Distortions, Policy Ineffectiveness and Tax Evasion

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Abstract

Developing countries face challenges to raise domestic resources to unlock their growth potential. In these countries, tax evasion is ubiquitous and shrinks public goods and services provided. Although a large body of the literature tried to understand the determinants of tax compliance, little is known on the cause of the variation of tax evasion across countries. This paper examines empirically and theoretically the impacts of distortions and policy ineffectiveness on tax evasion in 38 African and Latin American countries. The empirical approach provides evidence of a positive correlation between distortions and tax evasion using firm-level data from the World Bank Enterprises Surveys. We then develop a general equilibrium model with heterogeneous entrepreneurs where distortions and policy ineffectiveness affect tax evasion through a signal effect. We calibrate the model to the United States economy and treat this country as a benchmark economy with no distortions as is standard in the literature. The model is simulated for a sample of African and Latin American countries using each country specific distribution of productivity and distortions. We validate the model by showing that simulated aggregate output and tax evasion are strongly correlated with the data. Moreover, the model explains 45% of the variation of tax evasion and more than 25% of the dispersion of output across African and Latin American countries.

Keywords: Tax evasion, policy ineffectiveness, distortions, business environment, underdevelopment, calibration.
JEL codes: O1; H260; H310

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I Introduction

One fundamental issue for development economics is to understand how policies and institutions affect the performance of firms. This issue is even more important in developing countries, where institutions and business environment are less developed (Aterido et al., 2011). In these countries, inefficient business environment affects both the efficiency and the dynamism of the private sector. As pointed out by Besley and Burgess (2004), Aterido et al. (2011), Buera et al. (2013), and Goyette and Gallipoli (2015), a poor business environment generates costs and losses for firms, thus hindering their performance and ability to create jobs.

In parallel, tax evasion is ubiquitous in developing countries. Comparative statistics from the World Bank Entreprise Surveys (WBES) for OECD and developing countries show that on average, 22% of total sales are not reported for tax purpose in developing countries compared with only 7% in OECD countries[1]. Moreover, Daude et al. (2013) highlight that some developing countries, including half of those in sub-Saharan Africa, raise less than 17% of their GDP in tax revenues compared to OECD countries which raise on average close to 35% of GDP in tax revenues, a shortfall which has important social and economic consequences. Indeed, tax evasion reduces domestic revenues, thereby reducing the government ability to invest in development, social policies as well as productive infrastructures, and to provide public goods and services. The coexistence of tax evasion and inefficient business environment raises questions about a potential relationship between these two variables.

This is exactly the aim of this paper, where we examine the relationship between distortions in business environment, policy ineffectiveness and firms' decision to evade their taxes. The hypothesis is that distortions in the business environment and policy ineffectiveness send a signal about mis-governance and poor quality of the government policies related to the business environment. Two mechanisms can ex-

[1] Authors' calculations based on the World Bank Entreprise Surveys.

plain this hypothesis. First, entrepreneurs knowing that government effectiveness is weak anticipate also low monitoring and auditing and have therefore more incentive to evade their taxes[2]. In the second mechanism, we argue that establishments may use tax evasion as a way to counterbalance the negative effects of distortions and the losses generated by poor business environment. The underlying intuition is that poor business environment generates direct costs and losses for firms, and increases their transaction costs. So, establishments react by voluntary underreporting their total sales for tax purposes in order to counterbalance additional costs generated by poor business environment.

Using firm-level data from the WBES, we provide empirical evidence in support of our hypothesis. The findings highlight a positive correlation between distortions in the business environment and the proportion of sales not reported for tax purposes. Moreover, the findings show heterogeneous effects across size. Microenterprises and small firms evade more than medium and large firms.

However, empirical evidences of the relationship between tax evasion and distortions is subject to a number of methodological issues such as omitted variable bias, potential error measurement, and reverse causality. So, to understand the mechanism through which distortions and policy ineffectiveness affect firms' tax evasion decision, we develop a general equilibrium model and use simulations to match some empirical evidences. In the model, the economic environment consists of (i) heterogeneous firms which maximize their profits and make tax evasion decision based on the level of idiosyncratic distortions and the government ineffectiveness, (ii) one representative household which maximizes his inter-temporal utility, and (iii) a government which balances its budget constraint.

We calibrate the model using the United States as a benchmark economy and treat this country as an economy with no distortions. The benchmark economy allows us to normalize the value of the GDP per worker in both the model and the data.

[2]This mechanism has been discussed in (Goyette, 2014).

The model is simulated for a sample of 38 African and Latin American countries using each country-specific distribution of productivity and distortions. The simulated output and tax evasion are strongly correlated with the data and the model explains more than 45 percent of the variation of tax evasion and more than 25 percent of the dispersion of output per worker in the data.

This paper is closely related to Restuccia and Rogerson (2008) and Bah and Fang (2015). Restuccia and Rogerson (2008) argue that a country's policies and institutions can create taxes or subsidies (distortions) on establishment output. These distortions reduce aggregate total factor productivity (TFP) and can explain up to 50% of the cross-country differences in output, capital accumulation and TFP (Restuccia and Rogerson, 2008). Following Restuccia and Rogerson (2008), Bah and Fang (2015) introduce distortions as an idiosyncratic tax on output in the general equilibrium model of Amaral and Quintin (2010). In addition to a distribution of productivity approximated with firms size, Bah and Fang (2015) use the distribution of distortions from the data and collateral constraints to explain some of the variation in output in Africa. Our paper differs from these two papers in at least two ways. First, our analysis focuses on the relationship between distortions and firms' tax evasion decision. Second, we introduce government ineffectiveness in the production function of firms and analyze how the level of government ineffectiveness affects both firms' production and tax evasion in African and Latin American countries

The remainder of the paper is structured as follows. Section II reviews the related literature. Section III describes the data and examines empirically the relationship between distortions and firms' tax evasion. Section IV presents the theoretical model. In section V, we calibrate the model using the United States as a benchmark economy, we then describe our quantitative analysis and the results of the counterfactual experiments. Section VI presents concluding remarks and policy implications.

II Related literature

The business environment or investment climate refers to a set of factors, policies and institutions that shape the opportunities and incentives for firms to invest productively, create jobs and expand (Aterido et al., 2011; Dollar et al., 2005; World Bank, 2005). The literature reveals a large consensus that a good business environment fosters firms' growth, productivity and development, while an adverse business environment increases firms' transaction costs and constrains their development[3]. We focus here on the effects of three specific dimensions of the business environment: access to infrastructure, access to finance, and regulatory environment.

Access to infrastructure. Well-developed policies and infrastructures are essential to promote economic growth by reducing transaction cost for firms as well as for households. Indeed, infrastructure services like transport, energy water and sanitation are used by firms in their production processes and delivery of goods and services (Bah and Fang, 2015). Also, well-developed infrastructures are an asset for the competitiveness of firms both at the national and internatonal level. Bah and Fang (2015) argue that poor infrastructures in Africa increase transaction cost and makes African firms less competitive than their international counterparts. Indeed, in Africa like in other developing countries the cost of transportation, logistics, telecommunication, water, electricity, security and bribes are high, and firms suffer great losses due to transportation problems, power and water outages and crime (Eifert et al., 2005). Inefficient policies and infrastructures create barriers to opportunities and increase costs and risks for microentreprises as well as multinationals (World Bank, 2005) by limiting market access and shrinking the size of the available market.

