious prevalence, the entry cost for protestant countries (15% and 26%) is sensibly lower than the full sample average and then the average for muslim countries (48% and 70%), with the severance payment requirements following a similar pattern (3 and 8 weeks as compared to 9 or 11). Also the levels of entry regulation are positively correlated with the extent of ethnical division of the countries.

Providing that, to some extent, also the level of GDP per capita can be influenced by the size of the hidden sector, at a minimum because as many businesses go and produce underground the size of the hidden economy will rise, inducing a decline in the observed GDP, I also included the latitute of the capital city of the country, highly correlated with the GDP per capita, in the set of instruments. One last instrument entails the proportionality of the electoral system, according to the evidence reported by Pagano and Volpin (2005) of a positive relationship between this

[18]See Friedman et al. (2000) for a similar empirical strategy.

variable and the protection reserved to workers, that translates into more generous severance payments.

Table (6) reports the regression results for the two samples of data and for different possible regression specifications related to different variables definitions. The standard errors reported in the table are robust to potential eteroskedasticity. Since the Hausman test does not reject the null hypothesis of an instrumental variables estimator equal to the OLS estimator for several possible combinations of instruments, the results are reported for the OLS. This last results suggests that there is no statistical evidence of endogeneity.

One important empirical evidence seems to arise robustly: firing cost and tax rates have no explanatory power for the hidden economy over and above the cost of access. The coefficient on the cost of access is always positive, large and statistically significant while the coefficient on firnig costs and tax rates is always statistically insignificant. As far as the tax rates are concerned, all the regressions highlight a positive effect on the size of the hidden economy, which is endorsing the idea that the negative correlation found in the data for the two variables is indeed spurious and driven by the correlations of the tax rates with the GDP per capita.

A potentially puzzling result is the negative sign on the labor regulation variable in some of the regression specifications. In fact it is not difficult to rationalize this finding from a theoretical perspective. Basically imposing firing costs to legal businesses raises the relative convenience of using informal labor, thus shifting part of the labor demand towards the cheaper informal workers and therefore inflating the size of the hidden economy. Nevertheless part of the hidden economy is also composed by workers that, being temporarily unemployed, work informally while looking for a regular occupation (DeSoto (1989), Lemieux et al. (1994)). In this perspective, imposing an advance notice requirement, by raising the probability of finding a job right after the termination of an employment relationship, will actually decrease the probability that a laid-off worker will work informally, therefore reducing the size of the hidden economy. If, on top of that, mandatory severance payments provide also monetary payments in case the job is not found in the notice period, than the probability of working underground will be further reduced. The quantitative question is then if the cost effect of labor market regulation for the legal firms is bigger or smaller than the positive effect for the workers, and the regression results seem to be inconclusive, given the different signs in different regression specifications. But what is more interesting is the consequence of this result for the interpretation of the comparative statics results discussed before. In particular, we can consider the theoretical model as a best case scenario to evaluate the negative effect of labor market regulations on the hidden economy, being constructed only around the cost role of labor regulations. It follows that the quantitatively small effect found is actually a stronger statement in favor of the main result of the paper.

A further property of the model proposed in this paper is the higher importance of the cost of access at explaining bigger hidden economies. The natural way to test this implication is to model the quantiles of the distribution of the hidden economy as dependent upon the costs of the legal system, to then compare the magnitudes of the regression coefficients at different quantiles.

The regression specification is the following:

$$Q_{Y_j^i}(u|X_j) = X_j'\beta(u) \tag{8}$$

where $Q_{Y_j^i}$ is the notation for the quantile of the distribution of the relative size of the hidden economy, $u \in [0,1]$ is the quantile index, $X = \{c_j^e, \phi_j, \tau_j^y, x_j\}$ is the vector of explanatory variables and $\beta(u)$ is a vector of coefficients that depends on the quantile. The results from this exercise are summarized in figure (4), where the coefficients of the cost of access are plotted against the quantiles of the hidden economy. Indeed the coefficient is significantly higher for higher quantiles of the distribution, even if not monotonically increasing, and always statistically significant[19]. In particular, the values range from around 0.15 for the first decile to the 0.25 of the ninth decile, with a peak of 0.35 around the third quartile. As far as the tax rates are concerned (see appendix for further documentation), the coefficient is statistically insignificant at all quantiles, but the profile is actually increasing in contrast with the prediction of the model. One possibile explanation of this pattern is that the data are consistent with the vicious cycle that links increasing tax rates to lower tax revenues, lower public goods, lower incentives to produce legally and thus to a further increase of underground production and to a further decrease of tax revenues. But, since the coefficients are not significant, the data do not prove that this mechanism is actually operating.

