

# Essays on Rent-Seeking, Corruption and Informality

Thomas Robert Kenneth Lawrence Arthur Flochel

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## Declaration

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I declare that this thesis was composed by myself and that the work contained therein is my own. The second chapter was co-authored, as acknowledged below. No other person's work has been used without due acknowledgement. This thesis has not been submitted for any other degree or professional qualification.

Thomas Flochel



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## Introduction and Overview

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It is widely recognised that institutions play a key role in a country's economic development.<sup>1</sup> Countries with poor quality institutions generally suffer from pervasive corruption, a widespread culture of rent-seeking and large shadow economies, all of which hamper economic growth. Each chapter of this thesis aims to shed light on a particular aspect of these issues.

Procurement is one of the main areas of public spending at risk of corruption, especially in developing countries where regulations and their enforcement are often weak. Yet bad practice can be very costly. The second chapter of this thesis shows how favouritism in the allocation of public procurement contracts distorts the industrial organisation of an economy, thereby reducing its growth potential. On top of the static costs of bribery and embezzlement, economic theory indicates that systematic departures from competition and economic efficiency in the allocation of public markets are likely to have a devastating impact on economic agents' incentives and as a result may induce important long-term distortions in a country's productive structure. Murphy et al. (1991) ascribe these dynamic costs to distortions in the size of expected returns to unproductive rent-seeking relative to returns from innovative productive activities (such as entrepreneurship). When corruption tips the balance towards the former, they argue, potential entrepreneurs, particularly the more able ones, turn away from productive activities to capture the profits from rent-seeking. This results in reduced investments in innovation, lower aggregate output and an insidious purging of talent from the

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<sup>1</sup>See North (1990); Olson (2000), or more recently Acemoglu et al (2002).

productive sectors, which imposes important dynamic costs on the economy.

We illustrate this phenomenon in the case of Paraguay, where after more than 60 years of single party rule, the resources of the state have been all but privatised along party lines. As a result, a widespread network of patronage through bribes and political favours has emerged, operating notably through the allocation of public contracts to firms that in most cases are created with the sole purpose of supplying the state, often by selling a variety of imported goods. There is ample anecdotal evidence of corruption in public procurement, examples of which are reviewed in the chapter's introduction. We then build a model of entrepreneurial choice in an economy with a corrupt public procurement sector, which provides predictions along two main dimensions. First, corruption is more frequent in sectors where public institutions are large buyers. Second, firms favoured with corrupt contracts enjoy extra returns, so that procurement related activities attract the best entrepreneurs. These predictions are tested using a large-scale microeconomic database including all public procurement operations over a 4-year period. We find that institutions with an important procurement activity are more likely to engage in corrupt dealings. As for firms, they have a greater probability of obtaining a contract directly through an exceptional procedure from an institution with which they have a strong contractual relation, particularly when dealing with more corrupt State entities. Finally firms trading more with the public sector are found to be more profitable, even when controlling for their unobserved characteristics, reflecting the misallocation of talent towards this largely unproductive sector induced by favouritism. The consequences of such malpractice in Paraguay have been devastating. The industrial sector has been in steady decline since the 1970s and the economy more or less stagnant, with GDP per capita in 2005 equal to its late 1980s level.

The third chapter turns to labour market regulations and assesses whether political interests have affected their implementation since the late 1990s in Brazil. A growing body of empirical research finds evidence that politicians in Brazil make use of their power to influence fiscal transfers and the implementation of regulations in order to promote their political interests. No such research into the work of the labour inspectorate has been conducted to date, despite an ongoing debate in Brazil about the level of autonomy which labour inspectors should enjoy and a long-lasting struggle by this bureaucracy to free itself from the pressures of politicians. Interference in regulatory enforcement implies varying degrees of implementation according to politicians' local interests, which in the context of labour market regulations can have a significant impact on compliance as well as



on firms' productivity, employment and output. This is a matter that concerns Brazil in particular, with one of the most regulated labor markets in the world and over 40% of its workforce employed in the informal sector. The empirical analysis sets out firstly to evaluate the influence of (i) partisan alignment between different levels of government, (ii) electoral competition levels, and (iii) the presence of term limits, on the issuance of fines for labour infractions. Secondly, these political variables are interacted with dummies for election years to assess whether the pattern in sanctioning reflects a clientelist strategy aimed at swaying voters during election times. Each consideration is tested using a unique panel dataset including all fines distributed for infractions of labour regulations at a town level in two of Brazil's largest and most industrialised states over a 12-year period. The results of the empirical analysis suggest that labour sanctions are at most marginally influenced by state governors' interests, and that there is no evidence of their use to sway voters.

Chapter 4 turns to labour informality, a phenomenon that characterises most developing country labour markets. In Latin America and the Caribbean, the World Bank estimated in 2007 that 54 percent of total urban employment is informal. In the same report, the authors show that these high informality rates go hand in hand with high poverty rates. Yet most cross-country studies report a significant negative correlation between taxation rates and the size of the informal sector. This result is paradoxical for two reasons. First, a higher tax burden on the formal sector is generally thought to drive economic activity underground, which leads most dual sector models with exogenous policy to predict that high taxation and barriers to entry are associated with large informal sectors. Second, under standard assumptions and a uniform distribution of ideological bias most voting models would predict that a greater share of the poor in the electorate should lead to more redistribution. This paradox is best explained through a political economy model. I build the first theoretical framework integrating a probabilistic voting model in a dual economy setting where agents endogenously choose their sector of activity. Endogenising both economic and political mechanisms enables the model to explain the negative correlation between taxation and informality rates found in cross-country data. This relationship is found to emerge from an optimal choice by social welfare-maximising politicians in countries that differ in institutional quality. I then perform comparative statics on the level of labour productivity and show that improvements in institutional quality are more important in countries with a less productive labour force, as they lead to greater increases in redistribution and reductions in the informality share.

Finally, chapter 5 concludes and presents some implications of this thesis.

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# Public Procurement and Rent-Seeking: The Case of Paraguay

*Joint work with Emmanuelle Auriol and Stéphane Straub*

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### Abstract

A model of entrepreneurial choices in an economy with a corrupt public procurement sector is built, providing predictions along two main dimensions. First, corruption is more frequent in sectors where public institutions are large buyers. Second, firms favoured with corrupt contracts enjoy extra returns, so that procurement related activities attract the best entrepreneurs. A large scale microeconomic database, including all public procurement operations over a 4 year period in Paraguay, amounting annually to approximately 6% of the country's GDP, is then used to corroborate these predictions

*Key words:* Procurement, Corruption, Rent-seeking, Development;

*JEL codes:* H57, D73, D72, O5.

## 2.1 Introduction

Public procurement of goods and services is one of the main areas at risk of corruption in developing countries where regulations and legal enforcement are weak. On top of the static cost of corruption and fund embezzlement, systematic departures from competition in the attribution of public markets are likely to have a devastating impact on economic agents' incentives and as a result on these countries' productive structure. This paper presents the first large scale micro-level evidence on the channels of rent-seeking and its impact on economic development, using a unique database of nearly 50,000 public procurement operations in Paraguay, covering the period 2004 to 2007. In a nutshell, we show that in Paraguay corrupt behaviour in the allocation of public contracts is a key channel for rent-seeking. This large-scale network of favouritism, sometimes coined "la patria contratista",<sup>1</sup> has deeply damaging economic consequences: public institutions buy goods and services at inflated prices, and the set of incentives facing potential entrepreneurs is biased towards unproductive activities.

To guide the analysis, we model the choice of potential entrepreneurs with idiosyncratic cost levels, between remaining in the informal sector or paying a fixed entry fee to become formal. Moreover, in the formal sector they face the additional alternative of joining a productive segment, where they serve private consumers competitively, or a rent-seeking one, where they sell to public institutions. In this rent sector, contracts are attributed by corrupt officials, who distort allocation rules in exchange for bribes. Firms willing to do business with the government must therefore be profitable enough to cover their production costs as well as the formality fee and the bribes. We derive from the model two main sets of predictions that are sustained by the data, revealing the following story.

First, we establish that in Paraguay the main channel for corruption in procurement is the systematic use of an "exceptional" purchase mechanism, which bypasses legally required minimum standards of transparency and competition. Exceptional purchases are made more frequently by institutions, which are big buyers of specific goods. Thus, when the public sector concentrates a large share of a domestic market, which happens mostly in import-oriented and service activities, corruption rises. Moreover, the data reveal that this effect is reinforced by repeated interactions of these institutions with favoured firms: exceptional purchase is used more often by institution-firm pairs that trade in large volumes.

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<sup>1</sup>The "contracting homeland", see for example Alfredo Boccia Paz, *Diario Ultima Hora*, Asuncion, March 4th, 2009.

Second, this implies that firms doing more business with the State, those in the so-called rent sectors, enjoy above normal rates of return and are the most efficient ones. We provide evidence of these two aspects, by showing that firms selling more to the public sector, as well as those selling more through the exception channel, have higher profit margins, despite the fact that they trade mostly in standard goods and should face competition for the market.

As a result, average relative profitability should be biased towards sectors with an important procurement component, distorting firms' incentives and inducing additional entry in these activities. To the extent that this self-selection process pushes some of the best potential entrepreneurs towards rent sectors, distracting them from innovative or export-oriented ventures, it generates a serious misallocation of talents issue across the economy. Indeed, we document this strong selection bias by exploiting an original econometric strategy using firms' names.

The rest of the paper is structured as follows. Section 2 reviews the main strands of related literature and spells out the contributions of the paper. Section 3 describes the Paraguayan institutional environment. Section 4 develops the model and derives empirical predictions. Section 5 presents the data. Sections 6 and 7 present the results related to the two main sets of theoretical predictions, and Section 8 concludes.

## 2.2 Literature Review

The idea that rent-seeking behaviour has important social and economic costs is a relatively long-standing one in the economic and political science literature. Early contributions such as Tullock (1967; 1971), Buchanan (1980), Krueger (1974) and Baghwati (1982), were concerned, mostly in a theoretical framework, with the different types of costs associated with the transfer of rents and the waste generated by agents engaging time and resources in competing for rents, for example through political lobbying or corruption.

More recently, some papers have provided explanations for ways in which rent-seeking entails dynamic costs. Baumol (1990) and Murphy, Shleifer and Vishny (1991) focus for example on the resulting dysfunctional allocation of talents. In this approach, potential investments in physical or human capital are directed to rent-abundant sectors (such as those stemming from political favours, corruption or exploitation of natural resources), while investments in innovative activities, which have greater growth potential, become relatively less attractive and are discouraged. As supporting empirical evidence, Murphy et al. (1991)

present cross-country growth regressions augmented with country level proportions of engineering and law students, where the former are said to correspond to investments in productive activities while the latter are considered rent-seekers. Baumol's evidence, on the other hand, is based on historical accounts from Rome, Ancient China and the Middle Ages.

To date, there is still very little micro-evidence on the actual channels and consequences of rent-seeking in developing economies. Some papers have stressed the difference in performance between "captor" and "non-captor" firms in transition countries (depending on their ability to influence regulations or attract specific concessions), using either subjective answers on influence in firm surveys (Hellman, Jones and Kaufmann, 2003; Fries et al. (2003), or regional measures of preferential treatment received by a sub-sample of large firms (Slinko, Yakovlev and Zhuravskaya, 2004). Other contributions have documented the importance of political connections in securing access to key economic inputs. For example, Li, Meng, Wang and Zhou (2008) show that Chinese Communist Party members are more likely to obtain credit for their firms; Khwaja and Mian (2005) show how lending by public banks in Pakistan is systematically distorted towards firms with politicians on their boards; Hsieh, Miguel, Ortega and Rodriguez (2008) show that firms, whose directors have signed the recall petition against Chávez in Venezuela (the "Maisanta"), have experienced significantly lower performance thereafter, in particular because of a rising tax burden and more difficult access to foreign exchange; Agrawal and Knoeber (2001) study how directors' political connections help secure better regulatory conditions in the US; Fisman (2001) computes the stock market value of Indonesian firms derived from political connections to the Suharto network, using exogenous shocks to the dictator's health. At a more general level, the large literature on corruption that developed since the 1990s is also relevant here, and especially the strand of more recent papers using microeconomic evidence to directly measure corruption and its effects on outcomes.<sup>2</sup>

A few contributions have dealt specifically with public procurement. Hyytinen, Lundberg and Toinaven (2007), who study the effects of politics on municipal cleaning contracts in Sweden, show that the lowest bidder does not win 58% of the time and that the choice of the winner is subject to political considerations; Goldman, Rocholl and So (2009) show that US companies connected, through the

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<sup>2</sup>Authoritative surveys on corruption include Bardhan (1997), Rose-Ackerman (1999, 2006), Svensson (2005), Mishra (2005) and Pande (2008) among others. Micro-econometric papers include Reinikka and Svensson (2004), Olken (2007), Bertrand, Djankov, Hanna and Mullainathan (2007) and Ferraz and Finan (2007) to mention only a few.

composition of their boards, to the winning party in both legislative and presidential elections (in 1994 and 2000) are significantly more likely to have experienced an increase in procurement contracts. References dealing explicitly with corruption include Di Tella and Schargrotsky (2003), who document the impact of a crackdown on corruption in Argentinean hospitals, and Bandiera, Prat and Valletti (2009), who disentangle the effect of passive (inefficiency) versus active waste (corruption) in Italy, finding that the former accounts for about four times the effect of the latter.

With respect to this literature, our paper provides several original contributions. First, we have data not only on the expenses realised by public institutions, but also on the firms that are on the selling side. This enables us to capture the effect of large scale corrupt practices on the profitability of firms and hence on the industrial structure of the economy.<sup>3</sup> We provide evidence of the distortive effects of rent-seeking in terms of economic efficiency, by showing that it implies an inefficient specialisation of the more able entrepreneurs in imports and procurement activities. Second, we document one of the most prevalent channels of corruption in procurement activity, namely the use of purchase mechanisms circumventing standard rules, and uncover the economic characteristics of the institutions and sectors more prone to it.

## 2.3 Country Overview: Rent-Seeking and Corruption in Procurement

Paraguay is a small landlocked country of 6.2 million inhabitants (2008) located in the heart of South America. With a per capita GDP of US\$ 1,670 in 2008, it is a low-middle income country. Its main sources of growth are agrarian activities and local services.<sup>4</sup> The country also enjoys a unique source of rent in the form of revenues from big hydroelectric dams shared with its neighbours Argentina and Brazil. The biggest one is Itaipú, on the river Paraná between Paraguay and Brazil. Until the Chinese Three Gorges dam was built, Itaipú was the largest hydroelectric power plant in the world. It has 20 turbines, 1 of which provides 90%

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<sup>3</sup>Related papers are Rama (1993), who tracks the number of foreign-trade rent-seeking regulations over the XXth century in Uruguay and relates these to political and economic variables, and Fisman and Sarria-Allende (2004), who present cross-country, industry level evidence of the effect of regulatory distortions on the industrial structure.

<sup>4</sup>Indeed, a few non-processed commodities constitute its very narrow export base: 50% of all exports are in 3 traditional products (soy, cotton and meat); adding other barely processed commodities makes up close to 90% of total exports.



of all the energy used in Paraguay. The rest is channeled to Brazil.<sup>5</sup> In exchange, Paraguay receives every year an enormous amount of royalties, amounting to US\$ 366 millions in 2005 (resp. US\$ 553 millions in 2006), equivalent to 4.9% (resp. 5.8%) of GDP. This is approximately 50% of the total government tax collection (from VAT, custom duties, and rent, by order of magnitude).

Politically, after enduring the dictatorship of Alfredo Stroessner between 1954 and 1989, Paraguay returned to democracy through a military coup in 1989. Yet, the Asociación Nacional Republicana, traditionally known as *Colorado Party*, managed to retain power for 61 years, including the 19 years elapsed since the 1989 coup and covering the whole period of our study.<sup>6</sup> Given this political context, the dams' propitious source of income shaped the growth of the Paraguayan "rent-seeking economy". First, the dams' construction fostered a culture of intense rent-seeking and corruption and allowed a few entrepreneurs that were on good terms with the dictator to become immensely rich. Second, the free flow of resources to the government's budget meant that bureaucrats were in a position to favour friends through public expenses. During the whole period, the party effectively "privatised" public resources, using public employment and procurement to favour party members.<sup>7</sup> As a result, Paraguay is considered to be one of the most corrupt countries in the world.<sup>8</sup>

An important channel for corruption, which we focus on here, is the allocation of public contracts to firms that in most cases are created with the sole purpose of supplying the state, often by selling a wide variety of imported goods. There is ample anecdotal evidence of corruption in public procurement. As a result, and under pressure from international organisations, a law regulating public procurement practices (law 2051/03) was enacted in 2003 by the government of the newly elected president Nicanor Duarte Frutos, with the announced intention of promoting transparency and efficiency in public purchases. The most significant of its provisions were the creation of a public procurement watchdog (the National Directorate of Public Procurement, or DNCP), the design of a menu of purchase mechanisms to regulate procurement procedures, and the compulsion to make all information (calls, providers, award etc.) public. This last proviso was accompa-

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<sup>5</sup>Additionally, there is another huge dam, the Yacyreta one, lower down on the same river, on the border between Paraguay and Argentina. It is about one fourth the size of Itaipú.