Access to finance. A growing literature focuses on the effects of financial inclusion or credit constraints on firms' performance. Rajan and Zingales (1998), one of the first studies to analyze this relationship, highlight that industries which require more

[3]See World Bank (2005), Dollar et al. (2005), Dollar et al. (2006), and Aterido et al. (2011) for more extensive discussion.

external financing grow faster in more financially developed countries. Indeed, financial inclusion encourages investment by reducing liquidity constraints and therefore affects firm size, competition, and industrial structure (Beck et al., 2005). Raddatz (2006) examines the role of financial development in stabilizing the output of firms and shows that financial underdevelopment significantly increases the relative volatility of firms, especially in high liquidity needs sectors. Moreover, Beck et al. (2005) find that the effect of financial underdevelopment on firm's growth depends on a firm's size. Indeed, Beck et al. (2005) highlight that the smallest firms are consistently the most adversely affected by adverse investment climate in general but especially by financial underdevelopment.

Regulatory environment. The regulatory environment have received relatively little attention in the literature. López de Silanes et al. (2002) show that heavy regulation related to the starting of businesses increases the size of the unofficial economy. Moreover, Botero et al. (2004) find that heavy regulation of labor is associated with a larger unofficial economy, lower labor force participation, and higher unemployment. Finally, Klapper et al. (2006) show that entry regulations hamper establishment entry, especially in industries that naturally should have high entry. In these industries, the value added per employee grow more slowly in countries with high entry barriers (Klapper et al., 2006), and small firms may be more dissuaded from entering than large firms.

As described above, the literature supports that adverse business environment is costly for firms and negatively affects their growth and productivity. Hence, how do firms respond to an inefficient business environment ? Does an adverse business environment affect firms' decisions to evade their taxes? We support in this study that distortions in business environment and policy ineffectiveness create directs costs and losses for firms, and increases their transaction costs, and increase therefore their tax evasion. In the rest of the paper, we provide first the empirical evidence of this hypothesis, then we develop a general equilibrium model which matches theses facts.

III Empirical approach

In this section, we provide empirical evidence consistent with the hypothesis that distortions in the business environment are positively related with firms' tax evasion. We first describe the data, then the variables, and the results.

III.1 Data

The empirical evidence is based on the World Bank Entreprise Surveys (WBES) data. The WBES is a collection of firm-level survey of a representative sample (random stratified sampling) of firms mainly in developing countries. Questionnaires cover a wide range of business environment topics like infrastructure, performance measures, crime, corruption, competition, access to finance. The surveys are conducted within a framework of common guidelines in the design and implementation. A module of identical questions included in all questionnaires is used for assembling the data set, which allows cross-country comparisons. We use a sample of 27 485 firms in 38 African and Latin American countries during the period 2002-2006.

III.2 Baseline estimations

We develop a cross-country analysis on African and Latin American countries of the relationship between tax evasion and distortions in business environment by taking into account several dimensions of business environment. Especially, we control for regulatory environment, access to finance as well as firms individual characteristics. These variables help to minimize omitted variables bias. Distortions in business environment are measured as the percentage of sales lost due to inefficiencies in infrastructures and services (lost due to power outage or surges from public grid, insufficient water supply, unavailable mainline telephone service, transport failures, and delivery delays,), crime (lost due to theft, robbery, vandalism or arson against the establishment), and corruption (informal payments to get things done).

The empirical analysis focuses on the following specification :

$$Tax\_evasion_{ict} = \alpha_0 + \alpha_{1j} Distortions_{ijct} + \alpha_2 X_{ict} + \delta_c + \eta_s + \mu_t + \epsilon_{ict} \quad (1)$$

where, $Tax\_evasion_{ict}$ is the percent of total sales not reported for tax purpose by firm i in country c in a specific year t. $Distortions_{ictj}$ captures distortions in the business environment j facing firm i in country c in a specific year t. As described above, this variable is measured as the sum of the losses (in percentage of total sales) due to inefficiencies in infrastructures and services, crime, and gifts or informal payment to public officials to "get things done". X_{ict} is a set of control variables that includes firms' individual characteristics. We include variables capturing firms' access to finance and regulatory environment measured respectively as the share of working capital financed by commercial banks and the percentage of time the senior management spends dealing with requirements imposed by government regulation. As firms' individual characteristics, we include the percentage of the firm owned by foreign and government (*Foreign share* and *Government share*), the number of years since the firm began its operations in the country (*Age*), and the perrcentage of the establishment's sales exported directly or indirectly (*Sales exported*). We approximate the monitoring process by the number of days spent last year in inspections and mandatory meetings with tax inspectorate (*Monitoring*). Finally, we control for heterogeneous effects by using the firm size class (*Size*). This variable is ranged between 1 and 4, where 1 represents firms having less than 10 permanent employees (*Microenterprise*), 2 for permanent employees between 11 and 50 (*Small*), 3 for permanent employees between 51 and 200 (*Medium*) and 4 for more than 200 permanent employees (*Large*).

Finally, the model includes a full set of country, sector and year fixed effects (δ_c, η_s and μ_t). The latter account for differences in demand conditions, productive structure and culture of opportunist behaviours. These variables help to control for some important omitted variables at the country and sector level.

III.3 Descriptive statistics

Table 1 presents the descriptive statistics. Approximately, 77 percent of establishment's working capital is financed by commercial banks and 5.9 percent of annual sales are lost due to inefficiencies in infrastructures and services, crime, and informal payment to public officials. On average 12 percent of senior management's time each week is spent dealing with requirements imposed by government regulation (taxes, customs, labor regulations, licensing and registration). Finally, on average about 24.6 percent of total sales are not reported for tax purpose (tax evasion) and only 11.08 percent of establishment's total sales are exported. The sample contains 29.5% of microenterprises, 42.49% of small firms, 19.15% of medium firms and 8.85% of large firms.

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Tax evasion	24.616	32.824	0	100	22454
Distortions	5.934	11.916	0	100	26111
Access to finance	77.051	31.514	0	100	25660
Management time	11.995	18.511	0	100	22615
Foreign share	10.623	29.071	0	100	25476
Government share	1.188	10.235	0	100	25476
Sales exported	11.083	26.48	0	100	25864
Age	19.39	17.665	0	196	25047
Monitoring	3.362	11.146	0	365	22257

Figure 1 below highlights a cross sectional comparison of the relationship between tax evasion and distortions across countries. We observe in this figure a positive correlation between tax evasion and distortions in the business environment. On average, firms in low and low-middle income countries which face high level of distortions evade more than firms in upper-middle income countries. Figure 3 and 4 present the evidence of a positive relationship between tax evasion and distortions, and negative relationship between policy effectiveness and tax evasion.