6.3 Regression with Simulated Data

More than just reproducing the correlation pattern observed in the data, the model is able to reproduce the regression results previously shown. Table (7) reports the results of a regression of the simulated size of the hidden economy on the costs used to simulate it. In each regression the simulated data are obtained feeding the cost measures included in the corresponding regression specification. The regression equations include the GDP per capita and a constant term exactly as the regressions with the actual dataset, even if, given the simulation strategy, there is no need to control for the GDP. In fact the choice of including the control is inconsequential for the results (details available upon request). Also the results refer to the OLS estimator, providing that, even in this alternative specification, the Hausman statistics does not reject the null hypothesis.

In line with the previous results, the coefficient on the cost of access is always large and statistically significant, while the coefficient on the labor market regulation variable is not statistically different from zero in all regression specifications. The only discrepancy with the previous results is the statistically significant effect of tax rates on the hidden economy found in the mixed sample. This finding suggests again the possibility that the model tends to overstate the effect of taxes, which is a direct consequence of the exclusion of the positive effects of taxation in terms of more public goods supplied by the government. Nevertheless, as stressed by the result in the WB sample, even for such a model it is not difficult to find an insignificant effect of tax rates, which is a further assessment of the main result of the paper.

[19] The plot of the confidence bounds is omitted to allow an easier reading.

Figure (4) shows also similar quantile profiles of the coefficients on the cost of access for the regressions with actual and simulated data, with a correlation coefficient equal to 0.57 in the mixed sample and 0.67 in the WB sample. Again this result highlights the link between big hidden economies and cumbersome entry regulations, that shows up as a greater importance of the cost of access at explaining larger hidden economies. The results about tax rates and firing costs are less clear cut: in the mixed sample, they are consistent with the empirically observed increasing importance of tax rates, but they highlight also a failure to capture the behaviour at low quantiles of the distribution; in the WB sample they are inconsistent with a decreasing importance of taxes (a full description of the results can be found in the Appendix).

There is also something more that we can learn from this last exercise. In particular, the empirical identification of the model estimated with simulated data is perfect: all the variability of the hidden economy is induced by the cost measures and all the other characteristics of the economy are held fixed, as if a perfect set of control variables were included in the regression specification. But the results obtained with this perfectly identified model, which indeed has a value of the R^2 very close to 1, are similar in all respects to the results obtained with the actual data, in the context of a cross country regression for which it is always problematic to establish the empirical identification: the high degree of eterogeneity of the countries included in the sample opens to the possibility of unobserved individual characteristics that, being correlated to both the hidden economy and its determinants, could bias the estimates. Then how should we interpret the fact that the results obtained with the two methodologies are equal? A concrete possibility is that the identification of the empirical equation is in fact correct, therefore excluding the possibility of spurious estimates. But the problem with this argument is that it assumes that the proposed model is indeed a good stylized representation of the mechanism that relates the costs of the legal system to the hidden economy, which is of course hard to prove, even acknowledging the high correlation of the model based estimates of the hidden economy with their observed values. Nevertheless the alternative explanation is that both the empirical model is mispecified and the theoretical model is missing the key mechanism through which the costs affect the size of the hidden economy, which is perhaps even more challenging to prove.

7 Conclusion

The main message of the paper is that barriers to entry matter. Imposing an high and sometimes disproportionate cost for starting a business activity legally has the obvious side effect of disincentivizing potential entrepreneurs, making more attractive to start informally, waiting to grow or to become more productive before legalizing. The contribution of the work is showing that this effect is quantitatively very high, and in particular higher than the incentive effect implied by the costs of participation to the legal system, like the payment of taxes or the necessity of complying with labor market regulations. The general consequence is an erosion of the social contract: the proliferation of informal activities actually undermines the rule of law and, behind

the obvious negative economic effects like the loss of tax revenue, imposes a great burden on every government. But it is exactly the government or the bureaucracy to blame: barriers to entry are typically erected so that the politicians/bureaucrats can enjoy rents, sharing them with the incumbent firms in the market.