<sup>6</sup>See Pérez-Liñán et al. (2006) for a description of the political environment of Paraguay. In April 2008, the Colorado party was finally defeated in the presidential election by an opposition coalition led by former Catholic bishop Fernando Lugo.

<sup>7</sup>See for example Nickson and Lambert (2002).

<sup>8</sup>It has lingered in the bottom 4% of surveyed countries included in Transparency International's Corruption Perception Index since its inclusion in 2002. It had for instance a score of 2.1 in 2005, placing it 144th out of 158, and the same score in 2009 (154th out of 180).



nied by the creation of the DNCP web site where this information is available, but in practice access is often intermittent and the interface is impractical.

There are strong indications however that improvements in the regulatory framework did not translate quickly into cleaner procurement practices, partly because many officials did not comply with the new law and the wrongdoings continued.<sup>9</sup> As shown in Figure 2.1 below, in the period under study over 70% of all procurement contracts are awarded without competition. The main mechanism through which firms are favoured is the use of the exceptional purchase mechanism, by which specific regulations, such as the obligation to organise public tenders above certain amounts, are disregarded (see details in Section 5 below).

In 2006, Transparencia Paraguay (TP), the local chapter of Transparency International, published an extensive report focusing on the excessive use of exceptional procedures, which was clearly identified as one of the main irregularities in the procurement process. Indeed, in 2004 and 2005 purchases made through the “exceptional” procedure amounted to nearly 23% of the total procurement spending. For example during that period public firms awarded close to 90% of their advertisement contracts through exceptions. As for specific institution, the Office of the First Lady spent respectively 40% and 93% of its budget in these two years using the exceptional mechanism.<sup>10</sup>

Because the report was given ample coverage in the local media and through public presentations, some of the officials in charge of procurement in public institutions may have become more cautious. Indeed, purchases made through the “exceptional” procedure decreased over the period that we study. Still, they did not disappear, representing 17.3% of the total procurement spending between 2004 and 2007.

In 2006 the Superior Tribunal of Electoral Justice channeled 23% of its total spending through exceptions, while for the public enterprise “Cañas Paraguayas”<sup>11</sup> the corresponding figure was 59%. In 2007, an electoral year, the Presidency spent 16% of its budget through exceptional contracts. In all these cases, it is difficult

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<sup>9</sup>The World Bank’s review of Paraguay’s public expenditure in 2006 states that: “Operational efficiency is reduced by the existence of informal arrangements alongside formal rules. While spending control is highly centralised, with detailed rules concerning (...) procurement and other items of expenditure, these formal controls are often violated in practice [and] informal arrangements dictate how (...) procurement is contracted. When formal rules are unworkable and government operates through extralegal means, corruption rises although it often goes undetected or unreported.”

<sup>10</sup>Some cases have made headlines, such as the use of this procedure to pay close to US\$ 100,000 to a consulting firm formerly owned by the President, for the organisation of the XIII<sup>th</sup> conference gathering Americas’ First Ladies in 2005 in Asunción (Diario Última Hora, Asunción, June 7th, 2007).

<sup>11</sup>The State-owned alcohol-producing firm.

to argue that the use of the exception responded either to situations of emergency or to non-competitive markets. The State-owned electricity enterprise ANDE has also been pointed out for buying large numbers of electric transformers in this way, despite the fact that these are routinely required by the firm for network repairs. Firm officials recognise that this practice usually generates excess pricing of between 17 and 27%.<sup>12</sup> During the yellow fever outbreak of 2008, a state of national emergency was declared and, as a result, the Health Ministry proceeded to buy large quantity of fuel through exceptional purchases. The main provider, benefited with half of the total purchase, did not even have a distribution network in the interior of the country where the immunisation campaign was taking place, and close to three quarters of this fuel was actually delivered after the emergency period.<sup>13</sup> In a recent scandal, the education ministry invoked exception grounds to spend US\$3 million on a building in the center of Asunción, although such move had been planned for a about a year. Another year later, it was announced that the building was falling apart and that US\$700,000 would be needed to fix it.<sup>14</sup>

The next Section builds a model from which we derive testable predictions.

## 2.4 The Model

The model focuses on constant returns to scale industries (i.e., linear cost function).<sup>15</sup> We model a representative industry, of which there are many that vary in their characteristics such as the size of the private and public sector demands, entry costs, relative marginal cost of formal versus informal sector production. In each industry entrepreneurs have the choice between the informal and the formal sectors. In the informal sector, denoted by the superscript  $I$ , there is no entry fee or taxation. Traditional production techniques prevail so that the cost of production is  $C^I(q) = \bar{c}q$ , where  $q \geq 0$  is the quantity produced by the firm. The sector being competitive, in equilibrium the price is  $p^I = \bar{c} > 0$ .

By contrast, in the formal sector, denoted by the superscript  $f$ , firms need to pay an entry fee  $F \geq 0$ .<sup>16</sup> The total cost function of a producer operating in the

<sup>12</sup>Diario ABC Color, Asunción, January 3rd, 2010. These figures are consistent with the estimation by Auriol (2006) and with the results in Section 7 below.

<sup>13</sup>Diario Ultima Hora, Asunción, July 25th, 2008.

<sup>14</sup>Diario ABC Color, Asunción, January 6th, 2010, and Diario Ultima Hora, Asunción, December 22nd, 2010.

<sup>15</sup>This assumption is consistent with existing evidence on manufacturing and service firms in developing countries, whether they belong to the formal or the informal sector (see Tybout, 2000). It is also consistent with the nature of activities included in our procurement database.

<sup>16</sup>In the model taxation goes entirely through the entry fees. Yet we could add a linear tax

formal sector is  $C^f(q) = F + c^f q$ , where by assumption

**A1**  $c^f$  is independently and uniformly distributed in  $[0, \bar{c}]$ .

Formality gives access to a large set of technologies and management techniques so that entrepreneurs “abilities” (i.e., education, physical capital, experience, attitude towards innovation, access to credit markets and so on) matter. Production costs are hence lower and have *a priori* a wider dispersion in the formal sector than in the informal one.

As a benchmark, we first briefly discuss the corruption-free equilibrium. In the absence of rent-seeking opportunities, entrepreneurs specialise in productive activities. They serve market demand competitively and make no rents in equilibrium. The demand is composed of the private demand  $D(p) = A - p$ , where  $A > \bar{c}$  is a scale parameter that indicates the depth of the market,<sup>17</sup> and the public demand  $D^{Pub}(p) = \frac{Q\bar{c}}{p}$ , where  $Q\bar{c} > 0$  is the fixed public budget allocated to procurement. For the private demand consumers purchase from the cheapest provider. Proposition 2.1 summarises the industrial organisation of this economy (see derivation in the Appendix).

**Proposition 2.1** *In a corruption-free economy, formality prevails in a given industry if and only if*

$$A + Q \geq \bar{c} + \frac{F}{\bar{c}}. \quad (2.1)$$

**Proof.** See appendix A.1.1. ■

Proposition 2.1 implies that if  $F$  is small the traditional technique of production disappears. Production occurs in the formal sector in equilibrium at the lowest prevailing marginal cost  $c^{f*}$ . On the other hand, in countries where barriers to entry are high there is a segmentation between formal and informal sectors based on types of business or industry. An industry is organised formally if demand is strong (i.e.,  $A$  and  $Q$  large), and if the difference in productivity between traditional and modern methods of production,  $c^I - c^{f*} = \bar{c}$ , is large enough.<sup>18</sup> If (2.1) does not hold, public procurement cannot occur because by regulation

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*t* on operational profit without changing the equilibrium (see Auriol and Warlters, 2005). In practice entry fees are higher, in percentage of per capita GDP, in poor countries than in rich ones (Djankov et al., 2002).

<sup>17</sup>Assumption  $A > \bar{c}$  rules out corner solutions in the rest of the paper. Note that results are robust to other demand specifications (e.g., Cobb-Douglas).

<sup>18</sup>We expect  $c^I - c^{f*}$  to be small for services such as car washing or fruit selling (which do not suffer large productivity losses due to poor infrastructure or the inability to enforce contracts in courts and do not benefit too much from innovations). As a result, these activities are

public officials are required to purchase from the formal sector. To rule out this possibility in the sequel of the paper we make the following assumption:

$$\text{A2} \quad F < \bar{c}Q.$$

Since  $A > \bar{c}$ , under assumption A2 condition (2.1) always holds so that in the absence of corruption formality prevails. Any distortion away from this efficient equilibrium can then be related to corruption.

### 2.4.1 Rent-Seeking

We assume that individuals managing public institutions' purchases aim at maximising the total amount of bribes they extract from their suppliers. While this assumption cannot be directly tested, because in practice corruption and bribes are not observed, the model based on this null hypothesis will generate a number of testable predictions discussed below.

The first prediction, which is from Auriol (2006), is that, independently of the type of commodity, a corrupt procurement official favours limited tendering procedures, thereby maximising the price of the purchase and his bribe. We thus expect **corrupt Paraguayan public institutions to rely on the exceptional purchase mechanisms**. A firm, which is invited to serve the market in a monopoly position, asks for the highest possible price,  $\bar{c}$ . In the rent sector, denoted by the superscript  $r$ , a contract of size  $q$  hence costs  $T^r(q) = \bar{c}q$ .<sup>19</sup>

The decision parameter of government officials is  $b \in [0, 1]$ , the share of  $T^r(q)$  they take in exchange for giving the market to a firm without competition. In doing so, government officials do not try to distinguish between different entrepreneurs: they simply split the total quantity in equal parts among them, asking for a fixed share of each of these contracts in bribes.

Let  $c^r(b) \in [0, \bar{c}]$  denote the firm that is just indifferent between the rent and the productive sector. We show in the appendix that

$$c^r(b) = \bar{c} (1 - b) \frac{\bar{c}Q}{\bar{c}Q + F}. \quad (2.2)$$

We deduce that  $\Pi^r(c) = Q\bar{c} \left[ \frac{c^r(b) - c}{c^r(b)} \right] > 0$  if and only if  $c < c^r(b) < \bar{c}$ . **Entrepreneurs who choose to do business with the government are the most efficient ones and they make rents**. By contrast entrepreneurs with

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informal in developing countries. On the contrary, sophisticated commodities such as medicine or cars, which require a warranty or a certification, are characterised by larger values of  $c^I - c^{I*}$ , justifying that firms choose formality.

<sup>19</sup>For more details see Auriol (2006).

costs higher than  $c^r(b)$  would make a loss, and so prefer not to enter the procurement sector. It is intuitive that the share of firms in the rent sector,  $\frac{c^r(b)}{\bar{c}} = (1-b)\frac{\bar{c}Q}{\bar{c}Q+F} < 1$ , decreases with  $b$  and  $F$  and increases with  $\bar{c}Q$ . The more greedy government representatives are, the more profitable firms need to be to do business with them: they need to be able to cover the fixed cost of entry plus the bribes and still make non-negative profit.

To compute the optimal bribe rate, public officials internalize the risk of corruption being detected and punished.<sup>20</sup> Consistently with empirical evidence in Paraguay for the time of our study, we focus on weak punishment: in case of detection the bribe is simply lost to the officials. We assume that the probability of detection for any procurement contract is  $G(\frac{\bar{c}-c^r(b)}{\bar{c}})$  where  $\frac{\bar{c}-c^r(b)}{\bar{c}}$  is the fraction of firms excluded from the rent sector and  $G(x)$  is a strictly increasing and convex function varying between 0 and 1 for  $x \in [0, 1]$ . The expected bribe value writes  $B = b\bar{c}Q \left(1 - G(\frac{\bar{c}-c^r(b)}{\bar{c}})\right)$ . We deduce the next result.

**Proposition 2.2** *Let  $\phi = \frac{F}{Q\bar{c}} \in [0, 1]$  by assumption A2. Let  $H_G(x) = \frac{g(x)}{1-G(x)}$  be the hazard rate function associated to  $G(x)$ . The optimal bribe rate,  $b^r$ , is solution to:*

$$H_G\left(\frac{b+\phi}{1+\phi}\right) = \frac{1+\phi}{b} \quad (2.3)$$

**Proof.** See appendix A.1.2. ■

Under a technical assumption, one can check that  $\frac{db^r(\phi)}{d\phi} < 0$  for all  $\phi \in [0, 1]$  (see proof in the Appendix). Proposition 2.2 hence implies that the optimal bribe rate decreases with  $F$ . This is because corruption competes with taxation: firms that have to pay bribes are less able to pay taxes. More importantly for the empirical analysis, the optimal bribe rate also increases with the amount spent in public procurement  $Q\bar{c}$ . Institutions with large budgets are able to distribute larger lots to more firms, hence they can ask for a larger share of contracts in bribes without increasing the risk of detection. We hence expect, **at the purchasing institution level, a positive correlation between the volume of procurement activity and the use of exceptional purchase.**

In practice corruption detection varies from one institution to another. These differ in their level of exposure to public scrutiny, depending for example on how

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<sup>20</sup>This is a common assumption in the corruption literature, going back to the Becker and Stigler (1974) crime-deterrence model. See for example Besley and MacLaren (1993) and Mookherjee and Png (1995). Di Tella and Schardgrosky (2004) is an empirical application.

many people are harmed by corruption or on how politically sensitive their activities are. They also differ in their capacity to realise and hide corrupt acts. In the context of the model, this simply translates into hazard rate dominance, which implies stochastic dominance.<sup>21</sup> The next result is derived in the Appendix.

**Proposition 2.3** *Let  $G(\cdot)$  and  $K(\cdot)$  be two distributions of corruption detection.*

$$\frac{g(x)}{1-G(x)} \leq \frac{k(x)}{1-K(x)}, \forall x \in [0, 1] \Rightarrow b_G^r \geq b_K^r. \quad (2.4)$$

**Proof.** See appendix A.1.3. ■

Everything else equal, institutions characterised by a lower probability of detection (i.e., lower hazard rate) will have a higher bribe rate and, by virtue of equation (2.2), smaller number of firms, and thus larger lots size. We deduce that, everything else equal, **institutions characterised by a lower probability of detection will rely more heavily on exceptional purchase and will have larger lots size attributed to their providers.** We are now ready to derive the global market equilibrium.

**Proposition 2.4** *Let  $b^r(\phi)$  be defined by equation (2.3) and  $c^r(\phi) = \frac{1-b^r(\phi)}{1+\phi}\bar{c}$ . Entrepreneurs choose the rent sector if and only if*

$$c \leq c^r\left(\frac{F}{Q\bar{c}}\right). \quad (2.5)$$

*In the productive sector, formality prevails if and only if*

$$A \geq \bar{c} + \frac{F}{\bar{c} - c^r\left(\frac{F}{Q\bar{c}}\right)}. \quad (2.6)$$

**Proof.** See appendix A.1.4. ■

Proposition 2.4 (see derivation in Appendix) indicates that the most productive entrepreneurs (i.e., those with  $c \leq c^r\left(\frac{F}{Q\bar{c}}\right)$ ) choose the rent sector where there is no competition and commodities are overpriced, while the less productive firms are left to serve private demand. Compared to a corruption-free economy, prices are higher both in the public and private segments of the economy so that the

<sup>21</sup>Let  $K(\cdot)$  and  $G(\cdot)$  be two probability functions so that  $\frac{g(x)}{1-G(x)} \leq \frac{k(x)}{1-K(x)} \forall x \in [0, 1]$ , then it implies that  $G(x) \leq K(x) \forall x \in [0, 1]$  (e.g., see Nanda and Shaked, 2001).



quantities consumed and produced in equilibrium are everywhere smaller, leading to lower aggregate production. Comparing condition (2.6) with condition (2.1), it is straightforward to check that the formal productive sector shrinks. This effect is stronger in sectors where public purchases are large. Indeed, since  $\frac{db^r(\phi)}{d\phi} < 0$ , proposition 2.4 implies that  $\frac{dc^r(\phi)}{d\phi} < 0$  for all  $\phi \in [0, 1]$  so that  $\frac{dc^r(\frac{F}{\bar{c}Q})}{d\bar{c}Q} > 0$ . Moreover we can show that  $\frac{dq^r}{dQ} > 0$  (see Appendix). **Everything else being equal, the percentage of entrepreneurs who enter the rent sector and the size of their lots both increase with  $\bar{c}Q$ .**

## 2.4.2 Implications of the Model

The model generates 2 main sets of testable predictions.

1. *Corruption and the structure of purchases.* In practice procurement activities are decentralised at the institution level (ministries, state enterprises, etc.), so the predictions of the model apply at the purchase center-level. The theory predicts that corrupt institutions rely on the exceptional mechanism to circumvent competition and maximise bribes. We do not observe bribes, but we do observe purchase mechanisms. Therefore, we use the occurrence of exceptional purchases as dependent variable, to proxy for the fact that a given contract involves corruption.