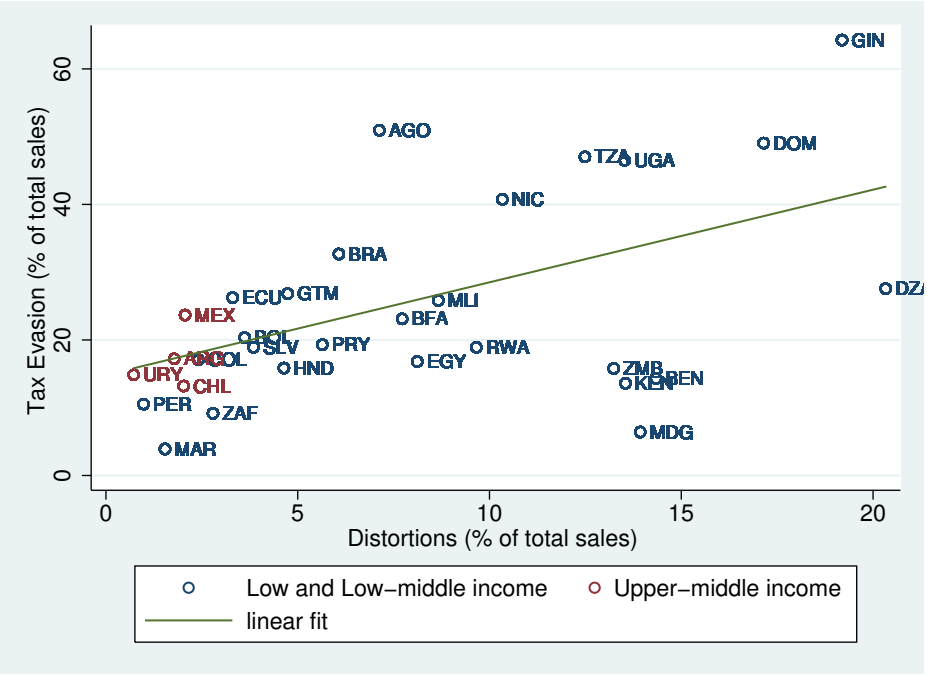

Figure 1: Distortions and Tax evasion

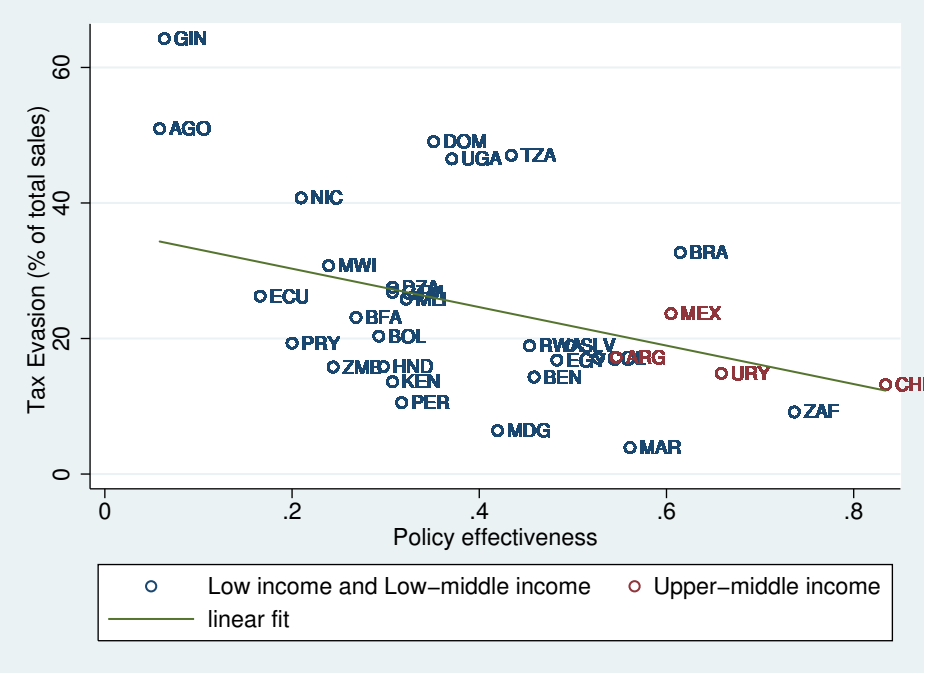

Figure 2: Policy ineffectiveness and Tax evasion

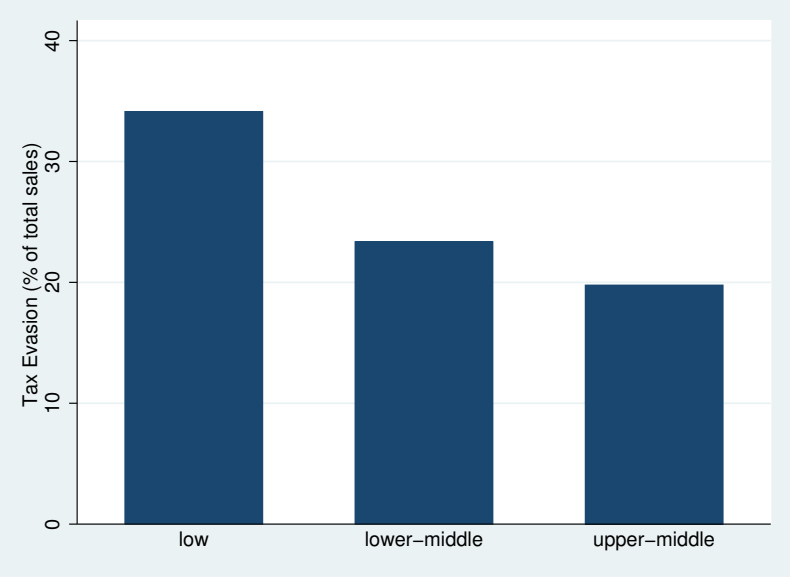

Figure 3: Firms' Tax Evasion and Countries Income Level

III.4 Methodology : Multilevel model

Firms are nested within countries, and they share similar contextual characteristics such as institutional environment, macroeconomic framework and policies. As a consequent, firms in the same countries may have some similar behaviours that may affect their their tax evasion. Standard estimation methods ignore such clustering effects that may generate biased estimations of the standard errors. Indeed, firms in the same countries may not be independent, thus standard errors in standard estimations method may be underestimated. The multilevel model has the advantage to take into account such clustering effects by allowing the intercept to vary across countries and the heterogeneity that exists at the country level. Our multilevel model considers therefore a two-level model where the highest level is the country and the lowest level is the firms such that:

$$Level \quad 1 : Tax\_Evasion_{ic} = \alpha_{0c} + \beta Distortions_{ic} + \eta X_{ic} + \gamma Z_c + \epsilon_{ic}, \quad \epsilon_{ic}(0, \sigma^2)$$

$$Level \quad 2 : \alpha_{0c} = \alpha_{00} + \vartheta_c, \quad \vartheta_c \sim N(0, \sigma^2), \quad \vartheta_c \perp \epsilon_{ic}$$

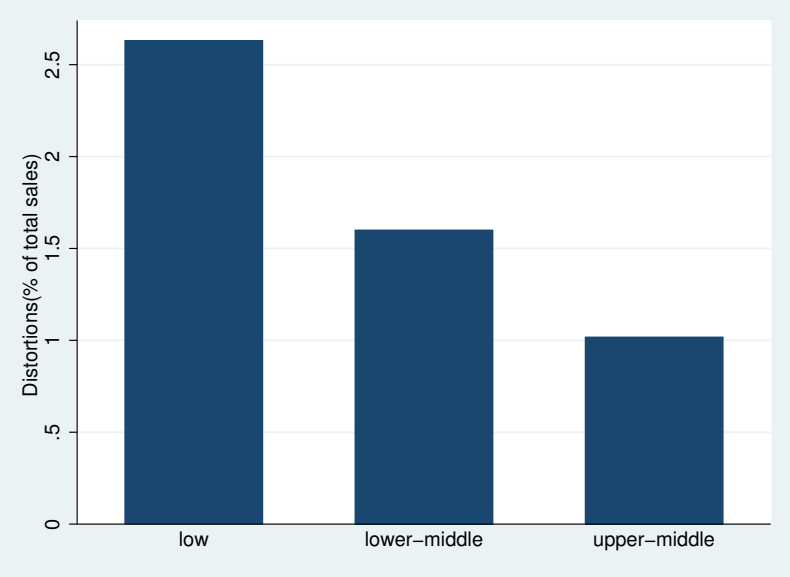

Figure 4: Distortions and Countries Income Level

Combining previous equations, the baseline model can be written as follows:

$$Tax\_Evasion\_ic = \alpha_{00} + \beta Distortions_{ic} + \eta X_{ic} + Z_c + \vartheta_c + \epsilon_{ic},$$

where,$\vartheta_c + \epsilon_{ic}$ is the error term of the model with ϑ_c the country-specific error term and ϵ_{ic} the firms level-error term. $Tax\_Evasion_{ic}$ is the measure of tax evasion of the firm i in in the country c. X_{ic} a set of firm individual characteristics described above and Z_c the measure of the policy ineffectiveness in the country c. Estimates include a set of country, sector and year fixed effects.