The importance of barriers to entry is in contrast with the conclusion by La Porta and Shleifer (2008). They interpret the smaller productivity of the firms in the informal market as evidence against the "*Romantic*" view of the hidden sector, according to which the informal entrepreneurs are dynamic and productive but somehow trapped in the informal sector by cumbersome regulations. Indeed I showed that the evidence of a lower productivity is consistent with a "*Doorstep*" theory of informality and with a strong impact of the costs of the legal system in the economy, rather than of no impact. Basically the lower productivity of the informal firms is a consequence of the fact that small, less productive, firms find it profitable only to start informally. Still, with my simple model, I cannot simply dismiss the theory by La Porta and Shleifer (2008) and, in particular, their conclusion that informal firms are intrinsically different than their legal counterparts, being characterized by less human capital on the management side. It might as well be the case that this difference is the most important source of productivity differentials. In fact, since the survey evidence is consistent with both their theory and the "*Doorstep*" theory, I have to conclude that the data cannot meaningfully discriminate among the two.

The results of the analysis have also strong policy implications. In particular, the model implies that a labor market deregulation will mainly induce more businesses to legalize their activities, while reducing the cost of access to the legal system will mainly increase the number of entrepreneurs that start their activities legally. But it also implies that reducing the cost of access to the legal system is far more effective, at stifling economy activities, than labor market deregulation policies, in the form of lower firing costs, or policies that reduce the fiscal burden. The problem is that, although product market deregulations are not generally perceived as a threat by workers, as labor deregluations are (perhaps with the exception of the employees of the big incumbent firms that might face a positive probability of unemployment as the firms looses its protected position), they still appear as a problematic instrument to use, because of the powerful coalitions that support them.

It is important to stress that the conclusion of the work must not be confused with a simplistic endorsement of the abolition of any form of product market regulation. In fact the argument is against unecessary bottlenecks in the bureaucratic process established only to appropriate rents, certainly not against screening procedures to ensure quality standards or polluting levels, that are obviously necessary and welfare enhancing. In a sense it is not desirable to completely eliminate the incentives for producing in the hidden sector, exactly because this would transalte into a product market deregulation that can have important negative effects on the economy. Making a parallel with the analysis of Acemoglu and Verdier (2000), there is here a trade-off between market failures and the hidden economy, and tollerating a moderate size of the hidden economy can be less dangerous that allowing an indiscriminate entry in the legal sector. The problems

arise if the costs reach extremely high values and if the greatest part of them is accounted for by rent seeking behaviours, as it is the case according to Botero et al. (2004): then the economy can end up with an higher fraction of entrepreneurs that, operating in the hidden economy, do not comply also with the regulations that are designed to raise welfare, therefore fostering the emergence of the problems that the regulation is supposed to avoid. In other words enacting a reduction of the unnecessary entry regulations, together with a rationalization of the procedures, is a plausible way to enforce a welfare enhancing regulation of the economy, otherwise threatened by the option to produce informally.

The analysis proposed suffers from several limitations. First, and foremost, I proposed an analysis of the cross sectional determinants of the hidden economy. I didn't provide any answer to the extremely interesting question of what drives the growth or decline of the hidden economy through time. Actually the cost of access is an unlikely candidate for such an explanation, since it plausible to think about legal systems as very resilient to change. Second, the only dimension of labor market regulation considered is related to the cost of firnig workers, while it is evident that, for instance, hiring costs and the flexibility of standard employment contracts, not to mention the power of the unions, could also play an important role in shaping the characteristics of the hidden economies. Third, the modelling of the benefits associated with the production in the legal sector is severely limited. Legal firms have access to courts, which, more or less perfectly, can enforce contracts. Legal firms can also collateralize their capital to obtain loans or they can just use the financial market to raise new capital. They can also advertise the product, having access to markets beyond the local areas. In other words, while the model developed in this paper is an empirically reasonable characterization of the cross country differentials in the size of the hidden economy, it is still a limited explanantion of a complex and only partially understood phenomenon.