First, proposition 2.2 shows that corrupt demands increase in markets where institutions are big buyers of the good. Therefore, controlling for all other standard determinants of exceptions, the likelihood that an individual contract is made by exceptional purchase should be higher when an institution's budget, as a percentage of the total sector's production, increases.

Second, controlling for institutions' budget size (which will be taken care of by institutions-year fixed effects), we can exploit the heterogeneity in the probability of corruption detection at the institution level stressed in proposition 2.3. For institutions that are more efficient at hiding corruption, we expect a stronger correlation between the frequency of exceptional purchases and the market shares attributed to providers.

2. *Profitability of firms.* Entrepreneurs in the rent sector make profits that exceed the levels observed in normal competitive sectors. These rents are derived from sales at inflated prices, because competition for the market is suppressed by corruption. However, only entrepreneurs that are efficient enough can afford to cover the cost of the related bribes. A corollary is therefore that these

entrepreneurs are also the most able ones, those with the highest intrinsic or acquired abilities (see (2.5) in proposition 2.4).

Finally, the model has noteworthy industrial organisation implications. Although we do not intend to test these directly in this paper, we briefly address them in the conclusion. In sectors producing goods procured intensively, the formal productive sector shrinks (see (2.6) in proposition 2.4). In addition, sectors in which a large fraction of output is sold to the government are characterised by less competition. Where there is corruption, prices are bid up in all sectors and quantities are depressed, leading to lower aggregate production.

## 2.5 The Data

### *Procurement data*

The main data set tracks all the procurement transactions made over the period 2004 to 2007 between 73 public entities (representing over 90% of total Paraguayan public spending and employment) and 5,517 different private suppliers.<sup>22</sup> These 47,615 public purchases include all types of goods and services, from stationary to machinery, oil purchases, food, services, etc. There are good reasons to believe that no public procurement operations escape registration as, under the new system, contracts need to be registered and executed before the corresponding funds are released. Total public spending amounts to Gs. 12,400 bn. (approx. US\$ 2,235m), which represents 5.5% of Paraguay's GDP in 2004, 5.6% in 2005, 6.3% in 2006 and 6.9% in 2007.

Each observation in the procurement data set contains the name and type of the public entity, the name and legal registration number (RUC) of the supplying firm and its owner, and information on the purchase including the nature of the good or service categorised in 16 different groups, the total cost in local currency, and the purchase mechanism used.

Purchase mechanisms are a key provision of the 2003 public procurement law, regulating the procedures to be followed in allocating contracts depending on their total value expressed in multiples of the current legal minimum daily wage (mdw).<sup>23</sup> There are five legal purchase mechanisms with gradually increasing constraints on the minimum number of offers, the mode and length of publication of the call for offers, and the attribution procedure. Below a value of 2,000 mdw,

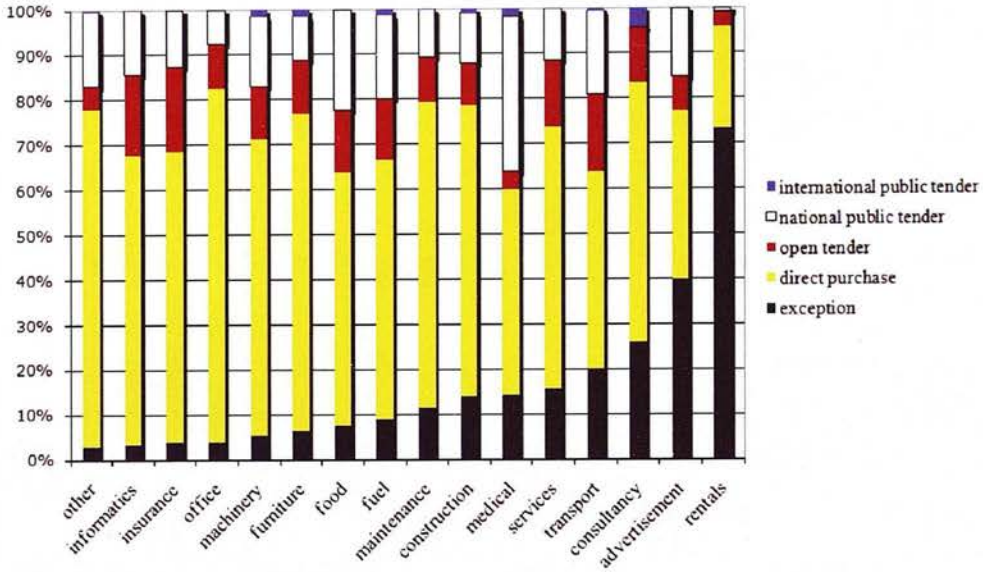
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<sup>22</sup>The data we use was initially painstakingly compiled by Transparencia Paraguay (TP), the national chapter of the international NGO Transparency International, using the information published on the DNCP web site.

<sup>23</sup>See the Appendix for more details.



Figure 2.1: Purchase mechanism used by types of good



a direct purchase is allowed, with public institutions legally compelled to have offers from at least three different firms. Between 2,000 mdw and 10,000 mdw, a so-called competitive bidding process is required, the call for offers must be published in advance and the minimum number of suitable offers is five. Finally, for contracts of a value above 10,000 mdw, a national or an international public tender must be organised, with still more stringent rules.

Finally, these guidelines can be disregarded in cases of emergency, such as natural disasters or health epidemics (for example the dengue fever outbreak of 2007), for the purchase of patented and copyrighted goods, or for purchases requiring defence secrecy. In those extraordinary circumstances, public officials can skip all formal purchase requirements through the so-called exceptional purchase mechanism. Figure 2.1 shows that exceptional purchases are quite common for certain categories of goods or services, such as rentals, advertisement, consultancy and transport.

The distribution of contract values has a fat left-hand tail (84% of purchases cost less than 2000 mdw.), while 5.5% of contracts costing over 10,000 mdw make up 86% of the total spending. The sample mean is approximately US\$ 47,000, equivalent to 36 times the national per capita GDP at the time.<sup>24</sup>

<sup>24</sup>There are a bit more than 200 contracts with a value superior to US\$ 1 million and the largest contract is worth US\$ 184 million. The 10 largest procurement contracts are oil purchase by the state monopoly Petropar.

### *Firms' profits*

We use annual rankings of top taxpayers published on the Ministry of Finance's web site. Firms' ranks are determined by their total payments on all taxes.<sup>25</sup> Once public firms are excluded, we have information for 748 firms in 2004, 459 firms in 2005, 482 firms in 2006, and 478 firms in 2007.

We use the information on total tax disbursements to approximate firms' profits, exploiting the fact that the income gains tax had a flat rate of 30% in 2004, 20% in 2005 and 10% thereafter. Issues related to the inclusion of other taxes and to evasion are discussed in the empirical section below.

### *Import-export data*

We also include annual rankings from the Customs' *SOFIA* official data base. These include the full universe of importers from 2004 to 2007, including the total free on board (FOB) value imported, and of exporters for the same period, including the cost, insurance, freight (CIF) value exported.

### *Production data*

We are able to match the good categories from our procurement database with National Account data for 6 categories of goods (food, rentals, fuel products, construction, machinery and transport). This is sectoral gross GDP data at the 2-digit ISIC level, as published by the Paraguayan Central Bank's Office of Economic Studies. Fuel is an outlier, as large amounts are bought from foreign companies (total procurement represents up to 15 times national production in some years). Once it is excluded, we match 17,438 observations, equivalent to 36.6% of the initial sample. We use this data to create a variable measuring total national production of the respective sectors year by year.

### *Institution-level corruption indices*

We introduce institution-level corruption indices for a subset of 13 institutions in our sample.<sup>26</sup> In total, this covers 15,640 of our initial observations, equivalent to 32.8% of the total. These indices were developed by the NGO *Transparencia Paraguay* between 2004 and 2008 (see Appendix for details).

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<sup>25</sup>Systematic data on total sales, profits, etc., for the whole universe of firms could not be accessed due to confidentiality restrictions.

<sup>26</sup>The institutions are Customs, the Senate, the Ministry of Education, the Supreme Court, the Social Prevision Institute, the Ministry of Agriculture, the National Housing Council, the Ministry of Justice, the Ministry of Health, the Superior Tribunal for Electoral Justice, the National Institute for Rural Land Development, the Public Ministry (Public Prosecutors' Office), and the Police (which belongs to the Ministry of Interior).

## 2.6 Corruption and the Structure of Purchases

### 2.6.1 Methodology

First, we want to test one of the model’s main predictions, namely the fact that the use of exceptional purchases *increases* in the share of institutions’ purchases in national sectoral production.

Our unit of observation is the individual purchase. Each of the 47,615 purchases available corresponds to a pair composed of a firm  $i$  and an institution  $j$ . The data set includes 73 institutions and 5517 firms, and in total there are 13,693 different “active” pairs, with an average number of contracts equal to 3.5 (std. dev. 10.5), a minimum of 1 (for 7,215 pairs) and a maximum of 460.

We estimate the following model:

$$exc_{ijkt} = 1[exc^* = \theta_i + \theta_j + \theta_k + \theta_t + \theta_{jt} + \beta_1 Q_{jkt} + X_{ijkt}\beta_2 + \varepsilon_{ijkt} > 0], \quad (2.7)$$

where  $1[\cdot]$  is an indicator function equal to 1 if the statement in brackets is true,  $exc$  is a binary variable equal to 1 if the contract is made through the exception,  $\theta$ ’s are firm ( $i$ ), institution ( $j$ ), good ( $k$ ), year ( $t$ ), and institution-year ( $jt$ ) fixed effects,  $X_{ijkt}$  is a vector of controls, and  $Q_{jkt}$  is the share of the total national production of good  $k$  procured by institution  $j$  in year  $t$ . We expect  $\beta_1$  to be positive.

The vector of controls includes firm-institution level variables: the total value of each pair’s transactions, and the proportion of an institution’s transactions done with each particular provider. These variables are meant to control for additional political or personal connections, and other effects such as reputation, which may influence contract allocation. We report these results, as they turn out to be relevant when we later introduce institution-level corruption. Other controls include the size of contracts, as we expect larger contracts that carry the obligation of an open bidding procedure to induce a different behaviour, and the yearly level of production of the sector, to ensure that our results are not polluted by sector size effects, for example if smaller sectors are more dependent on public procurement and therefore more subject to abuses. These results are omitted to save space.

The inclusion of fixed effects allows us to capture any systematic determinants of exceptional purchase that would correspond to characteristics of the firms (competitive advantage, exclusive dealing on a specific good), the goods (patented or monopolistic goods) and the institutions (specifically dedicated to

attend emergencies, involved in defence deals, etc., possibly with changes over time), as well as specific time fluctuations or trend in the use of exceptions. Once these fixed effects are introduced, we expect no additional features to be significant if procurement rules are applied correctly.

We use a linear probability model to estimate the model above. The inclusion of fixed effects prevents us from using a Probit estimation, while a conditional Logit would imply eliminating any pair for which there is no within variation, therefore reducing the final sample by approximately half.

## 2.6.2 Results

Table 2.1 contains the first set of results. It shows that more corruption (exceptional purchase) occurs when a public institution is a big buyer on the market, in the sense of purchasing a large share of a sector's production. In columns (1) to (4), the variable  $Q_{jkt}$  (Procurement/Nat.Prod $_{jkt}$ ) is systematically positive and significant. One additional percentage point in the share of the sector's production implies a 0.2 to 0.3% increase in the probability of using the exception. It is hard to think of an explanation other than corruption to explain the positive sign of the variable  $Q_{jkt}$ .

This result is key to understanding the distortions induced by corrupt procurement. Indeed, it tells us that in each sector the prevalence of wrongdoings is positively related to the weight of the public sector as a client. The economic effect is far from trivial. Domestic producers in sectors in which public purchases represent around 25% of total sales, such as drugs or machinery, face a 5 to 8% additional probability of being favoured with exceptional purchases compared with other sectors where public intervention is marginal (around 1% for transport or food for example). Given the extra-profitability that we uncover in the next section, this clearly increases the attractiveness of these activities.

Moreover, this is reinforced by the nature of specific institution-firm interactions. In columns (2) to (4), we also show that firm-institution pairs that do more business together use the exceptional purchase mechanism more often. The coefficient for the total value of a pair's transactions (*firm\_instit\_val*) in column (2) implies that an additional US\$ 200,000 translate in an increase of 0.4% in the probability to use the exception. The coefficient for the share of institutions' transactions done with each particular provider (*instit\_firm\_val\_share*) in column (3) implies that an institution that increases the share of its total procurement volume allocated to a particular firm by one standard deviation above the sample mean (that is 3.8% of its portfolio rather than 0.9%), would increase

the share of its contracts with that particular firm made through the exception by more than 13%. A pair with a volume of contracts two standard deviations above the sample mean (that is 6.7% of the institution’s portfolio rather than 0.9%), would use the exception for 22% of its contracts.

Table 2.1: Exceptional purchase determinants

<i>Dep. Variable:</i>	(1)	(2)	(3)	(4)	(5)	(6)
<b>Exc. Purchase</b>	Matched goods sample only			Full sample		2004-2005 only
Procurement/Nat.Prod <sub>ikt</sub>	0.178** (0.0834)	0.167** (0.0817)	0.175** (0.0819)	0.0313*** (0.0108)		
Firm_instit_val		0.0430*** (0.0139)		0.0324** (0.0126)	0.000499 (0.0016)	0.0296*** (0.00719)
Instit_firm_val_share			0.135*** (0.0508)	0.101** (0.045)	0.0211 (0.0136)	0.0112 (0.00817)
Firms F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Instit. F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Goods F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Years F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Instit*years F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17438	17438	17438	17438	47615	22180
R-squared	0.597	0.597	0.597	0.598	0.532	0.524

Robust standard errors in parentheses, clustered at the institution level. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Note: *Procurement/Nat.Prod<sub>ikt</sub>* = institution  $j$ 's purchase of good  $k$  as a fraction of sector  $k$ 's production; *firm\_instit\_val* = total value of pair  $ij$  contracts; *instit\_firm\_val\_share* = value of institution  $j$  contracts with firm  $i$  as a share of total value of institution  $j$  contracts.

In columns (5) and (6), we run some robustness checks on the pair variables, using alternative samples.<sup>27</sup> First, we use the whole sample, and then restrict ourselves to the period 2004-2005, in which the prevalence of exceptional purchases was higher. In both cases, the signs are as expected and the *instit\_firm\_val\_share* variable is nearly significant at the 10% level, while *firm\_instit\_val* is strongly significant in the 2004-2005 sample.

Alternative interpretations are possible for the results that frequent pair interactions lead to more contracts through the exception. For example, one could argue that a “reputation” effect is at play. In circumstances where public institutions need to use exceptional mechanisms, for example because of some social emergency, they naturally turn to firms they have had frequent interactions with, because they know these are more reliable. Yet another explanation would involve simple inefficiency or passive waste, as Bandiera et al. (2009) document in the case of public procurement in Italy. Here, the argument would be that procurement officials simply award contracts to firms they already know, because they do not internalize the new rules (they may be badly informed about the

<sup>27</sup>As we include all good categories, this forces us to exclude the production share variable.



regulations and fail to respect deadlines or to advertise the calls for applications) or because they are lazy and it is the solution that requires less effort. While the “reputation” explanation is clearly the most efficient, the welfare implications of the inefficiency relative to the corruption stories depend on a few factors. Bandiera et al. (2009) point out that in the case of corruption, the procurement agent derives utility from transactions, where as passive waste entails utility for no one. However, by generating rents in the public procurement sector, corruption attracts the most talented entrepreneurs to industries where corrupt public sector institutions are most active. This misallocation of talent, which is the topic of the next section, can entail very high welfare costs as it raises the price of goods and services purchased by both private and public demand.

To evaluate both the “reputation” and the “efficiency” arguments and compare them to the “corruption” story, we can use the result of proposition 2.4. It suggests that institutions more exposed to public scrutiny use less exceptional purchase. We use the institution-level corruption indices described in the data section to proxy for this exposure. We measure corruption with a synthetic index equal to the arithmetic mean of the three original indices, namely the evaluations based on the Comptroller General’s report and on the number of administrative indictments in any given institution, and the number of newspaper articles mentioning corruption in the institution.<sup>28</sup>

We introduce the following specification:

$$exc_{ijkt} = 1[exc^* = \theta_i + \theta_j + \theta_k + \theta_t + \beta_1 Q_{jkt} + \beta_2 Inst Corr_{jt} + X_{ij}\beta_3 + (X_{ij} * Inst Corr_{jt})\beta_4 + X_{ijkt}\beta_5 + \varepsilon_{ijkt} > 0]. \quad (2.8)$$

If the corruption story is relevant, we expect  $\beta_2$ , and especially  $\beta_4$  to be positive.

The results in Table 2.2 support the corruption hypothesis. In columns (1) to (3), we restrict our sample to the observations matched to the National Accounts. Note that the variable measuring the share of procurement demand in national production is again positive and strongly significant.