III.4.1 Results

Estimates of the relationship between firms' tax evasion and distortions in business environment are reported in Table 2 which shows estimates using ordinary least square regressions. All estimates include individual characteristics of firms described above country, sector and year fixed effects. The results show that distortions in business environment increase firms' tax evasion. The findings suggest that a 10% lost in total sales due to power outage, theft, robbery, vandalism, and/or bribes increases firms's

tax evasion from 1.0 to 1.41%. The results show also that higher shares of working capital financed by commercial banks decrease firms' tax evasion. This means that access to finance reduces the likelihood that an establishment underreports its total sales for tax purposes. As discussed in the literature, credit constraints and limited access to finance negatively affect firms' performance (employment growth, decision to export and the amount exported)[4]. Our results corroborate these facts by highlighting that tax evasion decreases with access to finance. In other words, financially constrained establishments seem to use tax evasion as an alternative source of financing or as a way to survive in an highly distorted environment. This result corroborates also Goyette (2016).

We find also in Table 2 that the larger the establishment, the less likely it underreports its total sales for tax purpose. We explain this result by the fact that larger establishments are less constrained relative to micro and small establishments. This result can also be explained by the fact that larger establishments face higher audit probabilities. In the next section, we will discuss more in-depth heterogeneous effects. Finally, tax evasion decreases with establishment' age, the percentage of the firm owned by foreign. Results on the percentage of the firm owned by the government/ the States, the share of the establishment total sales exported, the foreign ownership status, and the number of days spent in inspections and mandatory meetings with tax inspectorate are not statistically significant.

[4]See, e.g., Rajan and Zingales (1998); Beck et al. (2005); Berman and Héricourt (2010).

Table 2: Impacts of distortions and policy ineffectiveness on firm's tax evasion

Dependent variable: Tax evasion	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Distortions	0.149***	0.149***	0.142***	0.137***	0.137***	0.124***	0.127***	0.124***	0.118***
	(0.0311)	(0.0354)	(0.0358)	(0.0371)	(0.0371)	(0.0371)	(0.0373)	(0.0376)	(0.0398)
Management Time		-0.0172	-0.0166	-0.0166	-0.0166	-0.0123	-0.0119	-0.00776	-0.00368
		(0.0246)	(0.0252)	(0.0250)	(0.0250)	(0.0242)	(0.0244)	(0.0254)	(0.0257)
Access to finance			-0.0222*	-0.0227*	-0.0227*	-0.0213*	-0.0218*	-0.0224*	-0.0231*
			(0.0127)	(0.0125)	(0.0125)	(0.0120)	(0.0122)	(0.0127)	(0.0138)
Foreign share				-0.0502***	-0.0502***	-0.0283**	-0.0275**	-0.0292**	-0.0242*
				(0.0146)	(0.0146)	(0.0128)	(0.0122)	(0.0131)	(0.0128)
Government share					0.00253	0.0300	0.0191	0.0138	-0.00331
					(0.0346)	(0.0315)	(0.0287)	(0.0271)	(0.0229)
Size						-3.088***	-3.042***	-2.953***	-2.820***
						(0.529)	(0.540)	(0.570)	(0.623)
Sales exported							-0.00326	-0.00271	0.00922
							(0.0166)	(0.0207)	(0.0188)
Age								-0.0384	-0.0199
								(0.0259)	(0.0193)
Monitoring									-0.0411**
									(0.0175)
Policy effectiveness	-63.17***	-71.33***	-69.75***	-68.58***	-68.59***	-66.81***	-66.97***	-69.07***	-70.65***
	(16.11)	(14.17)	(14.70)	(15.47)	(15.46)	(16.29)	(16.31)	(16.71)	(17.96)
Observations	18,795	16,263	16,068	16,022	16,022	16,022	15,977	15,025	13,077
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes. The table presents the estimates of the effects of distortions and policy ineffectiveness on firms' tax evasion using a multilevel mixed effects model. Robust standard errors clustered at the country-sector level in parentheses. ***, **, * denote significance at the 1, 5, and 10 percent level.

III.5 Heterogeneous effects

Many papers highlight heterogeneous effects of adverse business environment according to firms' size[5]. In this section, we analyze the distribution of tax evasion for each size level and examine how distortions in the business environment affect tax evasion decision of firms of different sizes.

Figure 5 and columns (1) and (3) of the Table 3 corroborates our previous results by showing that tax evasion decreases with establishment size. The average of tax evasion is 26.97, 21.22, 18.10, 14.65% respectively for microenterprises, small, medium and large firms.

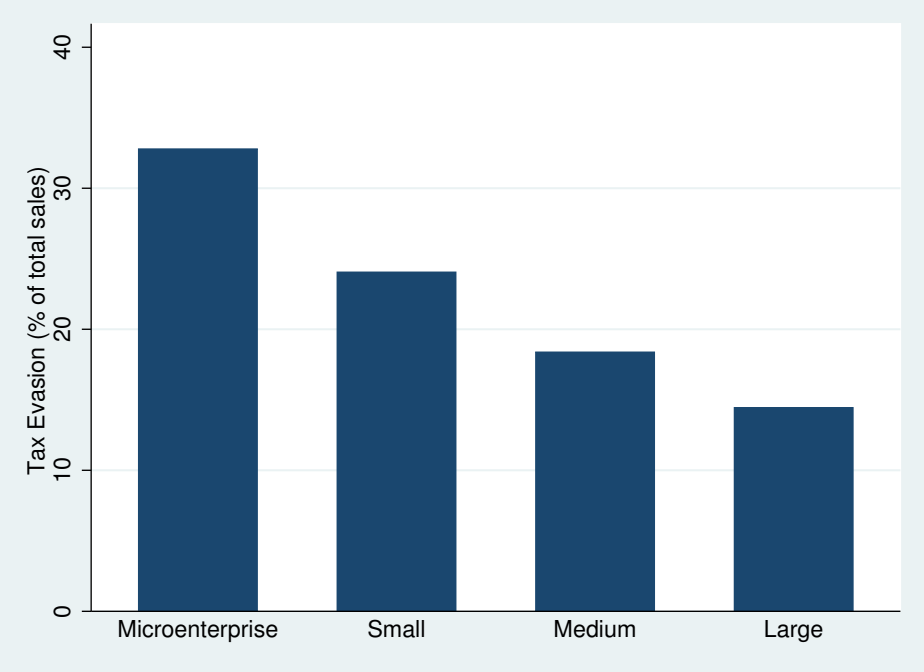

Figure 5: Tax Evasion by firms'size

Taking into account the interaction between distortions in the business environment and firm size dummies, we estimate equation (1). The results reported in Table 3 show that larger distortions in the business environment increase firms' tax evasion with heterogeneous effects across firm size. Columns (2) and (4) of Table 3 suggest that the percentage of total sales lost due to inefficiencies in infrastructures

[5]See Beck et al. (2005, 2008) for more extensive discussion.

and services, crime, and gifts or informal payment to public officials increases the tax evasion of microenterprises, small and medium firms. Also in columns (1) to (4), access to finance has a negative and significant effect on tax evasion. Unlike previous estimations, monitoring has here a statistically significant and negative effect on firms' tax evasion.