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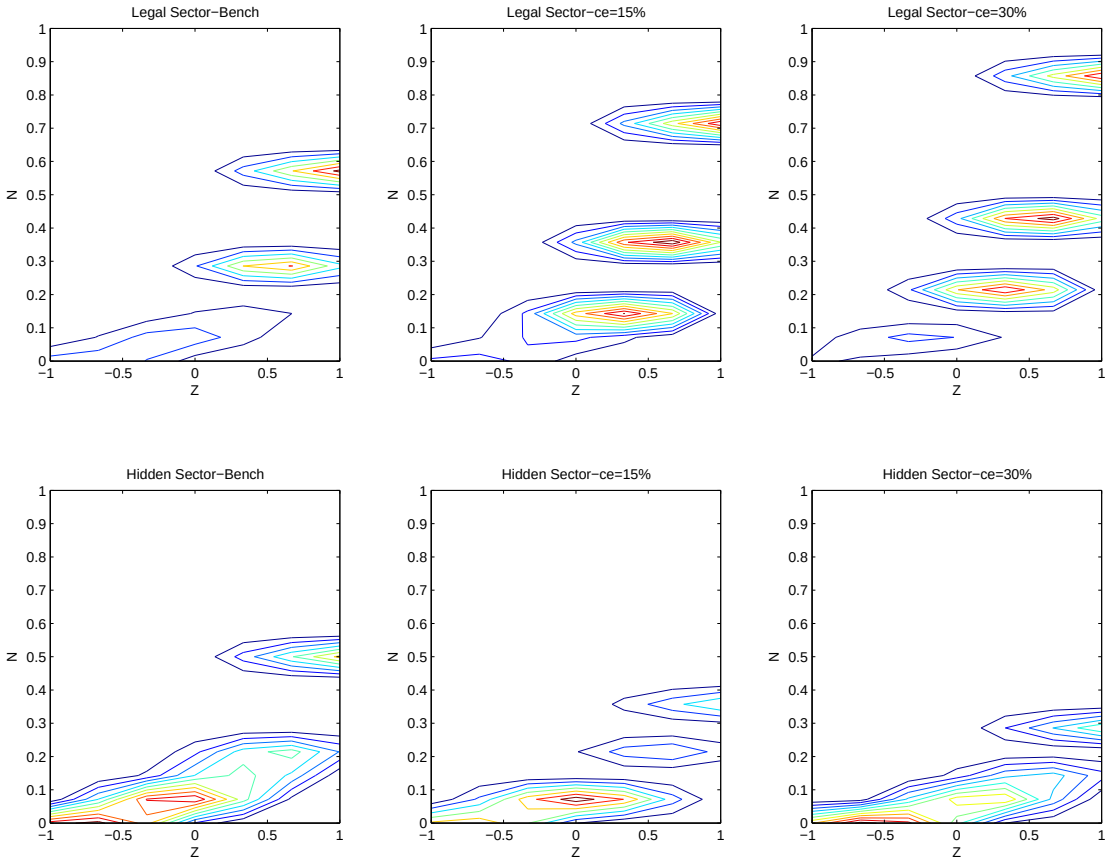
Tables and Figures

Table 3: **Size Distributions-Legal and Hidden sectors**

		small	avg small	avg big	big	exit prob.
legal	$firms$	37.96	31.75	17.85	12.44	
	emp	14.56	34.12	27.99	23.32	
	hire	28.49	49.95	21.55	0	
	$fire$	7.99	27.86	31.14	33.01	
cohorts	1	70.00	15.00	10.00	5.00	0.60
	2	18.15	45.78	20.57	15.49	0.31
	5	12.57	43.13	24.62	19.68	0.10
	10	12.42	42.86	24.65	20.08	0.01
$informal$	$firms$	75.00	15.00	10.00	0	
	emp	39.70	31.25	29.05	0	
	hire	63.70	30.45	5.83	0	
	$fire$	23.12	33.21	43.66	0	
cohorts	1	35.27	40.11	24.62	0	
	2	13.52	44.88	24.17	17.42	
	5	12.47	42.95	24.64	19.93	
	10	12.41	42.85	24.65	20.08	

Notes: The table reports the percentage of the total distribution of firms in each size category. The size categories are equally sized intervals between zero and the maximum value of employment choosen by the legal firms in the comparative statics exercises. The cohorts report the size distribution of incumbent firms according to the periods of permanence in the market. The cohorts for informal firms are the cohorts of firms swithching to the legal sector. $firms$ refers to the distribution of firms, *emp* to the distribution of employment, *hire* to the distribution of new hires and $fire$ to the distribution of the job destroyed.

Figure 1: **Size Distribution-Cost of Entry**



Notes: Contour plot of the size distribution of legal firms (upper panel) and informal firms (lower panel) for different values of the cost of access to the legal system. Bench refers to the benchmark zero value of the cost of access. N is the normalized levl of employment. Z is the normalized value of the technology.