In column (1), corruption introduced alone is positive (more corruption corresponds to a higher value of the index) and nearly significant.<sup>29</sup> In column (2),

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<sup>28</sup>The news index might be subject to caution, as press coverage of specific institutions, based for example on journalists inquiries or on denunciations, is likely to be influenced by the nature of the institutions and their past behaviour in procurement or other activities. Using only the mean of the evaluations based on the Comptroller General’s report and on the number of administrative indictments in any given institution yields similar results.

<sup>29</sup>Note that when corruption is introduced alone, it rules out the use of institution-year fixed

pairs' contract value becomes negative, while its interaction with corruption is positive and significant. This confirms that the link between frequent interactions and exceptional purchases is mediated by corruption. Compared with Table 2.1, the effect is 4 times larger for an institution that is at the top of the corrupt scale (an additional US\$ 200,000 translate in an increase of 1.6% in the probability of using the exception, i.e., such an institution would use it for 20% of its contracts). In column (3), the share of an institution's transactions done with a particular provider is now negative, while its interaction with corruption is positive and nearly significant at the 10% level. Again comparing with Table 2.1, the effect is 9 times larger for an institution at the top of the corrupt scale: for one additional standard deviation above the sample mean, this institution now has 120% more contracts by exception than the sample mean, i.e., it would use it for 38% of its total purchases with that firm.

Table 2.2: Exceptional purchase determinants and institution-level corruption

<i>Dep. Variable:</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<b>Exc. Purchase</b>	Matched goods sample only			Full sample		2004-2005 only			
Procurement/Nat.Prod <sub>ikt</sub>	1.026*	0.838*	0.813*						
	(0.472)	(0.398)	(0.405)						
Corruption	0.0212			0.0119*			0.234***		
	(0.017)			(0.00617)			(0.0412)		
Firm_instit_val		-0.0381			0.0245			-0.096	
		(0.0681)			(0.0209)			(0.0555)	
Val <sub>ij</sub> _corrupt		0.0198**			0.00354			0.0270***	
		(0.00866)			(0.00429)			(0.00838)	
Instit_firm_val_share			-0.0385			-0.148			-0.151
			(0.284)			(0.103)			(0.148)
Share <sub>j</sub> _val <sub>ij</sub> _corrupt			0.124			0.0746*			0.0605
			(0.0808)			(0.0411)			(0.0443)
Firms F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Instit. F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Goods F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Years F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Instit*years F.E.		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5435	5435	5435	15640	15640	15640	3474	3474	3474
R-squared	0.692	0.712	0.712	0.582	0.602	0.602	0.605	0.609	0.608

Robust standard errors in parentheses, clustered at the institution level. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Note:  $val_{ij\_corrupt}$  = interaction ( $firm\_instit\_val$ \* institution corruption index); See Table 2.1 notes for other definitions.

In columns (4) to (6), we perform robustness checks on the whole sample, and in columns (7) to (9) we use the 2004-2005 subsample. Corruption alone is now strongly significant. In the 2004-2005 subsample, a 1 point increase in the 10 points scale implies a 23% increase in the probability that the exception is used. The interaction terms are again as expected. In column (6), the  $instit\_firm\_val\_share_{ijkt}$  variable is negative, while its interaction with corruption is positive and significant at the 10% level, and it is also nearly so in column effects. When introducing interactions, we prefer to control for these fixed effects rather than just for corruption, as they capture the whole set of institution-year unobserved effects.

(9). In column (8), the  $firm\_instit\_val_{ijkt}$  variable is negative, while its interaction with corruption is positive and significant at the 1% level. The marginal effects are comparable to those described above.

In the next Section, we show how this higher prevalence of corruption in sectors where public institutions are big clients, and with specific frequent sellers, distorts the profitability of firms.

## 2.7 The Profitability of Firms

The model second prediction is that, as a result of the corrupt practices unveiled above, entrepreneurs doing business with public institutions are more profitable than their counterparts serving private consumers. As a result, we expect the most able entrepreneurs to self-select into the more profitable procurement activities, as only they are efficient enough to afford both the entry cost to formality and the bribes to public officials.

### 2.7.1 Methodology

To test these effects, we first perform a reduced form analysis of the effect on firms' profits of a number of variables, derived from the results in the previous section. As a proxy for the share of "favoured" contracts in the firm's portfolio, we use the share of a firm's contracts made through the exception, and the weighted average level of corruption of the institutions it deals with (where the weights are the share of the sales to these institutions in the firm's total sales). In addition, we also use firms' amount and number of contracts.

The amount of taxes paid provides a reasonable approximation for profits because the tax rate on gains is flat and uniform in each period (30% in 2004, 20% in 2005, 10% in 2006 and 2007). While the inclusion of other taxes (among which custom duties are by far the largest component) introduces some noise in the mapping between profits and taxes paid, we control for total imports in all estimations to minimise this issue. The model we want to estimate is:

$$G_{it} = \alpha + \beta_1 Z_{it} + \beta_2 M_{it} + X_{it} \beta_3 + \theta_t + \varepsilon_{it}, \quad (2.9)$$

where  $G_{it}$  denotes the net gains of firm  $i$  in year  $t$ ,  $Z_{it}$  is the variable of interest (alternatively, the share of sales through the exception, average corruption of buyers, total sales to the state, number of contracts),  $M_{it}$  is the total amount imported,  $X_{it}$  is a vector of control variables, and  $\theta_t$  are time fixed effects.



However, the income tax and other taxes are amalgamated in the tax data, so we only observe:

$$T_{it} = x_t G_{it} + \delta_i M_{it} + \nu_{it}, \quad (2.10)$$

where  $x_t = 0.3$  for 2004,  $x_t = 0.2$  for 2005, and  $x_t = 0.1$  for 2006 and 2007. In order to obtain the firms' net gains we therefore divide the total amount paid in taxes by the corresponding tax rates.

The distribution of profits resulting from the available data is truncated at a strictly positive point. Moreover, the set of firms for which we have non-zero tax data is not constant over time. This forces us to restrict the panel to the subset of strictly positive tax observations.<sup>30</sup> As a result, we obtain an unbalanced panel of 2167 observations across 4 years for 1017 private firms.

Using this sample, we test the following specification:

$$T_{it}/x_t = \alpha + \beta_1 Z_{it} + (\beta_2 + \delta_i/x_t) M_{it} + X_{it} \beta_3 + \theta_t + \varepsilon_{it} + \frac{\nu_{it}}{x_t}, \quad (2.11)$$

under the assumption that  $Z_{it}$  is uncorrelated with  $\nu_{it}$ .

One worry is that unobserved firm characteristics might be correlated both with the amount of taxes paid and with some of the  $Z_{it}$  variables on the right hand side.<sup>31</sup> For example, more efficient entrepreneurs might be more successful in general, hence pay more taxes, and also win more procurement contracts or be more frequently favoured through exception because of their good reputation. Another concern is related to firm size. Indeed, bigger firms may have larger overall profits and also be in a better position to win procurement contracts or to respond to emergency calls from public institutions. To address such issues, we add firm level fixed effects  $\theta_i$  to (2.11), exploiting the panel dimension of the data to wash out any time invariant firm-level unobserved characteristics.<sup>32</sup>

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<sup>30</sup>Using all the observations to measure the variations in net gains, we would have some positive measurement errors (when a firm's tax observation is out of the sample and therefore set at zero for one year and is positive the following one), some negative ones (in the reverse case), and more generally errors going either way for firms that do not make it to the ranking of top taxpayers.

<sup>31</sup>Note however that such endogeneity concerns are much less obvious for variables such as the average level of corruption.

<sup>32</sup>We do not have additional firm-level data to control for such general characteristics. Fixed effects will take care of the size issue as long as it is reasonably constant over the period of study.

## 2.7.2 Results

The results in Table 2.3 support our hypotheses. Column (1) shows that firms' profits are significantly increasing in the share of its contracts made by exceptional purchase. The average marginal effect implies that a 1 percent increase in the share of contracts made by exception corresponds to Gs. 28 millions (US\$ 5,600) additional profits.

In column (2), the correlation between the average level of corruption of public buyers and firms' profitability is positive but only nearly significant at conventional levels, which is not surprising given that the sample size is reduced to 261 since corruption indices are not available for all institutions.

Table 2.3: Procurement and profitability of firms

<i>Dep. Variable:</i>	(1)	(2)	(3)	(4)
<b>Gain</b>	Random Effects	Fixed Effects	Fixed Effects	Fixed Effects
Imports	0.001*** (0.000)	0.003*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Exports	0.000** (0.000)	-0.024 (0.021)	0.001** (0.000)	0.001** (0.000)
Exceptional purchase	2.834** (1.412)			
Corruption index		1.205 (0.814)		
Amount sold			0.293*** (0.108)	
Number of contracts				0.154** (0.062)
Time F.E.	Yes	Yes	Yes	Yes
Firms F.E.	No	Yes	Yes	Yes
Observations	476	261	2167	2167
R-squared	0.46	0.66	0.25	0.25
Hausman chi2	0.4	0	0	0

Standard errors in parentheses, clustered at the institution level. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Note: All data adjusted for yearly price variations. In each case, we test the appropriateness of the random versus the fixed effect model, using the standard Hausman test. We report only the specification supported by the test.

Finally, in columns (3) and (4), we look directly at the correlation between firms' profits and their procurement activity. The coefficients of both the amounts sold and the number of contracts are positive and significant. In terms of marginal effects, every additional Gs. sold to the state translates into a Gs. 0.29 increase in profits, i.e., a rate of return on procurement operations of nearly 29%, while a firm obtaining an additional contract increases its profits by Gs. 154 millions

(approx. US\$ 30,800).<sup>33</sup>

A technical concern has to do with tax evasion. Indeed, it is likely that Paraguayan firms do not report all of their sales for tax purpose, possibly biasing our estimations. One could think that sales to the State, because they are publicly registered, imply lower rates of evasion than other sales, in which case we may be facing an upward bias in our estimations. However, strong anecdotal evidence does suggest that well-connected firms use their influence to evade a bigger share of their tax obligations. Large state providers exploit loopholes in the tax system, in particular the fact that in Paraguay there is not tax on personal gains, to transfer firms' benefits to non-taxable kind of revenues. This leads us to think that our estimates should be considered as a lower bound on the true returns of these firms.

These results, together with those of the previous Section showing that corruption looms larger in sector with important public purchases, imply that average profitability should be higher in sectors with an important procurement component. In turn, this is likely to distort firms' incentives and induce additional entry of potential entrepreneurs into these sectors. Next, we provide evidence of this self-selection process.

### 2.7.3 Misallocation of Talents

An important point of the model is that firms' unobserved attributes (entrepreneurial or networking skills, efficiency, etc.) should explain part of their increased profitability due to a self-selection process. Some of the best entrepreneurs are attracted to sectors where they can benefit from the corrupt allocation of procurement contracts, resulting in a misallocation of talents in the economy.

The following test explicitly addresses the process of self-selection into the procurement sector, using a procedure proposed by Wooldridge (2002, p 631) to correct for the failure of the ignorability-of-treatment assumption.<sup>34</sup> This entails estimating first a Probit model to explain the fact that firms intervene in the procurement sector or not:

$$Y_i = 1 [Y_i^* = \theta_0 + X_i\theta_1 + S_i\theta_2 + e_i > 0], \quad (2.12)$$

where  $Y_i$  is a dummy variable equal to 1 if the firm sells to public institutions at

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<sup>33</sup>Results not shown here to save space indicate that the results in columns (1) and (2) are robust to systematically controlling for the amounts of firms' sales to the State.

<sup>34</sup>Fafchamps and La Ferrara (2009) apply this technique to control for individuals' self-selection into self-help groups based on unobservable characteristics.

any point during the sample period,  $X_i$  is a vector of firm-level observables, and  $S_i$  is a set of instruments. From (2.12), we derive  $\hat{\phi}$ , the predicted density and  $\hat{\Phi}$ , the corresponding predicted cumulative density. We then estimate, for each year, the following tobit model:

$$G_{it} = \max \left[ 0, \alpha + \beta_1 Z_{it} + X_{it} \beta_2 + \beta_3 Y_i \frac{\hat{\phi}}{\hat{\Phi}} + \beta_4 (1 - Y_i) \frac{\hat{\phi}}{1 - \hat{\Phi}} + \varepsilon_{it} \right]. \quad (2.13)$$

Remember that  $G_{it}$  denotes the net gains of firm  $i$  in year  $t$ ,  $Z_{it}$  is either total firm's sales to the state or its total number of contracts, and  $X_{it}$  is a vector of control variables. We are interested in the statistical significance of the two last regressors, as an indication of self-selection, as well as in how their inclusion will affect the coefficient  $\beta_1$ .

The crucial point is the availability of suitable instruments, that would predict access to the procurement sector, while being excludable from the second stage. To generate instruments, we exploit the fact that apart from raising the cost of procurement and changing the identity of sellers, corruption also distorts the sectorial abundance of firms. We capture this bias by exploiting firms' names, which are specific to the procurement categories where a large number of firms are active (see ranking in Figure A.1). First, there is a large number of contracts in office and machinery categories sold by commercial intermediaries; locally, these are often nicknamed "suitcase firms", because they specialise in importing and selling any item upon request.<sup>35</sup> Next, many contracts are in the construction and maintenance categories. Finally, we also focus on services, which are generally provided by consulting firms.

For each of these three groups, we define sets of related words and create three dummy variables, equal to one if at least one of the specific words appears in the firms' official denomination.<sup>36</sup> The first stage shows that our instruments are very strong predictors of firms being active in procurement (see Appendix). Note that there is no reason to think that names influence firms' profitability directly, supporting the excludability requirements.

Table 2.4 shows the results from estimating (2.13) on a sample of 12,759

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<sup>35</sup>For example, one of the firms in our sample, run by a member of close circuit of the former president (also member of the Masonic lodge and honorary consul of an Eastern European country), won 301 contracts between 2004 and 2007, for close to \$1.45m worth of office supplies, electric material, cooking utensils, textile, chemical products, cleaning products, computing equipment, Paraguayan flags, etc.

<sup>36</sup>See the Appendix for the specific list of words used and descriptive statistics on these dummy variables.

firms. For each year, we first display the results from a standard tobit estimation and then provide the results including self-selection correction terms, with bootstrapped standard errors. Panel 1 uses the total volume of procurement contracts as our variable of interest  $Z_{it}$ , while panel 2 uses the total number of contracts.

Table 2.4: Self-selection into procurement and firms' profitability

Panel 1 <i>Dep. Variable:</i>	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		
	Gains 2004		Gains 2005		Gains 2006		Gains 2007		Tobit		Tobit		Tobit		Tobit		
	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	
Volume of contracts	0.009 (0.006)	0.008 (0.019)	0.041** (0.016)	0.041 (0.034)	0.129*** (0.035)	0.105 (0.141)	0.075*** (0.026)	0.068 (0.159)									
Import dummy	3.701*** (1.130)	4.101*** (1.315)	10.653*** (3.172)	11.527*** (3.855)	27.689*** (7.237)	29.632*** (8.087)	30.8*** (8.443)	33.454*** (9.323)									
Import volume	0.000*** (0.000)	0.000*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001** (0.000)	0.001*** (0.000)	0.001*** (0.000)									
Export dummy	1.387*** (0.512)	1.44*** (0.553)	4.173*** (1.402)	4.658*** (1.690)	25.662*** (7.185)	29.741*** (8.254)	17.759*** (5.610)	17.168*** (5.732)									
Export volume	0.000 (0.000)	0.000 (0.000)	-0.001* (0.000)	0.000 (0.000)	0.001 (0.001)	0.001 (0.001)	0.001*** (0.000)	0.001 (0.001)									
mills1		1.035*** (0.283)		1.552*** (0.470)		10.834*** (2.583)		10.103*** (2.465)									
mills2		3.816*** (1.172)		6.741*** (2.201)		24.041*** (6.138)		25.15*** (6.823)									
Pseudo R2	0.185	0.232	0.275	0.289	0.133	0.162	0.156	0.178									
Observations	12759	12759	12759	12759	12759	12759	12759	12759									

Panel 2 <i>Dep. Variable:</i>	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		
	Gains 2004		Gains 2005		Gains 2006		Gains 2007		Tobit		Tobit		Tobit		Tobit		
	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	
Number of contracts	0.01 (0.008)	0.007 (0.009)	0.032** (0.016)	0.026 (0.024)	0.27*** (0.069)	0.187*** (0.061)	0.256*** (0.083)	0.15** (0.072)									
Import dummy	3.696*** (1.133)	4.101*** (1.386)	10.625*** (3.179)	11.511*** (3.634)	27.721*** (7.255)	29.748*** (7.935)	30.746*** (8.429)	33.512*** (9.360)									
Import volume	0.000*** (0.000)	0.000*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)									
Export dummy	1.381*** (0.514)	1.44** (0.566)	4.148*** (1.412)	4.653*** (1.606)	25.895*** (7.235)	29.942*** (8.331)	17.438*** (5.541)	17.196*** (5.616)									
Export volume	0.000 (0.000)	0.000 (0.000)	-0.001* (0.000)	0.000 (0.000)	0.001 (0.001)	0.001 (0.001)	0.001*** (0.000)	0.001 (0.001)									
mills1		1.02*** (0.289)		1.501*** (0.486)		10.328*** (2.446)		9.694*** (2.312)									
mills2		3.817*** (1.229)		6.741*** (2.063)		24.171*** (6.130)		25.232*** (6.751)									
Pseudo R2	0.186	0.232	0.275	0.289	0.135	0.162	0.157	0.178									
Observations	12759	12759	12759	12759	12759	12759	12759	12759									

Robust standard errors in parentheses (bootstrapped with 500 replications when mills ratios are included). \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$   
Tobit specifications with left truncation at the lowest observed profit level in each year. For each specification, explanatory variables correspond to the relevant year.