Table 3: Distortions Firm's Tax Evasion – Specific size effects

Dependent variable: Tax evasion	(1)	(2)	(3)	(4)
Distortions	0.105***	-0.0286	0.0994***	-0.0716
	(0.0300)	(0.0812)	(0.0330)	(0.0788)
(Microenterprise)*Distortions		0.120		0.155*
		(0.0908)		(0.0897)
(Small)*Distortions		0.157		0.198**
		(0.0953)		(0.0876)
(Medium)*Distortions		0.141*		0.192**
		(0.0817)		(0.0832)
Management Time	-0.0121	-0.0119	-0.00579	-0.00580
	(0.0192)	(0.0192)	(0.0192)	(0.0192)
Access to finance	-0.0191*	-0.0190*	-0.0253**	-0.0251**
	(0.0107)	(0.0107)	(0.0112)	(0.0112)
Microenterprise	8.234***	7.877***	7.611***	7.265***
	(1.436)	(1.526)	(1.370)	(1.469)
Small	4.345***	3.746***	3.380***	2.734**
	(1.298)	(1.381)	(1.097)	(1.077)
Medium	1.551	1.059	1.057	0.442
	(1.072)	(1.094)	(0.974)	(0.949)
Sales exported	0.000624	0.000728	0.00674	0.00667
	(0.0171)	(0.0171)	(0.0162)	(0.0162)
Age	-0.0383*	-0.0385*	-0.0242	-0.0244
	(0.0199)	(0.0200)	(0.0148)	(0.0149)
Foreign	-0.0343***	-0.0342***	-0.00839	-0.0301***
	(0.0112)	(0.0112)	(0.0261)	(0.0107)
Government share	0.00106	0.00202	-0.0116	-0.0108
	(0.0275)	(0.0273)	(0.0228)	(0.0228)
Monitoring			-0.0397*	-0.0389*
			(0.0235)	(0.0230)
Observations	18,278	18,278	15,596	15,596
R-squared	0.187	0.187	0.185	0.185
Country FE	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Note. Robust standard errors clustered at the country-sector level in parentheses. All specifications include country, sector and year fixed effects. *** p<0.01, ** p<0.05, * p<0.1

IV Model

Given the results from the empirical analysis are face methodological issues and should be carefully interpreted, we develop a general equilibrium model to analyze one potential mechanism that links distortions and firms' tax evasion decision. In the model, the economic environment consists of firms which maximize their profits and make tax evasion decision according to the level of distortions in the business environment, one representative household which maximize his inter-temporal utility, and a government which balances its budget constraint.

IV.1 Representative household

Consumers are aggregated through a representative household with preferences described by the following utility function:

$$\sum_{t=0}^{\infty} \beta^t u(c_t)$$

where c_t is consumption at date t and $\beta \in (0,1)$ is the discount factor. The household is endowed with one unit of productive time in each period and $K_0 > 0$ units of the capital stock at date 0. We assume that $u(c_t)$ satisfies the usual Inada conditions. The representative household maximizes his lifetime utility subject to the following budget constraint:

$$\sum_{t=0}^{\infty} (c_t + K_{t+1} + (1-\delta)K_t) = \sum_{t=0}^{\infty} (r_t K_t + w_t N_t + \Pi_t)$$

where, r_t, w_t are respectively the rental price of labor n_t and capital K_t at t, N_t the total labor supplies to the market. We assume that the representative consumer does not value leisure i.e. $N_t = 1$. Finally, Π_t is total profits from the operations of all firms.

IV.2 Firms

Entrepreneurs are risk-neutral and produce a homogenous consumption good. Each establishment i makes production decisions that maximize their profits based on their idiosyncratic productivity shock z_i, which is constant over time and varies across establishments. We assume a discret set of possible values for the establishment-level TFP. The values of the parameter z_i, are drawn from a probability density function of $g(z)$. The production function $F(z_i, A, k_i, l_i)$ takes as input capital k_i, labor l_i. We include policy effectiveness A which is the same for all the establishments in the same country. Policy effectiveness captures the quality of public policies formulation and implementation as well as the quality of public services. Effective public policies foster the development of productive activities, and encourage invention (through research and development, R&D) and technology transfer. Also, effective public policies protect establishments against expropriation, corruption, and provide adequate public infrastructures. The production function is assumed to exhibit decreasing returns to scale in both capital and labor, and to satisfy the usual Inada conditions :

$$F(z_i, A, k_i, l_i) = z_i A k_i^{\eta} l_i^{\gamma}, \qquad 0 < \eta + \gamma < 1.$$

There is a proportional tax τ on establishments total sales which is assumed to have two components τ^c and τ_i^d . The first component τ^c is a tax to finance public goods and services. This tax is assumed to be the same for all establishments in the same country. The second component τ_i^d refer to the fraction of output which is lost due to the distortions stemming from business environment. Indeed a poor business environment generates directs costs and losses for firms, and increase their transaction costs compared with an environment with better business environment. Also, poor business environment can send a signal about mis-governance and poor quality of government policies related to the business environment. We assume therefore that inefficient business environment generates an idiosyncratic distorsions at the

establishment level. To summarize, we have $\tau = \tau_i^d + \tau^c$.

We assume that establishments differ in their level of productivity and level of distortions. At each period an establishment reports a share $(1 - \vartheta_i)$ of its total sales for tax purposes. Two mechanisms can explain tax evasion decision. First, tax evasion can be a way for establishments to counterbalance additional costs and losses generated by inefficient business environment. Second, establishments may just see an opportunity to evade taxes due to poor monitoring. Hence, each establishment evade a share ϑ_i of its total sales. The expected profit for an establishment with productivity z_i is given by:

$$\pi(z_i, \tau_i) = (1 - \tau_i)(1 - \vartheta_i)F(z_i, A, k_i, l_i) + \underbrace{\vartheta_i F(z_i, A, k_i, l_i)}_{\text{T}} - wl_i - rk_i - \underbrace{p\vartheta_i^\theta F(z_i, A, k_i, l_i)}_{\text{B}} - c_f \tag{2}$$

where, c_f is a fixed cost of operation for incumbent establishment, p is the probability of detection, w and r are respectively the rental prices of labor and capital. T is the amount of total sales evaded. We assume that this amount is beneficial for the establishment (private benefit) but is a dead loss at the country level. We assume that the penalty B is proportional to total sales and is a non-linear function of the establishment's tax evasion, so that the cost associated with tax evasion is represented by $B = p\vartheta_i^\theta F(z_i, A, k_i, l_i)$, with $\theta > 1$. By rearranging equation (2) we have

$$\pi(z_i, \tau_i) = [1 - (1 - \vartheta_i)\tau_i - p\vartheta_i^\theta]F(z_i, A, k_i, l_i) - wl_i - rk_i - c_f \tag{3}$$

For the sake of simplicity, we abandon the index i, however z, k ,l, τ, ϑ are different for each establishment.

IV.3 Government

The government provides public goods and services A by balancing its budget constraint in each period :

$$\int_1^z \tau^c(1 - \vartheta_i)F(z_i, A, k_i, l_i)d(\tau, z) + \int_1^z p\vartheta_i^\theta F(z_i, A, k_i, l_i)d(\tau, z) \geq C(A, p)$$

All the government revenues appear on the LHS. The first component is the revenues from the proportional taxation on establishments total sales. The second component is the revenues from detection activities. The RHS is the cost associated with the provision of public goods and detection activities. The level of public goods and services A will be approximated by the measure of public policies effectiveness.

IV.4 Equilibrium

We consider the steady-state competitive equilibrium of the model in which the decision problems are described as follow.