Table 4: **Effects of the Costs of the Legal system**

		Cost of entry (% of GDP)			Sev. Payments			Output tax		
	bench	10%	20%	30%	6 months	9 months	1 year	+40%	+70%	+100%
exit rate	43.527	27.652	20.498	11.957	40.472	45.122	47.277	39.687	41.714	44.578
exit inf.	68.215	68.392	68.525	68.055	66.252	65.941	72.311	67.092	67.685	68.435
switch	31.785	31.612	31.475	31.945	27.576	21.448	15.926	32.911	32.315	31.565
avg size y	0.141	0.167	0.183	0.195	0.149	0.134	0.134	0.121	0.094	0.070
avg size n	0.059	0.075	0.085	0.091	0.062	0.060	0.059	0.062	0.060	0.059
avg prod	1.179	1.519	1.661	1.786	1.172	0.932	0.782	0.581	0.435	0.322
avg size y^i	0.087	0.061	0.039	0.023	0.086	0.086	0.087	0.089	0.088	0.087
avg size n^i	0.059	0.076	0.085	0.091	0.062	0.059	0.059	0.062	0.061	0.059
avg prod inf	0.427	-0.893	-2.441	-4.107	0.679	0.762	0.796	0.431	0.478	0.385
job turn	25.924	32.327	36.967	41.961	20.912	21.483	20.803	25.311	25.829	27.181
job corr	0.933	0.927	0.941	0.941	0.967	0.964	0.967	0.943	0.934	0.924
job turn inf	45.647	45.842	46.864	45.633	43.987	44.026	41.655	46.577	45.553	47.333
job corr inf	0.923	0.917	0.914	0.917	0.928	0.917	0.919	0.929	0.924	0.912
B	2.209	1.071	0.612	0.153	2.024	2.297	2.445	1.998	2.160	2.359
B^i	0.211	0.332	0.560	0.947	0.215	0.192	0.183	0.234	0.234	0.247
p	0.534	0.597	0.634	0.647	0.539	0.552	0.561	0.630	0.745	0.906
q	0.418	0.367	0.314	0.265	0.416	0.424	0.429	0.412	0.416	0.420
Y^i/Y	2.732	3.775	5.039	6.466	2.783	2.800	2.824	3.479	4.287	5.497
N^i/N	1.205	1.613	1.967	2.232	1.270	1.386	1.391	1.241	1.300	1.376
Q^i/Q	4.027	7.797	14.551	24.746	4.431	4.227	3.965	4.472	4.455	4.524

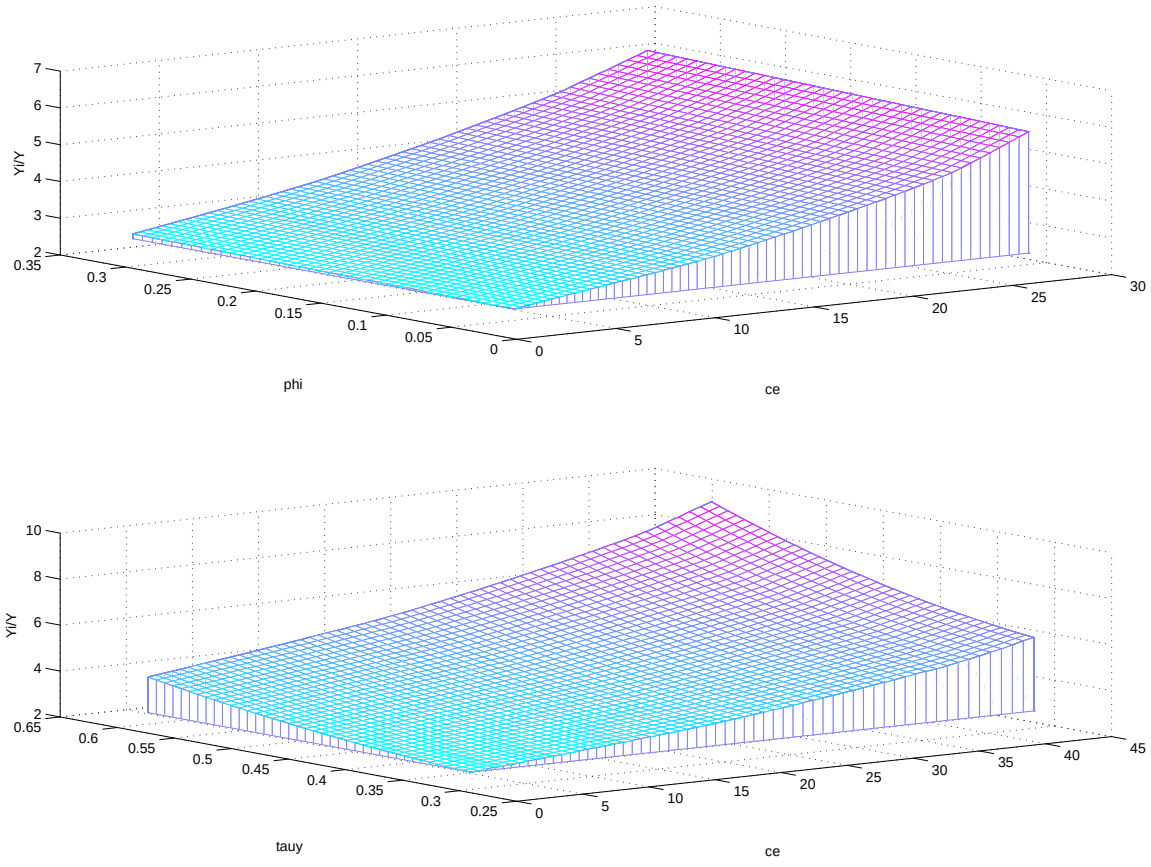
Notes: Selected properties of the stationary equilibrium of the model simulated under different values of the costs of the legal system. Each column reports the results for a model that is parameterized according to the benchmark for all parameters but the one indicated on top. The superscript i refers to the hidden sector. p and q are the prices of the good in the legal and hidden market. Q is the total number of firms and B the size of entry.