The correction terms are strongly significant (at the 1% level) in all estimations. Moreover, their inclusion systematically induces a reduction in the estimated coefficients of the variables of interest. The marginal effect of firms' contract volume on their profitability is reduced by between 9 and 19% (except in 2005, when it remains constant), and loses significance in the last three years. Similarly, the marginal effect of the number of contracts is reduced by between 19 and 42%, and becomes insignificant in the 2005 sample.

We conclude that part of the link between procurement and firms' profitability relates to unobserved self-selection of entrepreneurs into activities that offer

privileged access to the procurement sector. This provides the final element of our story, in which would-be entrepreneurs are likely to be disproportionately attracted to sectors in which strong demand from corrupt public buyers generate opportunities for rent-seeking.

## 2.8 Conclusion

We have illustrated the fact that rent-seeking is costly to development, by showing how entrepreneurs' economic incentives are distorted toward unproductive activities as the result of favouritism in the allocation of public contracts in Paraguay. After building an industrial organisation model, we have used a large scale microeconomic database including all public procurement operations over a 4 year period to test the predictions of the model. In Paraguay, institutions with an important procurement activity are more likely to engage in corrupt dealings. As for firms, they have a greater probability of obtaining a contract directly through an exceptional procedure from an institution with which they have a strong contractual relation, both in terms of the total value and frequency of transactions, particularly when dealing with more corrupt State entities.

We have also shown that firms trading more with the public sector are more profitable, even when controlling for their unobserved characteristics. This overall picture embodies the consequences of a systematic misallocation of talents à la Murphy et al. (1991). In this sense, rent-seeking is particularly costly because it destroys the development potential of the best entrepreneurs.

Indeed, the Paraguayan entrepreneurial class is in its overwhelming majority imports-oriented, with over 90% of the top 500 taxpayers being importers. Over the decade 1996-2005, the commercial balance displayed an average deficit of 8.5% of GDP. Large rents linked to the resale of imported goods to the State and the historical absence of an import-substitution strategy have contributed to make Paraguay one of the least industrialised economies in South America as, apart from the soybean and meat sectors, its entrepreneurs have systematically specialised in commercial intermediation, often with the public sector as sole client, rather than in production.<sup>37</sup>

The costs of this productive atrophy and biased specialisation are reflected in the poor record of economic growth. After a period of significant growth in the 1970s and early 1980s, linked in particular to the massive construction projects

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<sup>37</sup>This has also fuelled a flourishing and illegal reexportation business to the neighbours Brazil and Argentina. See Masi (2007) and Straub (1998) for more details on this.

including the hydroelectric dams, the rate of growth of per capita income was only 0.8% in the 1980s and strictly negative after that (-0.1% and -0.6% in the 1990s and 2000s). Over the last two decades, the Paraguayan Central Bank indicates that 92% of growth fluctuations were due directly to fluctuation in agricultural production and exports. As a result, per capita income was lower in real terms in 2005 than it was at the beginning of the 1980s.



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## A.1 The Model

### A.1.1 Proof of proposition 2.1

**Proof.** The traditional method of production is less efficient than the modern method, so in the absence of an entry fee the informal sector disappears. Indeed, when  $F = 0$ , the best technology prevails so that in equilibrium  $p^* = \underline{c} = 0$ . However this outcome is upset when  $F > 0$ , as firms need a mark-up to cover  $F$ . More generally let  $c \in [\underline{c}, \bar{c}]$ . Under competitive pressure the smallest possible price compatible with a firm breaking even is so that  $(p - \underline{c})(D(p) + \frac{Q\bar{c}}{p}) = F$ . Setting  $\underline{c} = 0$  and  $D(p) = A - p$  yield  $p(A - p) + Q\bar{c} = F$ . Solving this second order equation in  $p$  we obtain  $p^{f*} = A/2 - \sqrt{A^2/4 + Q\bar{c} - F}$ . In equilibrium formality prevails if  $p^{f*} \leq p^I = \bar{c}$ . Proposition 2.1 follows. ■

### A.1.2 Proof of proposition 2.2 and of $\frac{db_G^r(\phi)}{d\phi} \leq 0$

**Proof.** Substituting  $c^r(b)$  from (2.2), we get  $B = b\bar{c}Q \left(1 - G\left(\frac{b\bar{c}Q+F}{\bar{c}Q+F}\right)\right)$ . Under the assumption that  $G(\cdot)$  is convex, one can easily check that  $EB(b)$  is concave in  $b \in [0, 1]$ . The first order condition is sufficient, so that the optimal bribe rate, denoted  $b^r$ , solves  $\frac{dEB(b)}{db} = 0$ . Proposition 2.2 follows. ■

**Proof.** Let  $\phi = \frac{F}{Q\bar{c}}$  and let  $V(\phi, b) = \frac{1}{1+\phi} H_G\left(\frac{b+\phi}{1+\phi}\right)$ . It is straightforward to check that under the assumption that  $G(x)$  is increasing and convex,  $\frac{\partial V(\phi, b)}{\partial b} > 0$ .



By virtue of Proposition 2.2,  $b_G^r(\phi)$  is such that:  $V(\phi, b) = \frac{1}{b}$ . Since  $V$  increases with  $b$  while  $\frac{1}{b}$  decreases with  $b$  these functions cross only once. A sufficient condition for  $\frac{db_G^r(\phi)}{d\phi} \leq 0$  is that  $\frac{\partial V(\phi, b)}{\partial \phi} > 0 \forall b \in [0, 1]$ , which is equivalent to  $-H_G\left(\frac{b+\phi}{1+\phi}\right) + \frac{1-b}{1+\phi}H'_G\left(\frac{b+\phi}{1+\phi}\right) \geq 0 \forall b \in [0, 1]$ . A sufficient condition for the result to hold is thus  $\frac{\partial \log(H_G(\frac{b+\phi}{1+\phi}))}{\partial \phi} \geq \frac{1}{1+\phi} \forall b \in [0, 1]$ . This technical condition depends on the distribution function  $G(x)$ . An example of function that meets the paper conditions is  $G(x) = x^2 \forall x \in [0, 1]$ . One can check that  $\frac{\partial V(\phi, b)}{\partial \phi} \geq 0$  is then equivalent to  $\frac{1-b}{b+\phi} + 2\frac{b+\phi}{1+2\phi+b} \geq 1 \forall b \in [0, 1]$ . Differentiating the left hand side of the inequality with respect to  $b$  it is straightforward to check that it is decreasing with  $b$ . We deduce that  $\frac{1-b}{b+\phi} + 2\frac{b+\phi}{1+2\phi+b} \geq \frac{1-1}{1+\phi} + 2\frac{1+\phi}{1+2\phi+1} = 1$ . Computing the optimal bribe rate we get:  $b^r = \frac{\phi}{3} \left( \sqrt{3\left(\frac{1}{\phi} + 1\right)^2 + 1} - 2 \right)$ . ■

### A.1.3 Proof of proposition 2.3

**Proof.** Let  $\kappa = \frac{F}{\bar{c}Q+F} \in [0, 1)$ . Let  $\beta(b) = \frac{b\bar{c}Q+F}{\bar{c}Q+F} \in [\kappa, 1]$ . Let  $H_G(x) = \frac{g(x)}{1-G(x)}$  (respectively  $H_F(x) = \frac{f(x)}{1-F(x)}$ ) be the hazard rate function associated to the distribution function  $G(x)$  (respectively  $F(x)$ )  $\forall x \in [0, 1]$ . Then, by virtue of equation (2.3),  $\beta_G^r = \beta(b_G^r)$  is such that  $\frac{1}{H_G(\beta_G^r)} = \beta_G^r - \kappa$ , while  $\beta_F^r$  is such that  $\frac{1}{H_F(\beta_F^r)} = \beta_F^r - \kappa$ . Under the assumption that the distribution functions are convex the inverse of the hazard rate function,  $\frac{1}{H_F(x)}$  and  $\frac{1}{H_G(x)}$ , are decreasing in  $x$ . Moreover  $H_G(\beta) \leq H_F(\beta)$  implies  $\frac{1}{H_F(\beta)} \leq \frac{1}{H_G(\beta)} \forall \beta \in [\kappa, 1]$ . We deduce that  $\beta_G^r \geq \beta_F^r$  which implies  $b_G^r \geq b_F^r$ . ■

### A.1.4 Proof of proposition 2.4

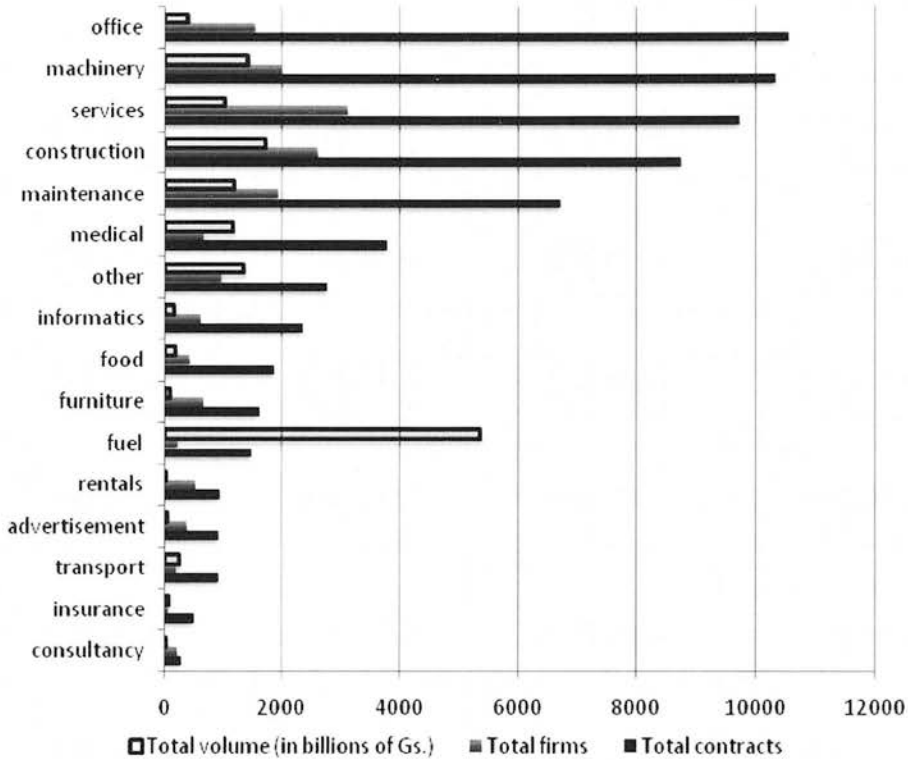
**Proof.** Let  $\phi = \frac{F}{Q\bar{c}}$ . Substituting  $b_G^r(\phi)$ , implicitly defined by equation (2.3), in equation (2.2) yields  $c^r(\phi)$  as defined in proposition 2.4. In the formal productive sector, under the pressure of competition the best available technology prevails. The price in the formal economy is such that  $(p - c^r(\phi))D(p) = F$  which is equivalent to  $(p - c^r(\phi))(A - p) = F$ . Rearranging yields:  $-p^2 + [A + c^r(\phi)]p - [F + Ac^r(\phi)] = 0$ . Solving this second degree equation in  $p$  yields the value of the price in the formal sector (i.e., the lowest root):  $p^f = \frac{1}{2} \left[ A + c^r(\phi) - \sqrt{[A - c^r(\phi)]^2 - 4F} \right]$ . Finally the formal productive sector prevails in equilibrium if and only if  $p^f \leq p^I = \bar{c}$ . One can check after some computations that this is equivalent to equation (2.6).

Finally we check that  $\frac{dq^r}{dQ} > 0$ . Let  $q^r = \frac{\bar{c}Q}{c^r(\phi)}$ . We deduce that:  $\frac{dq^r}{dQ} = \frac{\bar{c}}{c^r(\phi)} - \frac{d\phi}{dQ} \frac{dc^r(\phi)}{d\phi} \frac{\bar{c}Q}{c^r(\phi)^2}$ . Substituting the derivative of  $\phi = \frac{F}{Q\bar{c}}$  by its value  $\frac{d\phi}{dQ} = \frac{-\phi}{Q}$ , this is equivalent to:  $\frac{dq^r}{dQ} = \frac{\bar{c}}{c^r(\phi)^2} \left( c^r(\phi) + \phi \frac{dc^r(\phi)}{d\phi} \right)$ . We deduce that  $\frac{dq^r}{dQ} > 0$  if  $\frac{dc^r(\phi)}{d\phi} > -\frac{c^r(\phi)}{\phi}$ . By virtue of equation (2.2) we have  $\frac{dc^r(\phi)}{d\phi} = \frac{\bar{c}}{(1+\phi)^2} \left( -\frac{db_G^r(\phi)}{d\phi} (1+\phi) - (1-b_G^r(\phi)) \right)$ . We deduce that  $\frac{dq^r}{dQ} > 0$  if  $\frac{\bar{c}}{(1+\phi)^2} \left( -\frac{db_G^r(\phi)}{d\phi} (1+\phi) - (1-b_G^r(\phi)) \right) > -\frac{\bar{c}}{\phi} \frac{1-b_G^r(\phi)}{1+\phi}$ , which is equivalent to  $-\frac{db_G^r(\phi)}{d\phi} (1+\phi)\phi > -(1-b_G^r(\phi))$ . A sufficient condition is that  $\frac{db_G^r(\phi)}{d\phi} \leq 0$ . ■

## A.2 Procurement Data

Figure A1 shows the distribution of total volume and total number of contracts, as well as total number of firms active by categories of goods and services.

Figure A.1: Distribution of contracts and firms by types of goods



### A.2.1 Legal requirements for public procurement purchases

The 2.051/03 law of Public Procurement aims to promote competition among state providers and transparency in the procurement process. To this end, it regulates purchases differently according to their value.

The largest contracts (above 10,000 mdw; see Table A.1 below) are made through a Public Tendering. Calls for offers on such contracts must be published in the national press for a minimum of three days on top of the usual publication in the official newsletter and web site. The requirements and criteria for evaluation must be restricted to technically indispensable requisites. Grounds for disqualification must concern the failure to comply with substantial requisites, such as threatening the legality or solvency of the proposal. In this way calculus mistakes or mistakes in the layout of the offer, which were often used to justify

dismissal of an offer are no longer considered valid grounds. If two or more offers comply with the technical requirements, the offer with the lowest price wins. Bids and the winning offer are published on the web site.

The competitive bidding process (between 2,000 and 10,000 mdw) does not require a call for offers in the national press. However five different firms have to make offers and the call must be published on the web for any firm who might qualify to participate in the bidding.

When the value of the contract does not reach 2,000 mdw, the contracting institution can allocate the contract directly to a firm without organising an auction. It must however have published the call on the official web site and have received at least three official offers from different firms. contracts worth less than 20 mdw a 'fixed funds' mechanism was created to allow institutions to purchase directly from a single supplier without justification. This mechanism has no specific requirement on the number of offers or publication of the call for offers. We include it as a direct purchase.

Finally, in order to bypass costly administrative procedures in cases of "force majeure", the exceptional purchase mechanism described in the text was created. Under this regime, institutions can purchase as much as they want from a firm of their choice. The law stipulates that a report explaining the reasons of the purchase and justifying the choice of provider should be supplied to the national watchdog within a month after the date of purchase. In practice, this is rarely done.

Table A.1 summarises the evolution of the Paraguayan minimum daily wage, the Guarani/US\$ exchange rate, and the value of the thresholds defined above in US\$.

Table A.1: Minimum daily wage, exchange rate and procurement thresholds

	Until April 2004	April 2004 to March 2006	March 2006 to September 2007	Since September 2007
<b>Mdw in Gs.</b>	Gs. 37,401	Gs. 41,889	Gs. 46,915	Gs. 51,607
<b>Mdw in US\$</b>	6.28	6.78 - 7.47	8.37 - 9.34	10.28
<b>Exchange rate bounds</b>	1\$ = Gs. 5,955	Gs. 5,608 < 1\$ < Gs. 6,178	Gs. 5,021 < 1\$ < Gs. 5,608	1\$ = Gs. 5,021
<b>Procurement thresholds (US\$)</b>				
<b>20 mdw</b>	125.6	135.6 - 149.4	167.4 - 186.8	205.6
<b>2,000 mdw</b>	12,560	13,560 - 14,940	16,740 - 18,680	20,560
<b>10,000 mdw</b>	62,800	67,800 - 74,700	83,700 - 93,400	100,280

Note: Average exchange rate provided by BCP (Paraguay Central Bank), 1US\$ = Gs. 5955 in 2004, 1 US\$ = Gs.6178 in 2005, 1US\$ = Gs. 5608 in 2006, 1 US\$ = Gs.5021 in 2007.