IV.4.1 Consumer's problem

Using the first order conditions, we find a solution to the consumer's problem with the rental price of capital r and the consumption c constant, where

$$r = \frac{1}{\beta} - (1 - \delta) \tag{4}$$

IV.4.2 Incumbent establishment's problem

Solving for the first order conditions, the optimal tax evasion and factor demands are :

$$\vartheta^* = [\frac{1}{\theta p}\tau]^{\frac{1}{\theta-1}} \tag{5}$$

$$k^* = [zA(1 - (1 + \frac{1-\theta}{\theta}(\frac{1}{p\theta}\tau)^{\frac{1}{\theta-1}})\tau)]^{\frac{1}{1-\alpha-\gamma}}[\frac{\gamma}{w}]^{\frac{\gamma}{1-\alpha-\gamma}}[\frac{\alpha}{r}]^{\frac{1-\gamma}{1-\alpha-\gamma}} \tag{6}$$

$$l^* = [zA(1 - (1 + \frac{1-\theta}{\theta}(\frac{1}{p\theta}\tau)^{\frac{1}{\theta-1}})\tau)]^{\frac{1}{1-\alpha-\gamma}}[\frac{\gamma}{w}]^{\frac{1-\alpha}{1-\alpha-\gamma}}[\frac{\alpha}{r}]^{\frac{\alpha}{1-\alpha-\gamma}} \tag{7}$$

Given that the establishment-level productivity and tax rate are constant over time, the discounted present value of an incumbent establishment is given by :

$$V(z,\tau) = \frac{\pi(z,\tau)}{(1-\rho)} \tag{8}$$

where $\rho = \frac{1-\lambda}{1+r-\delta}$ is the discount rate for the establishment and λ the probability of death which is assumed to be constant. Substituting ρ in equation (8) we have

$$V(z,\tau) = \frac{(1-\delta)+r}{(\lambda-\delta)+r}\pi(z,\tau) \tag{9}$$

IV.4.3 Entry

Establishments' entry decision is made on the basis of the distribution over potential draws for the pair (z,τ). Letting $\bar{x}(z,\tau)$ denote the optimal entry decision with the convention that the establishment enters and remains in operation if $\bar{x}(z,\tau) = 1$. The actual discounted value of a potential entrant V_e is given by :

$$V_e(z,\tau) = \sum_{(z,\tau)} \max_{\bar{x}\in[0,1]} [\bar{x}(z,\tau)V(z,\tau)d(z,\tau) - c_e]$$

where, c_e is the entry cost paid by a new establishment, and $d(z,\tau)$ is the distribution of the probability density function.

In an equilibrium with entry, the free entry condition is fulfilled for $V_e(z,\tau) = 0$. In the steady state and according to equations (4) and (9), $V(z,\tau)$ is determined only by the endogenous variable w. Hence, there is a unique value of the wage rate w for which $V_e = 0$ as in Restuccia and Rogerson (2008).

IV.5 Invariant distribution of establishment

Let E and $\mu(z,\tau)$ denote respectively the mass of entrants and the distribution of producing establishments in period t. Given the decision rule for production of enter-

ing establishments $\bar{x}(z,\tau)$, the next period distribution of producers μ' over the pair (z,τ) satisfies the following condition :

$$\mu'(z,\tau) = (1-\lambda)\mu(z,\tau) + \bar{x}(z,\tau)d(z,\tau)E$$

where $(1-\lambda)\mu(z,\tau)$ refers to the mass of incumbent establishments that have survived, and $\bar{x}(z,\tau)d(z,\tau)E$ represents the mass of entering establishments that enters and remains in operation. The unique invariant distribution of establishments $\hat{\mu}(z,\tau)$ is characterized by a constant distribution of μ over the time and a death rate bounded away from 0. This invariant distribution of establishments is given by :

$$\hat{\mu}(z,\tau) = E\frac{\bar{x}(z,\tau)}{\lambda}d(z,\tau)$$

IV.5.1 Labor market clearing

Given values for w and r, the steady state of this model is characterized by the functions $\bar{\vartheta}(z,\tau)$, $\bar{k}(z,\tau)$, $\bar{l}(z,\tau)$, $\bar{x}(z,\tau)$ and the associated invariant distribution of establishments $\hat{\mu}(z,\tau)$. Using these functions, the aggregate labor demand and the steady-state equilibrium level of entry are given by :

$$N(r,w) = E\sum_{(z,\tau)}\bar{l}(z,\tau)\hat{\mu}(z,\tau)$$
$$E = \frac{N(r,w)}{\sum_{(z,\tau)}\bar{l}(z,\tau)\hat{\mu}(z,\tau)}$$

IV.5.2 Definition of a competitive equilibrium

The steady-state competitive equilibrium with entry is a set of prices $\{w^*, r^*\}$, a set of decision rules $\{k^*, l^*, \vartheta^*; c^*, K'^*\}$, a distribution of establishments $\mu(z,\tau)$, value functions $\pi(z,\tau)$, $V(z,\tau)$, $V_e(z,\tau)$, and a mass of entry E such that :

1. Given prices (w,r) and preferences, the pair $\{c^*, K'^*\}$ maximizes the consumer lifetime utility;

2. Given prices (w, r), the functions $\pi(z,\tau)$, $V(z,\tau)$, and $V_e(z,\tau)$ solve incumbent and entering establishment's problems, with $\{k^*, l^*, \vartheta^*\}$ the optimal policy functions;

3. The free-entry and invariant distribution conditions are satisfied i.e.

$$V_e = 0,$$

$$\mu(z,\tau) = E\frac{\bar{x}(z,\tau)}{\lambda}d(z,\tau), \qquad \forall\ z,\tau$$

4. Market clearing conditions are satisfied :

$$c + \delta K = \sum_{(z,\tau)} [f(z, A, \bar{k}, \bar{l}) - c_f]\mu(z,\tau) - c_e E$$

$$K = \sum_{(z,\tau)} \bar{k}(z,\tau)\mu(z,\tau)$$

$$1 = \sum_{(z,\tau)} \bar{l}(z,\tau)\mu(z,\tau)$$

IV.6 Theoretical predictions

From the optimal tax evasion equation (5), we can draw two major predictions :

Prediction 1: $\frac{\partial \vartheta^*}{\partial \tau} > 0, \quad \forall\ \tau \in]0,1]$. This prediction means that an increase in distortions faced by a firm raises the share of its total sales not reported for tax purposes i.e. tax evasion.

Prediction 2: $\frac{\partial \vartheta*}{\partial p} < 0, \quad \forall\ p \in]0,1]$. The probability of detection reduces firms' tax evasion. This prediction implies that a better detection probability reduces an establishment likelihood to underreport its sales.

V Calibration and quantitative analysis

V.1 Calibration

In this section, we calibrate the model to the United States economy, that we consider as an economy with no distortions. Several of the parameter values are assigned following the literature. The period in the model corresponds to one year in the data.

Preferences. The yearly interest rate is targeted to 4% as Restuccia and Rogerson (2008) and Bah and Fang (2015). This implies a value of $\beta = \frac{1}{(1+0.04)} = 0.96$.

Technology. We follow the literature by using 0.85 as the returns to scale of the production function[6]. Parameter values are attributed to match capital and labor shares of income, respectively $\frac{1}{3}$ and $\frac{2}{3}$. As Restuccia and Rogerson (2008), we choose δ so that the investment to output ratio is equal to 20%, implying $\delta = 0.08$. The range of employment across establishments in the data determines the range of establishment-level productivity. According to the United States data from the Census Bureau[7], the number of employees at the establishment level ranges from 1 to 10 000. Hence, the minimum and maximum level of productivity are chosen to obtain the range of employments, as in the data. Normalizing the lowest firm-level productivity to 1, the highest level of productivity is chosen to obtain the maximum number of employees of 10 000, as in the data. We approximate the distribution of establishment-level productivity with 100 grid points. We choose a log-spaced grid so that the invariant distribution of establishments size across employments level matches the data. Descriptive statistics on firms highlight one important stylized fact. Establishments with less than 20 employees represent 86.1 percent of all the establishments. However, these establishments account only for 24.9 percent of the employment.

Distortions. We use distortions from the WBES in the exact same way as we

[6]See for instance Restuccia and Rogerson (2008), Atkeson and Kehoe (2005), and Pavcnik (2002)

[7]The data can be downloaded from the website of the US Census Bureau: http://www.census.gov/econ/susb/data/susb2007.html in the table "U.S. & states, totals".

did in the empirical section. For each establishment, we sum up the percentage of sales lost due to inefficiencies in infrastructures and services (lost due to power outage or surges from public grid, insufficient water supply, unavailable mainline telephone service, transport failures, and delivery delays), crime (lost due to theft, robbery, vandalism or arson against the establishment), and corruption (informal payments to get things done)[8]. For a given country, we compute total distortions for each establishments and use the distribution of distortions across establishments in the simulation. Data on distortions are taken from the WBES.