Table 5: **Percentage contribution of the costs of the legal system to the simulated size of the hidden economy**

		Mixed Sample			WB Sample		
		$c^e = ce$	$\phi = sev$	$\tau^y = tax$	$c^e = wbce$	$\phi = wbsev$	$\tau^y = wbtax$
Full Samp.	Mean	74.8	10.9	14.3	64.0	5.2	30.8
	Median	78.7	12.0	8.0	73.7	3.2	20.0
	Std	16.2	4.2	19.1	25.6	4.7	27.6
1^{st} Quar.	Mean	61.4	6.2	32.4	40.8	2.3	56.9
	Median	75.0	7.1	19.2	48.8	1.3	50.7
	Std	27.9	4.9	30.7	24.7	3.8	23.5
2^{nd} Quar.	Mean	78.6	11.1	10.3	59.8	1.9	38.3
	Median	78.6	11.4	9.9	69.1	2.0	29.1
	Std	6.7	1.8	8.4	27.5	1.2	28.1
3^{rd} Quar.	Mean	78.9	12.4	8.7	75.4	5.1	19.5
	Median	80.3	13.1	5.9	76.7	5.4	25.8
	Std	5.4	18.3	6.8	18.3	2.9	19.6
4^{th} Quar.	Mean	79.5	13.4	7.1	79.9	11.4	8.7
	Median	79.7	14.1	5.8	78.5	10.9	10.3
	Std	4.6	2.7	5.4	4.6	1.8	4.6

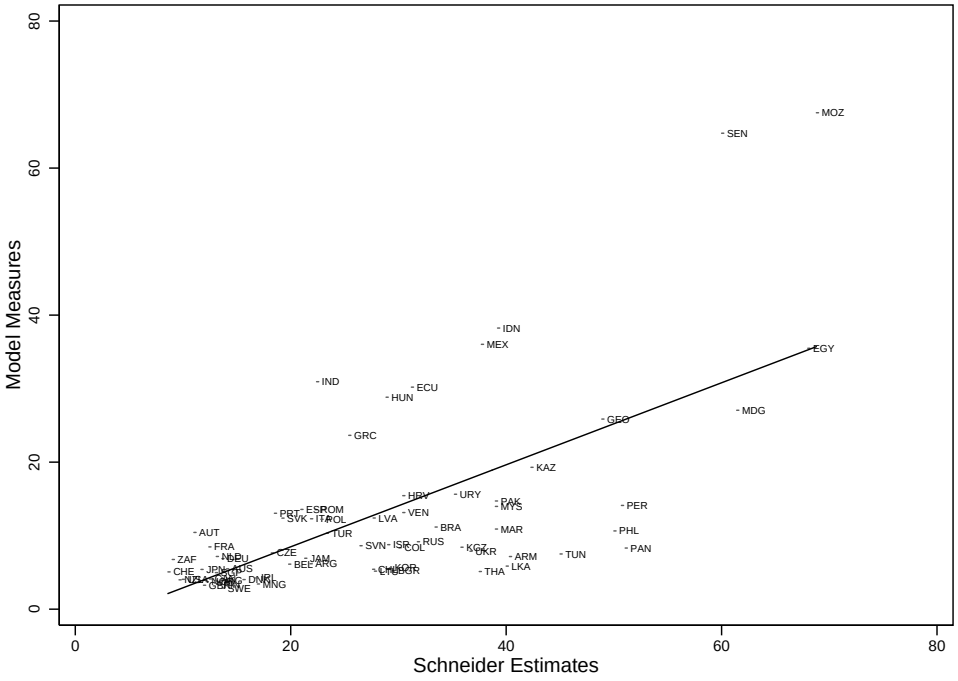
Notes: Summary statistics relative to the distribution of countries simulated from the model using data on the costs of the legal sector an keeping the parameterization at its benchmark level. Mixed Sample: $c^e = ce$ is the cost of access to the legal system as a percentage of GDP per capita computed by Djankov et al. (2002). $\phi = sev$ is the per period wage equivalent of the weeks of severance payments reported by Botero et al. (2004). $\tau^y = tax$ is the tax rate on income, profits and capital gains from the World Bank Development Indicators (WBDI). 78 countries simulated. WB Sample: all data are from the WBDI and averages over the period 2002-2006. $c^e = wbce$ is the cost of access to the legal system as a percentage of GNI per capita. $\phi = wbsev$ is the per period wage equivalent of the weeks of severance payments and $\tau^y = wbtax$ is the tax rate on income, profits and capital gains. 90 countries simulated. The Quartiles refer to the distribution of the relative size of the hidden economy implied by the model.