## A.2.2 Institution corruption data

There are three tentative measures of corruption: the news index, which counts the number of newspaper articles referring to corruption cases involving each specific institution, published in the 3 main national newspapers each year; the control index, based on the Comptroller General's (the "contraloria") evaluation of each institution; and the trial index, summarising the number of outstanding administrative corruption cases in any given administration. We rescale all indices on a 0-10 scale, with 10 representing more corruption. The appeal of these indices, contrary to those based on perceptions of corruption, is the objectivity of the criteria used to construct them. More importantly, our theory calls for a measure of the probability of detection at the institution level, which is well captured by these indices as they are widely advertised.

## A.3 Empirical Evidence. Complements

### A.3.1 Descriptive statistics on the relationship between institution budget size, corruption and contracts size

The model predicts that public institutions with larger procurement budgets contract with more firms ( $\frac{dc(b^r)}{dQ} > 0$ ) and that their providers get larger contracts ( $\frac{dq^r}{dQ} \geq 0$ ).

For the 230 institution-year data points available, Table A.2 displays the empirical correlations between institutions total budget and average contract size, total number of contracts and of providers, as well as the level of corruption for the subset of 37 institution-year pairs available. The correlations between total budget and the first three variables are all positive and strongly significant, indicating that institutions with bigger procurement budgets do indeed offer more and larger lots to a larger pool of providers. Moreover, the average index of corruption (computed as the arithmetic mean of the indices defined above) displays the expected positive correlation, supporting the idea that large buyers are more corrupt (although the correlation is not significant due to the reduced sample size).

Table A.2: Institution-level correlations

	Average contract size	Number of contracts	Number of providers	Corruption measures
<b>Institution total budget</b>	0.95 <sup>a</sup>	0.18 <sup>a</sup>	0.27 <sup>a</sup>	0.19
<b>N</b>	230	230	230	37

<sup>a</sup> Significant at the 1% level.

### A.3.2 Self-selection dummies (Section 2.7.3)

We construct three dummy variables, equal to one if at least one of the specific keywords appears in the firms' official denomination and zero otherwise. The keywords are chosen so as to match standard names used by firms in the relevant sectors of activities (allowing for variations such as abbreviations):

- "Import-export" dummy: ferretería, comercial, distribuidora, casa, representación, servicio, supply, venta, supermercado, material, pieza, trade, import, export.

- “Construction and maintenance” dummy: ingeniero, arquitecto, mecanico, taller, repuesto.
- “Consulting” dummy: abogado, auditor, consultor, asociados, asesor, comunicación.

Table A.3 shows how these categories of firms are represented among state providers and non state providers respectively. Concerning excludability, as stated in the text, there is no reason why firms’ names would influence their profitability directly, other than through the nature of their branch of activity (the “construction” and “consultancy” dummies are actually negatively correlated with firm-level gains). The “import-export” dummy can be discussed on the ground that it may affect profitability through a distinct channel, namely the fact that firms in these activities could also be benefiting from the widespread smuggling rents available in the Paraguayan economy. To address this concern, we rerun the estimations excluding this variable from the set of instruments. Results, not shown here to save space, are identical to those in Table 2.4. Table A.4 presents the first stage estimations, including respectively the three instruments or only the last two.

Table A.3: Distribution of self-selection dummies

<b>State providers</b>	<b>0</b>	<b>1</b>	<b>Total</b>
<b>Impexp</b>			
<b>0</b>	7,035 (97.1%)	4,170 (75.7%)	11,745
<b>1</b>	213 (2.9%)	801 (24.3%)	1,014
<b>Construct</b>			
<b>0</b>	7,224 (99.7%)	4,983 (90.4%)	12,207
<b>1</b>	24 (0.3%)	528 (9.6%)	552
<b>Consult</b>			
<b>0</b>	7,246 (99.97%)	5,277 (95.8%)	12,523
<b>1</b>	2 (0.03%)	234 (4.2%)	236
<b>Total</b>	<b>7,248</b>	<b>5,511</b>	<b>12,759</b>

Note: In each cell, the number in parenthesis indicates the share of firms with or without the name attribute, as a percentage of the total of firms in the category (state provider or not). For example, firms in the “impexp” category represent 2.9% (213/7248) of non state providers, and 24.3% (801/5511) of state providers.



Table A.4: First stage estimations

	(1) State provider dummy	(2) State provider dummy
<b>impexp</b>	1.051 (0.080)***	
<b>construct</b>	1.540 (0.164)***	1.781 (0.163)**
<b>consult</b>	2.244 (0.547)***	2.170 (0.542)**
<b>Importer</b>	-2.414 (0.036)***	-2.415 (0.034)**
<b>Exporter</b>	-1.235 (0.074)***	-1.241 (0.076)**
<b>Constant</b>	1.303 (0.026)***	1.379 (0.025)**
<b>Pseudo R2</b>	0.53	0.51
<b>Observations</b>	12759	12759

Note: Robust standard errors in parentheses. \*\*\* significant at 1%.

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# Political Manipulation in the Enforcement of Labour Regulations

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### Abstract

Increasingly, the literature on labour regulation is turning to the de facto implementation of employment laws to understand their economic effects, rather than simply analysing their de jure provisions. This chapter takes a political economy look into the space between labour institutions and implementation. In the context of Brazil, several recent studies have found evidence of political manipulation in regulatory enforcement and fiscal transfers. The chapter sets out to assess whether labour regulations are arbitrarily enforced according to political motivations, to identify the political channel for interference, and to determine whether labour sanctions are used as a clientelistic tool to sway voters. A unique dataset of all fines imposed by labour inspectors in two of Brazil's largest states, matched with data on electoral results at municipal, state and federal levels over a 12 year period, is used to test for evidence of political manipulation. Towns with a large presence of voters loyal to the governor receive fewer fines on average, but the pattern of sanctioning does not vary over the electoral cycle. While governors may be able to exert some pressure over the inspectorate, labour sanctions are not manipulated for electoral motives in Brazil.

*Key words:* Electoral Politics, Intergovernmental Relations, Bureaucrats, Regulation;

*JEL codes:* D73, D78, H77, Q28.

## 3.1 Introduction

It is widely advocated in the political economy literature that regulations be drawn up by elected officials but implemented by an independent bureaucracy, in order to shelter enforcement from short term political considerations.<sup>1</sup> In practice however bureaucrats are rarely immune from the influence of politicians, especially when appointed by them. As a consequence regulatory enforcement can be arbitrary, with the de facto regulatory environment varying according to politicians' interests. In the context of labour market regulations, enforcement has been shown to have a significant impact on compliance as well as on firms' productivity, employment and output.<sup>2</sup> Hence whether the implementation of labour regulations is politically influenced has important economic implications. Moreover, if sanctions are used to sway voters in election years this will also distort electoral competition, increasing the likelihood that corrupt officials are reelected and that the public good is underprovided as a consequence.<sup>3</sup> Brazil is a particularly relevant setting for such a study as it has one of the most regulated labor markets in the world and over 40% of its workforce is employed in the informal sector.<sup>4</sup> Moreover, a substantial body of empirical research, reviewed below, finds ample evidence of political interference in the Brazilian bureaucracy and manipulation of fiscal policies.

This chapter investigates whether political factors influence the allocation of fines for infractions of labour law in Brazil. The empirical analysis sets out firstly to evaluate the influence of (i) partisan alignment between different levels of government, (ii) electoral competition levels, and (iii) the presence of term limits, on the issuance of fines for labour infractions at a town level. Secondly, these political variables are interacted with dummies for election years to assess whether the pattern in sanctioning reflects a clientelist strategy aimed at swaying voters during election times. Each consideration is tested using a unique panel dataset including all fines distributed for infractions of labour regulations at a town level in two of Brazil's largest and most industrialised states over a 12-year period.

Manipulation of the enforcement of labour regulations for electoral purposes has been documented in other countries<sup>5</sup> and was surmised in particular by

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<sup>1</sup>See for example McCubbins et al. (1987), Alesina and Tabellini (2007, 2008) and Maskin and Tirole (2004).

<sup>2</sup>See Almeida and Carneiro (2009).

<sup>3</sup>See Vicente and Wantchekon (2009).

<sup>4</sup>The World Bank's *Doing Business* dataset places Brazil third in the world in terms of labor regulation strictness. See also Bank (2004); Botero et al. (2004).

<sup>5</sup>See for example Ronconi (2010) who exploits the existence of an electoral cycle in the

Tendler (2002) in the context of Brazil. The results of the present analysis however suggest that labour sanctions are at most marginally influenced by political interests, but there is no evidence for their use to sway voters. Indeed, the number of fines issued is not affected by electoral cycles. It is found to be on average slightly lower in those towns where the governor received most votes in the previous election, but mayors' and the president's local political interests are found to have no impact on the allocation of fines. This is in line with the institutional analysis presented in Section 2, which identifies the state-level inspectorate directors, who are nominated upon recommendation from state governors, as the most likely channel for political influence. However the magnitude of the effect is very small and the partisan alignment of local politicians with state governors has no robustly significant impact on the distribution of fines. Moreover, no evidence is found that labour sanctions are allocated tactically in order to sway voters. On an efficiency note, the election of a new governor is found to have a highly disruptive effect on the work of regional inspectorates, as the number of fines issued in a state in a governor's first term is significantly smaller than in his second term.

The empirical analysis uses the number of sanctions to proxy for enforcement and not the number of inspections for which data are not available. Since there are no town-level data on the infraction rate either, the variation in the number of sanctions may be due to changes in firms' compliance with labour law, changes in the number of inspections or changes in the rate at which inspected firms found to be non-compliant are sanctioned. Various provisions are taken to identify the latter effect. Firstly, town Fixed Effects are included in all regressions to control for time-invariant town heterogeneities in the level of compliance due for example to the different industries implanted in different towns. Secondly, a variable measuring town population annually and a time trend are included in all regressions to control for changes in the inspection rate, as the staffing of inspectorates is calculated on the basis of population and industrial activity and has trended upwards over the period. Thirdly a measure of labour informality at the state level allows to control somewhat for economic fluctuations that cause compliance levels to vary overtime.

This chapter tests various predictions about the political manipulation of government resources made by the theoretical political economy literature and identified in various contexts by the empirical literature on Brazil. The favouring of towns where mayors are aligned with the governor's or president's party is

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staffing of labour inspectorates in Argentina to proxy for enforcement in his study of the effects of enforcement on compliance.

analysed in Grossman (1994)'s model in which the central politician transfers resources to local politicians in exchange for their support during the next election. One mechanism the central politician can use to increase the enforcement of this political deal is to favour local politicians that belong to the same political party. An example of such behaviour is found by Brollo and Nannicini (2010) in the context of infrastructure transfers to municipal governments in Brazil. Moreover, the literature on distributive politics describes ways in which politicians can use public resources to increase their re-election chances. A "core voter model" proposed by Cox and McCubbins (1986) shows that risk averse politicians can optimally boost their electoral support by rewarding core supporter groups. Alternatively, Dixit and Londregan (1996) and Lindbeck and Weibull (1987) argue that a better strategy to maximise reelection chances is to target "swing voters" who are close to ideological indifference between two parties. The most common method used in the literature to test for the existence of such strategies, also used in the present analysis, is to consider constituencies where the last election was won by a large majority as "core voter" groups and those where the incumbent politician faced a tight electoral race as "swing voter" constituencies. This is the approach followed for example by Ferraz (2007), who finds that the number of environmental licenses released in the state of Sao Paulo is higher during state election years in towns where the governor won by a large majority. Whilst most of the research in the empirical political economy literature focuses on the political manipulation of fiscal transfers,<sup>6</sup> few, such as Ferraz (2007) look at political interference in the implementation of regulations. The present analysis provides an alternative reference point for estimates of the extent of political manipulation of implementation in the context of labour regulations.

This chapter also contributes to the empirical literature on corruption, particularly studies of favouritism of politically aligned firms by public institutions.<sup>7</sup> Although the industrial organisation consequences of selective regulatory enforcement are not measured here, a reduction in sanctions is likely to give certain firms a competitive advantage based solely on their political connections and hence be nefarious for allocative efficiency.

Finally, this chapter also relates to the literature on labour regulations in developing countries.<sup>8</sup> It investigates an important aspect of the regulation of

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<sup>6</sup>See for example Arulampalam et al. (2009); Brollo and Nannicini (2010); Ferreira and Burgarin (2005); Camacho and Conover (2009); Finan (2004).

<sup>7</sup>See for example Auriol et al. (2011) in the context of public procurement contracts, Khwaja and Mian (2005) on access to public bank loans, or Hsieh et al. (2011) on the discriminatory treatment of firms that supported the opposition to Hugo Chavez in Venezuela.

<sup>8</sup>See Almeida and Carneiro (2009); Bertola et al. (2000); Boeri and Jimeno (2005); Boeri

labour, which can interfere with the relation between de jure provisions and labour market outcomes, namely the underlying political economic factors behind the enforcement of labour regulations.

The paper is structured in the following way: Section 1 analyses the institutional context and Section 2 the political context; the data are then described in Section 3 and Section 4 explains the empirical methodology; finally, Section 5 presents and interprets the results and concludes.

## 3.2 Labour regulation and enforcement

### 3.2.1 Institutional structure of the Labour Inspection Secretariat

The Labour Inspection Secretariat (SIT) is one of the four offices directly below the Minister's office in the Labour and Employment Ministry (MTE). It is composed of a central office in the federal capital Brasília and 27 decentralised units that are also directly subordinate to the Minister. The 27 Regional Labour and Employment Superintendencies of (SRTE, *Superintendencia Regionais do Trabalho e Emprego*) are located in each of the 26 states plus the Federal District. These support and monitor the work of the labour inspectors who work from 114 Subregional Labour Offices (GR, *Gerencia Regional*) and 480 smaller agencies (*Agencia Regional*), each having jurisdiction over constituencies of one or more municipalities. The positions of power within the inspectorate's institutions are politically strategic, not least because employment and labour rights in particular are key electoral issues in Brazil. The Head of the Labour Inspection Secretariat (SIT, *Secretaria de Inspeção do Trabalho*) is in control of a large bureaucracy that reaches into all parts of the country, and is in part responsible for the enforcement of taxes that represent a significant share of the federal budget. There has been a move towards greater organisational autonomy, more resources, and higher professionalisation in the upper echelons of the Secretariat since the mid 1990s. For example, the past four heads of the SIT have been career inspectors - rather than political appointees as was previously the case. But whilst in theory the institutional organisation of the inspectorate and bureaucrats' work has moved towards greater autonomy from politicians' influence, in practice anecdotal evidence as well as official reports paint the picture of an overstretched bureaucracy

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et al. (2008); Botero et al. (2004); Djankov and Ramalho (2009); Heckman and Pagés (2004) for key recent inputs in the research on the labour market impacts of regulation in developing countries and the importance of looking at enforcement.



that lacks the resources to fully enjoy the extent of its official autonomy.<sup>9</sup>

There are currently 2,997<sup>10</sup> labour inspectors (AFT, *Auditor-Fiscal do Trabalho*) in Brazil, a figure that is widely recognised to be far too low, as each inspector is on average responsible for 32 thousand potential workers and 2,470 firms.<sup>11</sup> The allocation of resources to regional offices is decided centrally by the Ministry of Labour following a simple rule that takes into account the population of the area, its estimated informal employment rate depending on the size and sector of firms operating there, and the industrial activity.<sup>12</sup> Two inspectors are allocated per geographical area within each SRTE's circumscription and are randomly rotated every twelve months so as to minimise the chances that they are captured by local elites. These are supplemented by mobile task forces that cut across geographical areas to implement special enforcement programs where they are most needed. The Decree 4,552/02 of the new Labour Inspection Regulation deepened the autonomy of labour inspectors by subordinating them directly to the federal authority.<sup>13</sup> Yet although this decree grants them the power to inspect and issue a Notice of Infraction to any firm within the geographic area of their agency, the volume of denunciations received and the limited resources available to the agencies means that inspections are rarely direct visits to randomly selected firms.<sup>14</sup> Instead, inspectors are generally told which firms to inspect. Such a situation of excess demand may leave space for a two-speed system involving a regional-level selection of the cases investigated based on political criteria. Moreover whilst the career of Labour Inspector is highly professionalized, the directors of the regional SRTEs who have a key role in determining the issuance of sanctions to firms remain politically appointed by the state governor. The next subsection describes the heavy regulatory burden faced by firms, and the procedures for issuing sanctions.

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<sup>9</sup>See Magalhaes (2012).

<sup>10</sup>Information from June 2010 available on the ILO website.