Institutional environment. We calibrate public policies effectiveness A using the measure of government effectiveness from the Worldwide Governance Indicators. We use the percentile distribution of this variable so that the variable is ranged from 0 to 1. Given the difficulty to find detection probability for each country, we calibrate detection probability using the same index of government effectiveness. Indeed, this variable captures also the credibility of the government's commitment to public policies implemented. We argue that effective government in formulating and implemented public policies will be also in an equivalent manner effective and credible in monitoring and detection activity. Finally, we assume that the cost of tax evasion for an establishment is a convex cost function in tax evasion. Hence, the tax evasion cost parameter θ is assumed to be 3. We have conducted sensitivity analysis and our results are robust to various values of θ. Table 4 summarizes the parameter values.

[8]Unlike Bah and Fang (2015), we do not consider the percentage of the senior manager's time in dealing with requirements imposed by the government regulations as a proportional tax on output. This choice can be explain by the fact that we can not assume a one-to-one relationship between the management time in dealing with various government regulation and establishments loss in production.

Table 4: Benchmark calibration

Parameter	Value	Description	Source
τ^d	[0; 1]	Distortions	WBES
A	[0; 1]	Policy Effectiveness	Worldwide Governance indicators
p	[0; 1]	Detection probability	Worldwide Governance indicators
τ^c	0.2	Tax rate	Assumption
β	0.96	Real rate of return	Literature
η	0.283	Capital income share	Literature
γ	0.567	Labor income share	Literature
δ	0.08	Investment to output ratio	Literature
λ	0.1	Annual exit rate	Literature
θ	3	Evasion cost parameter	Assumption
c_e	1	Entry costs	Literature
c_f	0	Fixed costs	Literature
z	[1; 3.98]	Distribution of productivity	Relative labor demand

V.2 Quantitative analysis

V.2.1 Validation of the model

In this section, we use data on establishment employment, distorsions, and country level social infrastructures to calibrate the model for 38 African and Latin American countries. We use the WBES panel data on African and Latin American countries over the period 2002-2006. Our analysis focuses on countries with at least 200 establishments. A list of countries examined is presented in the appendix. In our simulation, we use the distribution of distortions and the productivity of the United States in order to preserve in each country the distributional structure of distortions and productivity.

Figure 6 plots the GDP per worker from the model and the data. The data on GDP per worker comes from the World Development Indicator. Each circle represents one country. The straight line is obtained from an OLS regression between the model and the data. The reported value of the GDP per worker are normalized by the United States levels in both the model and the data. The model's predicted values

are positively correlated with the data. The coefficient is statistically significant at the 1% level, and the regression coefficient is 2.43. Figure 7 plots the level of tax evasion from the model and the data. The predicted values of tax evasion are highly correlated with the data. The regression coefficient is 0.88 and is statistically significant at the 1% level. Focusing on the R-squared our model explains 26% of the variation of the GDP per worker and 45% of the dispersion of tax evasion among African and Latin American countries.

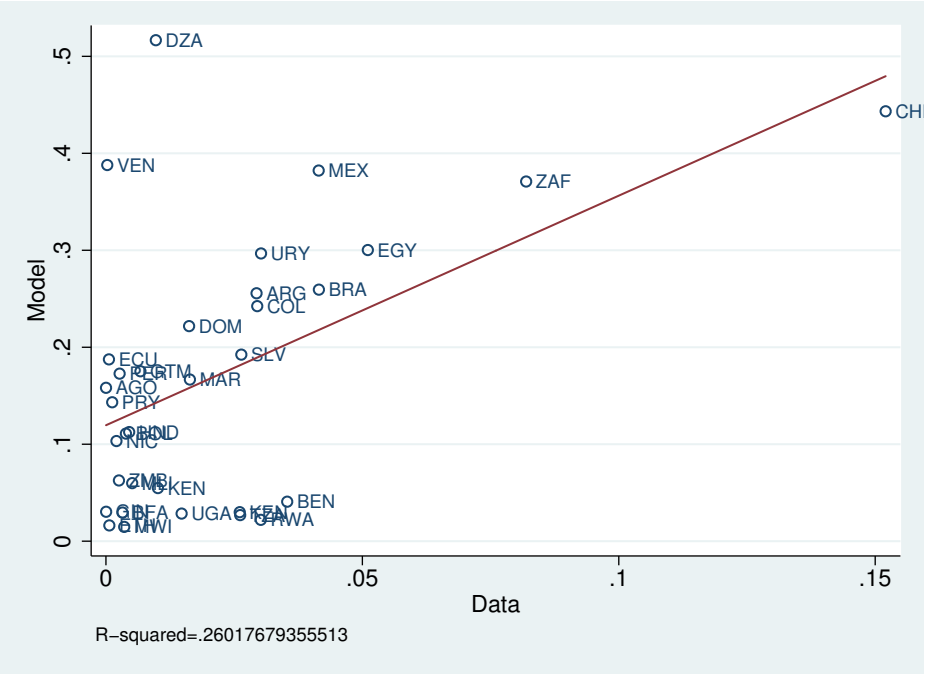

Figure 6: GDP per worker - data vs the model predictions

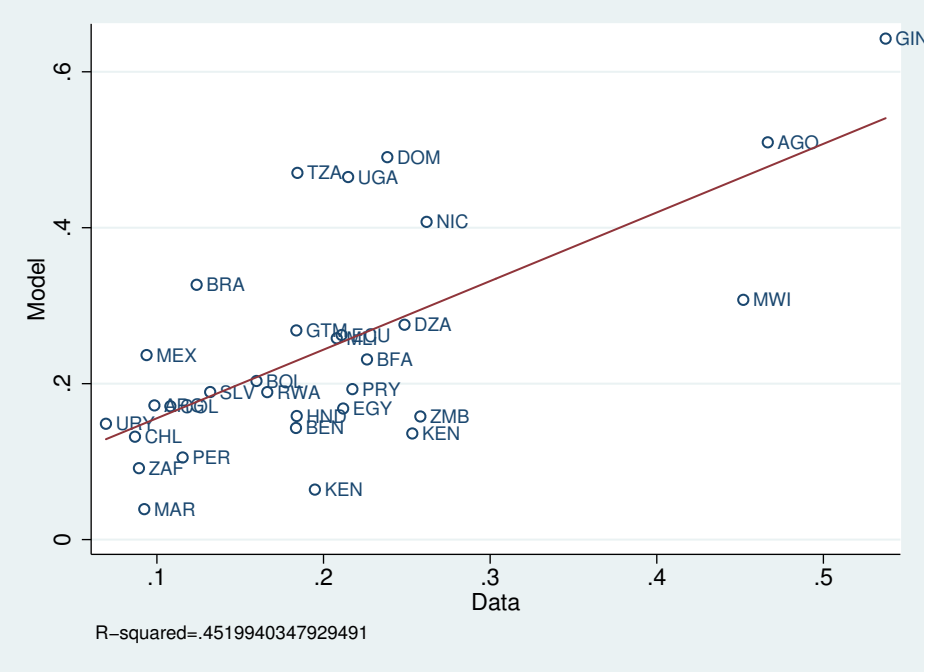

Figure 7: Tax evasion - data vs the model predictions

V.2.2 Counterfactual experiments

This section examines the implications of changes in distortions and government effectiveness. We focus on Guinea, the country with the highest level of tax evasion in the data. We first examine what happens in term of tax evasion, ceteris paribus, if the level of distortions in a country could be reduced to the average level of the sample average level of distortions. Especially, we replace the distribution of distortions across size by the average distribution of distortions across firms' size in the sample. This experiment aims to quantify the change in tax evasion in Guinea following an hypothetical change in the distribution of distortions. As discussed early, entrepreneurs knowing that government effectiveness is weak can anticipate also low monitoring and auditing, and have more incentive to evade their taxes. In the second experiment, we explore this mechanism by analyzing the impact of a change in Guinea's government effectiveness. Especially, we examine what happens in Guinea if the level of government effectiveness can be improved to the average level of the sample. Finally, the last counterfactual experiment combines both changes in dis-

tortions and government effectiveness. This experiment aims to examine happens in Guinea following a simultaneous changes in government effectiveness and distortions.