Figure 2: **Counterfactuals-cost of entry, labor regulation and taxes**



Notes: Relative size of the hidden economy simulated from the model for several combinations of costs of access and firing costs (upper panel) and costs of access and tax rates. *ce* is the cost of access measured as a percentage of GDP per capita. ϕ is the wage equivalent of the severance payments, where 0.2=1 year of payments. τ^y is the tax rate on income.

Figure 3: **Size of the Hidden Economy**



Notes: Average relative size of the hidden economy estimated by Scheider and Enste (1999) and relative size of the hidden economy simulated from the model using the following costs of the legal system: *cetime*, *sevadv* and *tax*. *cetime* is the cost of access to the legal system plus the opportunity cost of the enterpreneurs time computed by Djankov et al. (2002). *sevadv* is the weeks of severance payments and advance notice requirements by Botero et al. (2004). *tax* is the tax rate on income, profits and capital gains from the World bank Development Indicators. The fitted line is estimated via OLS.

Table 6: **Regression Results-Actual data**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ce	0.243*	0.244*			0.243*	0.244*			
	(0.059)	(0.059)			(0.058)	(0.060)			
cetime			0.198*	0.199*					
			(0.048)	(0.049)					
wbce							0.171*	0.169*	0.168*
							(0.056)	(0.052)	(0.054)
sev	0.015		-0.090		0.021				
	(0.150)		(0.158)		(0.153)				
sevadv		-0.004		-0.101					
		(0.144)		(0.144)					
wbsev							-0.007	-0.003	
							(0.031)	(0.032)	
tax	0.055	0.056	0.074	0.066		0.056	0.072		0.068
	(0.103)	(0.100)	(0.102)	(0.101)		(0.100)	0.134		0.133
R^2	0.574	0.574	0.568	0.569	0.577	0.579	0.586	0.592	0.595
obs	76	76	76	76	76	76	51	51	51