<sup>11</sup>This estimate is based on estimates of the active population - 95 million - and number of economic entities - 7.4 million - from the 2009 *RAIS* dataset available on the IBGE website.

<sup>12</sup>However, just as Almeida and Carneiro (2009), I do not know the details of this formula.

<sup>13</sup>See Cardoso and Lage (2005).

<sup>14</sup>According to a Labour Ministry document (2004:7, reported in Cardoso and Lage (2005)):

“The greatest source of information that, in compliance with the priorities laid out in planning, will guide inspection activities are the denunciations filed by labour unions, the Public Labor Ministry, other governmental and nongovernmental bodies, and workers themselves, who turn to Inspection Auditors from the Regional Labor Office daily.”



### 3.2.2 Labour regulations and sanctions

Brazilian labour law burdens employers with substantial regulations and mandatory contributions. Employers are responsible for registering workers' employment on a work permit which entitles workers to wage and non-wage benefits paid for by the employer. These include retirement benefits, unemployment insurance, and contribution to a severance pay fund, the FGTS (Employment Duration Guarantee Fund), which requires the payment of 8% of the monthly salary into a bank account that is accessible to the employee in case of unfair dismissal. These mandatory non-wage benefits amount to 85% of workers' net wage,<sup>15</sup> pricing low productivity workers out of the formal labour market and contributing to the widespread avoidance of labour law. The informality rate in Brazil rose from 40% in 1980 to 60% in 1990.<sup>16</sup> Beside the Brazilian Labour Code (CLT, *Consolidação das Leis do Trabalho*), which includes 922 contractual regulations, employers also bear the capital cost of abiding by the more than 2000 rules of the Health and Safety Code. Yet despite such generous provisions for workers' welfare, abuse is reportedly widespread and apart from certain areas of infraction, such as child or slave labour which special task forces have been effective at tackling, most firms get away with it unpunished.<sup>17</sup>

Inspectors have discretion in their response to infractions, provided these do not pose a significant threat to workers' health. In the event that they decide to issue a fine, inspectors must first give a Notice of Infraction within 24 hours of the inspection, after which the firm then has ten days to present its defence. It is then the director of the regional SRTE who ultimately has the authority to decide on the imposition or not of a fine, and on its amount, within guidelines set by the law for the amount by which each type of infraction is punishable.

Once a fine is issued the firm can appeal to the central inspectorate office in the Federal District. This is common, particularly in the case of large firms, and because of the scarce resources dedicated to treating such cases, the judicial procedure takes years to come to a decision. As a result, a great majority of sanctioned employers end up evading their fines by closing down the firm.<sup>18</sup> Nonetheless, fines still carry substantial costs for both employers and employees. In the period of study, firms were compelled to make a deposit of the full value of the fine whilst waiting for the case to be dealt with.<sup>19</sup> As for workers, while the

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<sup>15</sup>Bank (2004).

<sup>16</sup>Bank (2004).

<sup>17</sup>See Magalhaes (2012).

<sup>18</sup>See Magalhaes (2012).

<sup>19</sup>This requirement was ruled unconstitutional by the Supreme Federal Court in February

visit of an inspector and subsequent redress of their working conditions represents a welfare gain, it is not clear that the imposition of a fine upon inspection also does, as its likely short term consequence is a combination of job loss or firm closure. In the analysis presented in the next section, the dependent variable used in all regressions is not the number of inspections but the number of fines imposed. This leads me to interpret reductions in the number of fines as a short term favour for voters, where as it is not obvious that interference in the actual inspection of firms would be amenable to the same interpretation.

During the period of study, the institutional structure of the SIT has moved significantly towards providing more autonomy to labour inspectors and sheltering them from local and federal political interests. In practice however, it is argued that malpractice by employers is still widespread and mostly left unpunished, particularly in the case of large firms. Moreover, the scope for political interference remains present at the state level, through the Regional Superintendent who is nominated by the state governor and whose actions may therefore be dictated by the governor's political interests. Whilst potential mechanisms and incentives for political manipulation of the issuance of sanctions are identifiable, the absence of documentation of such practices is notable. One explanation for this might be the absence of a public database of inspections or fines. Indeed, the dataset used in this analysis has to my knowledge never before been released, and due to the limited resources available to the inspectorates, the data are also scarcely used by inspectors to follow up on inspections.<sup>20</sup>

### 3.3 Electoral politics in Brazil

The president, state governors and town mayors are elected every four years, with the elections staggered at a two year interval. During the period of study, the state and federal executive were elected in 1998, 2002 and 2006, and three municipal elections were held in 2000, 2004 and 2008. The electoral rules (including the election date) are the same throughout the country. President, governors and mayors are all elected through a dual-ballot plurality rule (runoff system), except in towns of fewer than 200,000 inhabitants, where simple plurality rule applies for mayoral elections. Registering to vote and voting are compulsory for all citizens aged 18-70 under Brazilian law.

The period of study covers four presidential mandates, two successive mandates

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2010.

<sup>20</sup>See Magalhaes (2012).

of Fernando Henrique Cardoso of the centrist-right Brazilian Social Democracy Party (*Partido da Social Democracia Brasileira*, PSDB) from 1995 to 2002, followed by Luiz Inácio Lula da Silva of the Workers' Party (*Partido dos Trabalhadores*, PT) from 2003 to 2010. Although both parties enjoy large support in Sao Paulo, the state of Sao Paulo has been governed by a PSDB governor since 1994. This provides variation in the alignment of state and federal level politicians, with both executives ruled by the same PSDB party from 1995 to 2002, and a governor from the opposition PSDB during the PT presidency of Lula from 2003 to 2010. Similarly the state of Minas Gerais was ruled by the PSDB for the entire period, bar one term from 1999 to 2002 when the Brazilian Democratic Movement Party (*Partido do Movimento Democrático Brasileiro*, PMDB) was in power.

The Brazilian constitution was amended in 1997 to allow two consecutive terms for executive posts, giving governors and the president the opportunity to run for re-election in for the first time in 1998 and mayors to stand for re-election in 2000. Therefore, during the 2001-2004 mandate mayors were in either of two positions - serving their first term with a potential re-election in the next term, or serving their second term and facing a binding term limit. This institutional change is exploited to identify whether mayors' ability to repay a political favour, which depends on whether they can stand for reelection, affects the manipulation of fines in their municipalities. Municipal governments in Brazil are responsible for the provision of many public goods such as health, education, garbage services and transportation and as such receive large intergovernmental transfers from the federal government. Consequently, they wield significant political power, particularly in larger towns. The analysis will therefore look into political interference in the imposition of sanctions by governors to favour mayors who are politically aligned and test whether the ability to repay the favour during the next state election is a significant factor in the incidence of manipulation.

There is substantial evidence of the use of distributive transfers for electoral purposes in Brazil. Ferreira and Burgarin (2005) show that governors favour municipalities ruled by a mayor of their own party in the distribution of voluntary intergovernmental transfers, while Finan (2004) shows that federal deputies target public investments from budgetary amendments for public works to reward municipalities for local electoral support. More relevant to this chapter because it focuses on regulatory manipulation, Ferraz (2007) finds that the issuance of environmental licences is targeted to municipalities based on patronage concerns in the state of Sao Paulo. Environmental licenses are subject to political influence

because they can be targeted at specific municipalities and have an important impact on job creation, so they can be used to gain political support. Similarly, the sanctioning of firms following labour inspections involves substantial fines and can lead to the closure of firms and destruction of its employees' jobs.<sup>21</sup> In the next section, the data and methodology used to establish this are presented.

### 3.4 Data and descriptive statistics

The empirical analysis makes use of municipality-level data from all 1498 towns in Sao Paulo and Minas Gerais, two of the largest and most industrialised states in Brazil. The period of study spans a twelve year period from 1997 to 2008, forming a panel with 17,976 observations.<sup>22</sup>

The data on labour sanctions were provided by the Labour Ministry (*MTE, Ministerio de Trabalho e Emprego*). For each town, the main variable is the annual total number of fines distributed to firms between 1997 and 2008 for several different types of infractions.<sup>23</sup>

Three mayoral elections (2000, 2004, 2008) and three gubernatorial and presidential elections (1998, 2002, 2006) took place during the period of study (see Appendix A for a timeline). For each election, the electoral data obtained from the Superior Court of Electoral Justice (*TSE, Tribunal Superior Eleitoral*) include candidates' name and party, the vote share obtained in each municipality in each round of the election, the participation rate and size of the electorate. I use these data to construct three categories of variables that represent towns' political characteristics. Firstly, two dummy variables are created that take value 1 when the mayor of a town is politically aligned with the Governor or President's party. For example,  $Mayor \& Gov. Aligned_{it} = 1$  if the mayor of town  $i$  in year  $t$  belongs to the same party as the state's Governor. I also construct a variable  $Gov. Margin_{it}$  (resp.  $Pres. Margin_{it}$ ,  $May. Margin_{it}$ ) that measures the difference between the share of votes earned by the incumbent governor (resp. president and mayor)

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<sup>21</sup>See Almeida and Carneiro (2009), Magalhaes (2012).

<sup>22</sup>Note that the dataset for the dependent variable includes data from 1995 to 2010. However, the 2010 data are incomplete, and control variables are only available until 2008, so the sample used for the analysis stops in 2008. Moreover, because electoral data are not readily available for the 1992 mayoral election, the analysis begins in 1997, the first year for which the party of both the mayor and governor in each town and state is known.

<sup>23</sup>The different categories of infractions include the denial of breaks, excessive working hours, wage issues, denial of transport money, failure to pay contribution to workers' pension/severance fund *FGTS* (8% of wage), or to register them for unemployment insurance, failure to respect Health and Safety norms, failure to register employment on worker card (informal employment), child labour, and others. The present analysis focuses on the total number of infractions.

and his closest contestant in town  $i$  in the last election. These variables are used to measure the local level of electoral competition faced by politicians in each town. Towns where the margin of votes is small, or negative in the case of towns where the governor actually lost the vote, are considered 'swing' towns where the politician has little electoral support.<sup>24</sup> Towns where the incumbent's margin of votes in the previous election is large are 'core supporter' towns. Thirdly, I match the names of politicians with those of incumbents to identify politicians in their second term who face a term limit. Hence the variable  $Gov.Term\ Limit_{it} = 1$  if the governor cannot run for reelection, and zero otherwise. The governors' term limit is likely to be important if the manipulation of labour sanctions is a manoeuvre aimed at promoting electoral support in the subsequent electoral race (rather than for example, a favour to a firm in exchange for a monetary compensation). As explained earlier, the mayors' mandate will determine their ability to repay an electoral favour. These variables and their interactions with electoral timing allow to study how the targeting of towns for sanctioning is affected by the local political environment. These results are then interpreted in the light of the institutional analysis and of theories of political economy reviewed earlier in order to identify the likely political channels for influence and attempt to understand the patronage strategies implemented.

Time invariant data on town characteristics were obtained partly from the 2000 Population Census and partly from a national statistics office IBGE for the year 2007. Moreover, annual town-level population data for the 1997 to 2008 period were also obtained. Population is the only time-variant municipality-level control variable to be included in all estimations. Finally, annual state-level data on the total number of job contracts officially terminated were obtained from the Labour Ministry's website, and are used in all estimations as a measure of control for macroeconomic labour market fluctuations.

Table B.1 in the Appendix reports summary statistics for all variables included in the estimations. Note that all variables but the political characteristics exhibit large variation. This large variation is partly due to the capital cities, Sao Paulo and Belo Horizonte, which are clear outliers in the sample. Table B.2 in the Appendix therefore reports, for each variable, the results of a t-test for mean differences between the two capital cities on the one hand and the rest of the sample on the other hand. The means of all variables are significantly different across these two subsamples, except for the political characteristics. Importantly,

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<sup>24</sup>Note that incumbent governors and president could have earned a minority of votes in some towns and still won the election in the state (resp. nation). Therefore, whilst mayors' margin of votes is necessarily positive, governors' and presidents' can also be null or negative.



this indicates that the political environment of these outliers is not significantly different from the rest of the sample. The inclusion of municipality Fixed Effects and control variables should therefore account for the major differences in the number of inspections, fines, population and economic activity, so that the political effects identified are not biased by the presence of these outlier towns in the sample. To ensure robustness of the main estimates, results of a regression run with and without outliers are reported in the Appendix.

### 3.5 Empirical methodology

The dependent variable in all regressions is the total annual number of fines distributed at a municipal level. The empirical analysis aims to establish firstly whether political motivations influence the distribution of sanctions for labour infractions. One obvious way in which to trace this is by testing for the presence of electoral cycles in fining. I therefore begin by testing whether the number of fines is significantly lower in election years, and more specifically in municipal or state/federal election years.<sup>25</sup> However, political motivations can take other forms, which would not be apparent in the mere time series variation in fines. Next I therefore assess the impact of several political characteristics that vary across municipalities and over time within each municipality. The second set of regressions assesses the influence of (i) partisan alignment between different levels of government, (ii) electoral competition levels, and (iii) the presence of term limits, on the number of fines distributed in each town overtime. Finally, I analyse separately whether sanctions are used to sway voters during election years. Indeed the targeting of core supporter or swing voter towns specifically during election years may not transpire in the estimates of the previous regressions. I therefore interact the political variables with dummies for election years to assess whether the patterns in sanctioning reflect a clientelist strategy aimed at swaying voters.

The initial regression exploits the time-series dimension of the data, regressing the total number of fines on dummy variables for municipal and state election years, first grouped and then separately. Municipality fixed effects are used to control for time-invariant between-town heterogeneities. A time trend is also included to control for changes in the staffing of the inspectorates:

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<sup>25</sup>State and federal elections taking place on the same year, we denote them by  $State\ Election_{it}$  in the following equation.

$$Fines_{it} = f(\gamma_i + Trend_t + \beta_0 + \beta_1 State Election_t + \beta_2 Munic. Election_t + \epsilon_{it}) \quad (3.1)$$

where  $\gamma_i$  are municipality fixed effects,  $Trend_t$  is a time trend, and  $f(\cdot)$  is a non-linear function.<sup>26</sup> Significance of the  $\beta_1$  or  $\beta_2$  coefficient indicates that the intensity with which firms are sanctioned for labour regulation infractions changes in election years. However, the significance of this coefficient could be due to other reasons than political manipulation. It is plausible that the work of bureaucrats is affected by the event of an election due to a change in political administration, possible policy readjustments or simply extra workload in election years to report on the inspectorate's activity for the purpose of the political debate.

If the enforcement of regulations is influenced by political considerations, then the variation in the number of fines should follow local political characteristics such as the partisan alignment of mayors with state governor or president, the level of local electoral support and the presence of term limits. These characteristics vary both across municipalities and overtime within municipalities, so that both dimensions of the panel are exploited. I introduce the margin of victory variables into specification (1) as a measure of local electoral competition. This aims to capture the use of selective sanctioning of labour infractions to favour towns based on past local electoral results. The two dummy variables for partisan alignment are also introduced, taking value 1 respectively if mayor and governor, or mayor and president in year  $t$  are from the same party in town  $i$ . I also match the names of incumbent politicians with the names of the previous incumbents' and construct a dummy for "lame duck" politicians facing a term limit.<sup>27</sup> This takes value 1 for incumbent governors and mayors in their second mandate:

$$Fines_{it} = f(\gamma_i + Trend_t + \beta_0 + \beta_1 State Election_t + \beta_2 Munic. Election_t + Aligned_{it}\beta_3 + Margin_{it}\beta_4 + Term Limit_{it}\beta_5 + \epsilon_{it}) \quad (3.2)$$

where  $Aligned_{it}$  is a vector of the alignment variables,  $Margin_{it}$  a vector of the vote margin variables and  $Term Limit_{it}$  a vector of term limit dummies. A positive significant coefficient  $\beta_3$  on either of the alignment variables indicates that

<sup>26</sup>More details on the estimation method given below.

<sup>27</sup>Prior to the 2000 election, mayors were only allowed one mandate. Incumbent governors and politicians could first run for reelection in the 1998 election.



either the incumbent governors or presidents who influence the issuance of fines favour local political allies from within their party. A significantly negative  $\beta_4$  is evidence that the incumbent politician favours towns where she received strong support in the previous election. When the sign is positive, the indication is that towns where the political competition is strong are targeted. Which of these coefficients is significant also reveals which politicians' interests are being served by the distribution of sanctions, which most likely coincides with the political channel for influence over the bureaucracy.