Experiment 1: In the first scenario, we set the distribution of distortions to the average distribution level of distortions in the sample. As described in the Table 5, distribution of distortions by size in Guinea is ranged between 17 and 20.60 percent of sales, whereas in the sample the costs of distortions in business environment are ranged between 7.4 and 10.85 percent their sales. On average counterfactual experiment 1 corresponds to a 50 percent drop in the level of distortions in Guinea.

Table 5: Distribution of distortions in Guinea vs the sample

Establishment size (number of employees)	Average distorsions in Guinea	Average distortions in the sample
< 10	19.59	9.14
10 to 19	19.24	10.86
20 to 49	14.97	9.45
50 to 99	20.60	7.71
≥ 100	17.00	7.38

Setting the distribution of distortions in Guinea to the average distribution level, we observe a 19 percent drop in sales not reported for tax purposes in Guinea. Guinean's firms sales not reported for tax purposes decline from 54 percent to 44 percent. This experiment puts emphasis on the strong relationship between distortions in business environment and firms' tax evasion, so that a decrease in the level of distortions facing firms reduces the proportion of sales not reported for tax purposes.

Experiment 2: In the second counterfactual experiment, we examine what happens in Guinea if the government effectiveness can be improved to the average level of the sample, while the distribution of distortions remains at the initial level. Especially, the government effectiveness will raises from 0.06 to 0.39. In this experiment, sales not reported for tax purposes decline from 54 percent to 22 percent, corresponding to a 60 percent drop in firms' tax evasion in Guinea.

Experiment 3: Finally, we combine both changes in distortions and government

effectiveness described above and examine the effects on firms' tax evasion in Guinea. A simultaneous improvement in distortions and government effectiveness decreases the sales not reported for tax purposes by 67 percent. The latter declines from 54 percent to 18 percent.

Table 6: Change in tax evasion following counterfactual experiments

Counterfactual experiments	Change in tax evasion (%)
Experiment 1	-19
Experiment 2	-60
Experiment 3	-67

In sum, counterfactual experiments show that a reduction of distortions facing firms along with an improvement in government effectiveness in Guinea decrease sales not reported for tax purposes between 19 and 67 percent. A simultaneous improvement in both distortions and policy effectiveness generate the sharpest drop in firms tax evasion. As discussed early, two mechanisms can explain these findings. First, firms knowing that the government effectiveness are weak have more incentive to underreport their sales for tax purposes, given that a weak government effectiveness send a signal about low monitoring and auditing. Second, both distortions and policy ineffectiveness generate direct costs and losses for establishments. In such context, underreporting sales for tax purposes may appear as a way for firms to protect themselves against distortions and government ineffectiveness.

VI Conclusion and policy implications

Firms in developing countries face huge contraints to their development due to distortions in their business environment, policy ineffectiveness and weak institutions. In parallel, underreporting sales for tax purposes is widespread and pervasive in developing countries generating a substantial negative effect on domestic resources mobilization, thereby the government ability to provide infrastructures and public goods.

As a novelty this paper examines empirically and theoretically the relationship between firms' tax evasion, distortions and policy ineffectiveness in African and Latin American countries. Tax evasion is measured as the proportion of sales not reported for tax purposes. While distortions are measured as losses in percentage of total sales due to inefficiencies in infrastructures and services, crime, and gifts or informal payment to public officials to "get things done". The empirical approach shows the evidence of a positive relationship between firms' tax evasion and distortions in business environment. Moreover, we show that sales not reported for tax purposes are higher for microenterprises and small firms relative to the larger ones.

To understand the mechanism through which distortions affect firms' tax evasion and overcome potential endogeneity issues in the empirical approach, we develop a general equilibrium model with heterogeneous firms. In the model, distortions generate directs costs and losses for firms, and increase their transactions costs. Hence, establishments can use tax evasion to counterbalance additional costs generated by adverse business environment. Also, entrepreneurs knowing that the government is ineffective can anticipate low monitoring and auditing and have therefore more incentive to evade their taxes. The model is calibrated using the United States as a benchmark economy and simulated for a sample of 38 African and Latin American countries. The simulated output per worker and tax evasion are strongly correlated with the data and our model explains more that 44% of the variation in tax evasion and more 25% of the dispersion of output per worker across African and Latin American countries.

Distortions in business environment and policy ineffectiveness can generate therefore a vicious circle of underdevelopment in which tax evasion and distortions interact positively. Firms' tax evasion shrinks public revenue and this, in turn, reduces the government capacity to curtail tax evasion, invest in productive infrastructures, and thereby reduce distortions in business environment. Improving the quality of business environment in African and Latin America would have a two-fold positive impact. On the one hand, it would boost firms' productivity through better public infrastructures, a better access to finance, and a lighter regulatory environment i.e. reduces distortions. On the other hand, improving the quality of business environment would reduce establishments likelihood to evade.

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Table 7: Business environment in Africa and Latin American countries

Country	**Year**	**Sample size**	**Distortions**	**Government effectiveness**
Algeria	2002	537	19.78345	.3073171
Angola	2006	419	7.876055	.0585366
Argentina	2006	1022	1.787471	.5463415
Bolivia	2006	604	3.38329	.2926829
Botswana	2006	316	3.134426	.697561
Brazil	2003	1635	5.33664	.6146341
Burundi	2006	268	11.77837	.1365854
Chile	2004	948	2.453499	.8780488
	2006	1006	2.138938	.8341463
Colombia	2006	998	2.224883	.5268293
Costa Rica	2005	340	6.954154	.5902439
DRC	2006	339	11.03199	.0195122
Dominican Rep	2005	223	14.05665	.3512195
Ecuador	2003	434	8.7104	.195122
	2006	653	3.210159	.1658537
Egypt	2004	969	11.4405	.4829268
El Salvador	2003	448	3.80738	.4292683
	2006	684	3.746984	.497561
Ethiopia	2002	373	8.033917	.1609756
Guatemala	2003	442	6.500172	.3853659
	2006	518	4.631119	.3073171
Guinea	2006	223	18.28393	.0634146
Honduras	2003	413	5.904942	0.3268293
	2006	426	4.583889	.297561
Kenya	2003	249	14.55079	.3073171
Madagascar	2005	278	13.77299	.4195122
Mauritania	2006	233	7.921278	.2585366
Mexico	2006	1468	1.984761	.604878
Morocco	2004	849	1.460906	.5609756
Namibia	2006	306	1.964641	.5902439
Nicaragua	2003	423	8.567049	.2536585
	2006	477	9.193109	.2097561
Panama	2006	599	4.834579	.5658537
Paraguay	2006	589	5.692745	.2
Peru	2006	618	.9123296	.3170732
Rwanda	2006	212	8.413472	.4536585
Senegal	2003	254	8.338241	.4731707
South Africa	2003	594	2.653237	.7365854
Swaziland	2006	305	3.683106	.2146342
Tanzania	2003	257	13.96641	.4097561
	2006	418	12.11063	.4341463
Uganda	2003	297	9.312656	.4243903
	2006	562	1340214	.3707317
Uruguay	2006	567	.6812586	.6585366
Venezuela	2006	498	1.259287	.1463415