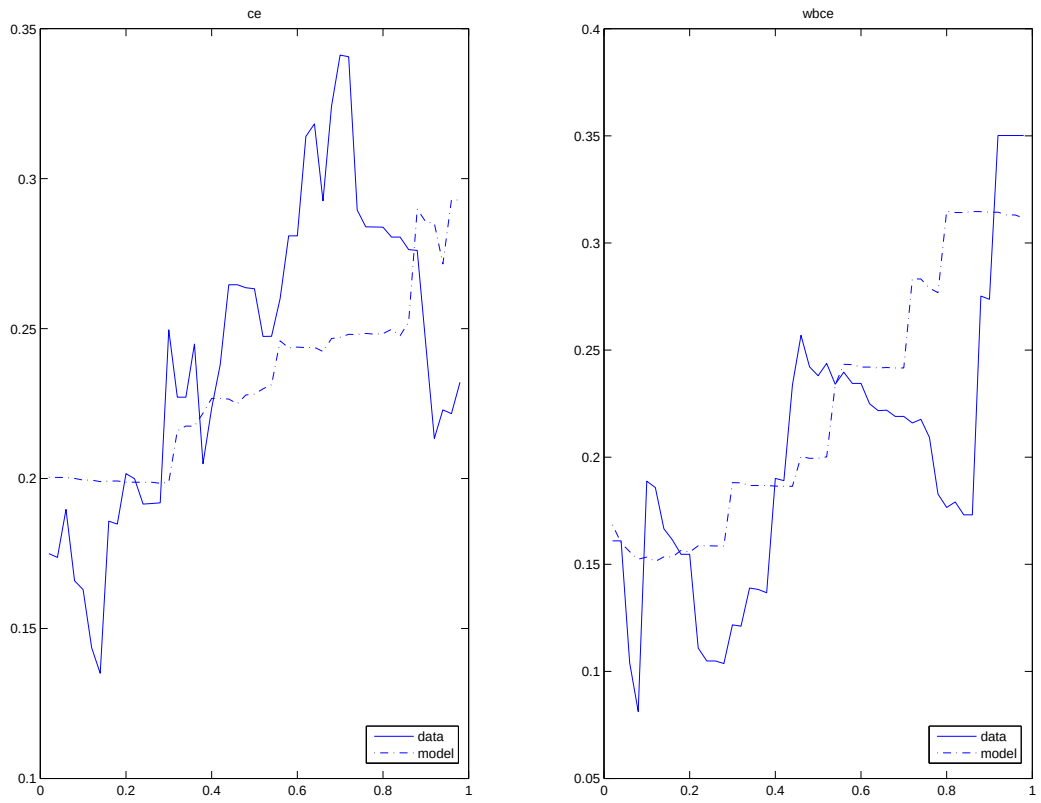
Notes: Dependent variable is the average relative size of the hidden economy reported by Schneider and Enste (1999). *ce* is the cost of access to the legal system relative to the GDP per capita computed by Djankov et al. (2002). *cetime* is the cost of access to the legal system plus the opportunity cost of the enterpreneurs time computed by Djankov et al. (2002). *wbce* is the cost of starting a business as a percentage of the GNI per capita reported by the World Bank Development Indicators (WBDI). *sev* is the weeks of severance payments reported by Botero et al. (2004). *sevadv* is the weeks of severance payments and advance notice requirements by Botero et al. (2004). *wbsev* is the weeks of severance payments reported by the WBDI. *tax* is the tax rate on income, profits and capital gains from the WBDI. Each regression specification includes a constant and GDP per capita. Standard errors robust to eteroskedasticity are reported in brackets. *=significant at the 1% level.

Table 7: **Regression Results-Simulated data**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ce	0.245*	0.246*			0.244*	0.245*			
	(0.018)	(0.017)			(0.020)	(0.017)			
cetime			0.328*	0.193*					
			(0.022)	(0.016)					
wbce							0.281*	0.280*	0.280*
							(0.027)	(0.026)	(0.027)
sev	0.020		0.058		0.030				
	(0.023)		(0.046)		(0.036)				
$sev + adv$		0.030		-0.064					
		(0.019)		(0.043)					
wbsev							-0.003	-0.002	
							(0.004)	(0.004)	
tax	0.102*	0.104*	0.152*	0.114*		0.103*	0.021		0.019
	(0.015)	(0.014)	(0.020)	(0.021)		(0.015)	0.022		0.021
R^2	0.946	0.949	0.950	0.849	0.906	0.946	0.952	0.952	0.953
obs	76	76	76	76	76	76	51	51	51

Notes: Dependent variable is the relative size of the hidden economy delivered by the model feeding the costs used in the regression specification. *ce* is the cost of access to the legal system relative to the GDP per capita computed by Djankov et al. (2002). *cetime* is the cost of access to the legal system plus the opportunity cost of the enterpreneurs time computed by Djankov et al. (2002). *wbce* is the cost of starting a business as a percentage of the GNI per capita reported by the World Bank Development Indicators (WBDI). *sev* is the weeks of severance payments reported by Botero et al. (2004). *sevadv* is the weeks of severance payments and advance notice requirements by Botero et al. (2004). *wbsev* is the weeks of severance payments reported by the WBDI. *tax* is the tax rate on income, profits and capital gains from the WBDI. Each regression specification includes a constant and the GDP per capita. Standard errors robust to eteroskedasticity are reported in brackets. *=significant at the 1% level.

Figure 4: **Profiles of the Regression Coefficients on the Cost of Access at Different Quantiles**



Notes: Regression coefficients in the regression of the quantiles of the hidden economy on the costs of the legal system. The horizontal axis is the quantile index, with 0.5 corresponding to the median. The left panel refers to the regression in the mixed sample with the lower bound measures of the cost of entry and of the firing costs, while the right panel to the WB sample. Each panel plots both the profile for the regression with actual data on the hidden economy by Scheider and Enste (1999) and for the regression of data simulated from the model using the costs used in the regression specifications. *ce* is the cost of access to the legal system relative to the GDP per capita computed by Djankov et al. (2002). *wbce* is the cost of starting a business as a percentage of the GNI per capita reported by the World Bank Development Indicators (WBDI).