Finally, I interact the political variables with election year dummies to see how the targeting of towns varies along the electoral cycles. Specifically, I interact the municipal election year dummy with the alignment of mayor with the governor to test whether towns where the mayor is aligned with the governor receive fewer fines in years of municipal elections in order to boost their reelection chances. I then interact the state election year dummy with the governor's margin of votes to test for the use of "core voter" or "swing voter" strategies (as defined previously). The third specification is:

$$\begin{aligned}
 Fines_{it} = f & (\gamma_i + Trend_t + \beta_0 + \beta_1 State\ Election_t + \beta_2 Munic. Election_t \\
 & + \beta_3 Aligned_{it} + \beta_4 Aligned_{it} * Munic. Election_{it} \\
 & + \beta_5 Gov. Margin_{it} + \beta_6 Gov. Margin_{it} * State Election_t + \epsilon_{it}) \quad (3.3)
 \end{aligned}$$

The dependent variable in all regressions takes on non-negative integer values. As can be seen in Figure B.2 of the Appendix, the data for total fines are characterised by a very large mass at zero (41% of the observations of the dependent variable are zeros) and a long right hand tail. The conditional mean of such a count variable is best described by a distribution of the Poisson family. Let the conditional mean of  $Fines_{it}$  be a function of a vector of the explanatory variables noted  $X$ , then:

$$E[Fines_{it} | X] = f(x'_{it}\beta). \quad (3.4)$$

Estimating equation (4) using Ordinary Least Squares (OLS), yields an unbiased estimate of a linear conditional mean function, when this function is non-linear. Indeed linearity would imply the unrealistic assumption that the difference between zero and one fine being handed out in a time period is the same as the difference between say 500 and 501 fines. A linear estimation model is also problematic as it often yields negative predicted counts. Moreover, because the variance of a variable that follows a Poisson distribution is proportional to its

mean, heteroskedasticity follows practically by definition. Indeed larger values of the conditional mean have a larger variance and as the mean approaches zero the variance must also be smaller since zero is the lower bound of the distribution. Because the Poisson distribution is positively skewed, the heteroskedasticity is also strongly asymmetric. By not taking into account the correct functional form, the underlying distribution of the disturbances, nor the inherent asymmetric heteroskedasticity, OLS estimates are highly inefficient as well as biased.<sup>28</sup>

The most common approach in the empirical literature using count data is to assume an exponential conditional mean function  $f(\cdot)$ <sup>29</sup> and use a Poisson or Negative Binomial (NB) regression model to obtain unbiased and consistent estimates of the model parameters by Maximum Likelihood. The NB distribution assumes that the variance is proportional to the mean,<sup>30</sup>  $Var(y_{it}) = \mu_{it} + \alpha\mu_{it}^2$ , whilst the Poisson distribution is a special case of the NB model where the mean of the distribution equals its variance  $E(y_{it}) = Var(y_{it})$ , i.e where  $\alpha = 0$ . Although the two regression models are similar, Poisson estimates are known to be highly inefficient when the data are overdispersed ( $\alpha$  significantly different from zero), with downward-biased standard errors yielding spuriously large z-values. In order to assess the relative merit of these estimation methods, we first plot the mean and variance of  $Fines_i$  in Figure B.3 where each data point corresponds to a different town and the red line represents the one-for-one ratio implied by a Poisson model.<sup>31</sup> The concentration of most data points above this line is indicative of highly overdispersed data with variance strictly larger than the mean. Second, Figure B.4 graphs the observed variable distribution against a Poisson probability distribution with the same mean and a NB distribution with the same mean and variance. It is clear from the graph that the NB model has a far better fit of the actual observed dependent variable than the Poisson. Finally, the results of a BIC test on the Fixed Effects Poisson versus Fixed Effects Negative Binomial, not reported here, support the choice of the latter.

The specifications outlined above will therefore be estimated by Conditional Maximum Likelihood Estimation using a Negative Binomial regression model with Fixed Effects. Final robustness checks are then performed using OLS and

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<sup>28</sup>See Cameron and Trivedi (1998).

<sup>29</sup>The exponential function has the advantage that it ensures non-negativity and is the only function that is its own derivative. See Cameron and Trivedi (1998) for more details on count data regression analysis.

<sup>30</sup>This is known as the NB2 model, which is the most commonly used version of the generalized NB model with mean  $\mu_i$  and variance  $\mu_i + \alpha\mu_i^p$ . See Cameron and Trivedi (1998).

<sup>31</sup>Note that the sample was restricted for expositional purposes, but inclusion of the omitted right-hand tail of the data would make the picture even more striking.

Zero-Inflated NB with Town and Year Fixed Effects. The results are reported and interpreted in the next section.

## 3.6 Results

### 3.6.1 Political manipulation of labour fines

The estimation results are reported in Tables B.3 to B.6 of the Appendix.

Table B.3 reports the results from estimating equation (1), which tests for the influence of electoral cycles on the distribution of fines. Beginning with a simple dummy for election years, I then separate municipal election years (2000, 2004 and 2008 in the period of study) from years of federal and state elections (1998, 2002, 2006). The results suggest that there is no significant difference in the number of fines distributed between election years and non-election years, independently of the type of election. This result is robust to Negative Binomial (NB) and Ordinary Least Squares (OLS) estimations with Fixed Effects and standard errors clustered at the municipality level to control for serial correlation in the error term.<sup>32</sup> The absence of electoral cycles in labour fines suggests that any manipulation of enforcement does not happen specifically during election times when it is most likely to sway voters' behaviour. Nonetheless, this may hide some manipulation during election years in particular towns and not others based on other political characteristics. We address this possibility in Table B.5.

The estimations so far have only exploited the time series variation in the data. If the allocation of fines is influenced by political considerations, then we should expect to find significant differences across towns depending on political factors such as the partisan alignment of the town mayor with governor and/or president, the level of political competition they face in each town and the presence of term limits.

Table B.4 addresses such issues. To begin with,  $Fines_{it}$  is regressed on the three vote margin variables described above to determine whether labour sanctions are used to promote politicians' interests according to the level of electoral support they received locally in the last election. Given the institutional analysis, a significant coefficient might be expected for the mayor's margin if we believe inspectors are subject to local capture despite the reforms aimed at boosting their

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<sup>32</sup>Column (2) is the result of a regression using NB using Random Effects rather than Fixed Effects. This is because a NB model needs a lot of information to be estimated, and a Fixed Effects models throws a lot of information away (all comparisons between individuals), so that this specification does not converge.

independence from local powers. Alternatively we expect the governor's margin to be significant as the most likely channel for political influence is at the regional director's level.

The results in Columns (1) and (3) suggest that mayors' and the president's local electoral support in the previous election has no bearing on the distribution of fines. The coefficient on the governors' margin of votes in Column (2) is negative and strongly significant however, indicating that towns where there is a strong concentration of the governor's supporters receive fewer fines than other towns. The magnitude of the coefficient suggests that a one standard deviation increase in the margin of votes won by the governor in the average municipality is associated with a 7.5 per cent reduction in the number of fines.<sup>33</sup> This suggests that governors can marginally influence the allocation of labour sanctions across towns in their state to favour towns with a large presence of their supporters.

Next, I introduce the dummy variables for the mayors' partisan alignment to test whether towns with mayors from the same party as the governor or president receive fewer fines than others. The results in Column (4) show that whilst the mayors' alignment with the president's party has no impact on the number of fines distributed in a municipality, alignment with the governor's party is associated with a small but significant reduction in fining. The negative coefficient on the alignment variable, significant at a 5% level, suggests that towns where the mayor is aligned with the governor's party receive on average 4.7% fewer fines than towns where the mayor is not aligned, keeping all else equal. This result, while in line with the intra-governmental partisan distributive patterns identified in the empirical literature on intergovernmental transfers and political intervention in environmental regulation in Brazil,<sup>34</sup> is very small in magnitude and as reported in Table B.6, it is also not robust to other estimation methods.

Finally, I look at the impact of a binding term limit on the pattern of sanctions by introducing a dummy variable taking value one when the governor (resp. mayor) is in his second mandate and cannot run for reelection. The coefficients in Column (5) reveal that when the governor faces a binding term limit the total number of fines is 17.2 per cent higher on average in his state. This large coefficient probably reflects the efficiency gains from the fact that a second term governor is less likely to make disruptive changes in the regional inspectorate offices such as selecting a new director. However, the event of a mayor facing a term limit has no significant consequences for the issuance of fines in his town. In

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<sup>33</sup>The standard deviation of the governor's margin of victory is 28.23 implying an average reduction of  $0.00268 \times 28.23 = 7.56\%$ , where 0.00268 is the marginal effect for the average town.

<sup>34</sup>See for instance Ferreira and Burgarin (2005); Camacho and Conover (2009); Ferraz (2007).

Columns (6) and (7) I then interact these dummy variables with the significant partisan alignment and vote margin variables. The results in Column (6) indicate that the mayor's ability to run for reelection is of no consequence to the favourable treatment received from the governor. This suggests that the governor's support for an aligned mayor is not conditional on the mayor being able to repay the favour in his next election, which is contradictory with previous empirical studies in Brazil and with the basic assumptions of the theoretical literature. Finally, the results in Column (7) suggest that the targeting of "core supporter" towns by the governor is not significantly different in the governors' two mandates. If this targeting of "core voter" towns were aimed at capturing votes however, then one would expect that the rise in the number of fines in the governor's second term should be concentrated in those towns where sanctioning was previously reduced.

In order to test whether this targeting of towns is unrelated to an electoral strategy, I next interact the governor's margin of votes and partisan alignment with dummies for election years.

### 3.6.2 An electoral strategy?

Although the results of the first series of estimations suggest that on average there are no electoral cycles in sanctioning, it is plausible that certain towns are targeted during election years based on their political characteristics and not others. For instance, if towns where the governor faces high political competition are targeted during state election years, characterising a "swing voter" strategy, this might not be reflected in the average effect of the state election year dummy on the distribution of fines across all towns. Following the literature, I therefore investigate whether the targeting of sanctions across towns changes during election years depending on their political characteristics. If manipulation of sanctions aims to promote the governors' (or partisan mayors') electoral success, one should expect to find that the targeting of towns would be particularly relevant in state (respectively municipal) election years. To test this, I interact the relevant political variables with the corresponding dummies for the timing of elections. The results are reported in Table B.5. As shown in Column (1), while the coefficient on the mayors' partisan alignment with the governor is negative and significant as in the previous estimation, the interactions with the municipal election year dummy is insignificant. Similarly for the governors' votes margin in Column (2), its coefficient is negative and significant, but the coefficient on its interaction with the state election year dummy is not. Hence sanctioning is marginally reduced in towns when a large share of the supporters turned out to support the incum-



bent governors at the last election, but this favouritism is not part of an electoral strategy to sway voters during election years.

### 3.6.3 Robustness checks

The analysis of the data in Section 4 concluded that given the distribution of the observations on the dependent variable, the most appropriate estimation method is to estimate the specifications using the FENB model by Conditional Maximum Likelihood. In this section, the robustness of the results to other estimation methods and to the exclusion of the state capitals from the sample is tested, and reported in Table B.6 of the Appendix. In particular, the coefficients on the key three variables that had significant coefficients are re-estimated by OLS with Town FE and Year FE, and by Zero-Inflated NB (ZINB) with Year FE, in both cases clustering standard errors at the town level to control for serial correlation in the error terms. The inclusion of these two dimensions of FE allows to control further for the possibility of time-variant confounders as well as time invariant town-level unobserved heterogeneity. Moreover, the ZINB model takes into account the “excess zeros” in the distribution of  $Fines_{it}$ , by assuming that these zeros can come from two different processes. A first Logit equation is estimated, regressing  $Fines_{it}$  on the town controls to estimate the role of town characteristics in the sample of towns where zero fines were distributed throughout the period. The second equation addresses the other towns that are not “sure zeros”, to estimate by NB the impact of town controls and political factors on the number of fines distributed annually (as previously). The results, reported in Table B.6 of the Appendix, mostly confirm the conclusions of the previous sections. Whilst the governor’s margin of votes is consistently significant across estimation methods, the partisan alignment of the mayor is not robust to most estimation methods. Finally the effect of a binding term limit for the governor has a robustly positive impact on the number of fines.

## 3.7 Conclusion

Chapter 3 takes a political economy perspective on the space between institutions and implementation in the context of labour regulation enforcement in Brazil. The empirical investigation tests firstly for electoral cycles in the imposition of labour fines, secondly whether labour regulations are selectively enforced according to political motivations and finally, it assesses whether “pork barrel” strategies are used in order to sway voters. Electoral results are matched with a

novel dataset of fines imposed on firms for labour infractions to test these considerations. Firstly, the analysis finds that mayors' and the president's political interests are not significantly correlated with the distribution of fines, neither is the alignment of local politicians with governors or the president. Secondly, the appointment of a new governor is a highly disruptive event for the inspectorate, as evidenced by the steep rise in the number of fines issues in governors' second term. Thirdly, towns where the governor received strong support in the last election have marginally fewer fines on average. These results corroborate the evidence from the institutional analysis of the inspectorate, namely that a key channel for political influence on regulatory enforcement is through the Regional Inspectorate superintendents who are appointed by the state governors. However fourthly, in contrast with Ferraz (2007)'s findings in the context of environmental regulations in Brazil, the pattern of targeting does not vary significantly along the electoral cycle making it unlikely to be an electoral clientelism strategy. The results are interpreted as indicating that labour sanctions are not amenable to significant manipulation by politicians, particularly not for swaying voters. The significant reforms in the organisation of labour inspectorates in Brazil since the mid-1990s to guarantee more autonomy to the inspectors are likely to be partly responsible for this. Another plausible explanation is the availability of other, more efficient and more effective means to sway voters. In fact, fiscal transfers have received far more attention in the political economy literature precisely for this reason.



## B.1 Data description

Figure B.1: Election timing

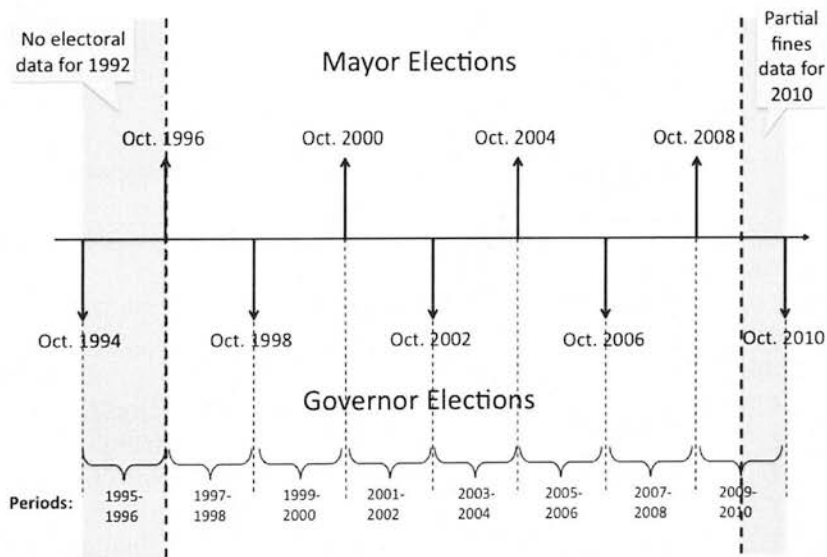


Table B.1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	Median
<i>Town characteristics</i>					
Population	37,802.406	287,386.909	774	11,016,703	8,819
<i>Inspections</i>					
Office	0.028	0.165	0	1	0
Regional Office	0.017	0.128	0	1	0
Inspectors	12.457	6.912	4	121	12
Regional Inspectors	8.84	26.606	1	121	1
Total Fines	31.46	279.685	0	13761	2
Fine: Breaks	3.496	36.365	0	1468	0
Fine: FGTS	4.871	43.459	0	1864	0
Fine: Working Hours	2.85	28.976	0	1483	0
Fine: Health & Safety (NR)	7.17	65.236	0	4546	0
Fine: Other	5.714	61.115	0	2917	0
Fine: RAIS	0.052	0.837	0	52	0
Fine: Worker Registration	4.021	29.521	0	1132	0
Fine: Wage	2.877	24.728	0	991	0
Fine: Health & Safety	0.21	0.851	0	24	0
Fine: Seguro Desemprego	0.006	0.118	0	9	0
Fine: Child Labour	0.059	1.092	0	107	0
Fine: Transport	0.134	2.302	0	124	0
<i>Political characteristics</i>					
General Election	0.25	0.433	0	1	0
Municipal Election	0.25	0.433	0	1	0
Electorate	24,799.56	198,946.6	698	7,953,144	6,377
Gov. Margin	24.845	28.145	-75.393	92.353	24.26
May. Margin	18.175	19.316	0	100	12.266
Pres. Margin	26.776	28.167	-73.708	89.22	29.938
Mayor & Gov. Aligned	0.253	0.434	0	1	0
Gov. & Pres. Aligned	0.31	0.463	0	1	0
Mayor & Pres. Aligned	0.171	0.376	0	1	0
Mayor, Gov. & Pres. Aligned	0.092	0.29	0	1	0
Mayor Term Limit	0.182	0.386	0	1	0
Governor Term Limit	0.238	0.426	0	1	0
President Term Limit	0.5	0.5	0	1	0.5

*Notes:* The data on town characteristics apart from the population data refer to the year 2000 or 2007 only and were obtained from the web pages of the national statistical offices IBGE and IPEA. The data on inspections were obtained directly from the Brazilian Ministry of Labour (MTE), and the electoral data from the Electoral Tribunal (TSE). See main text for further data description.

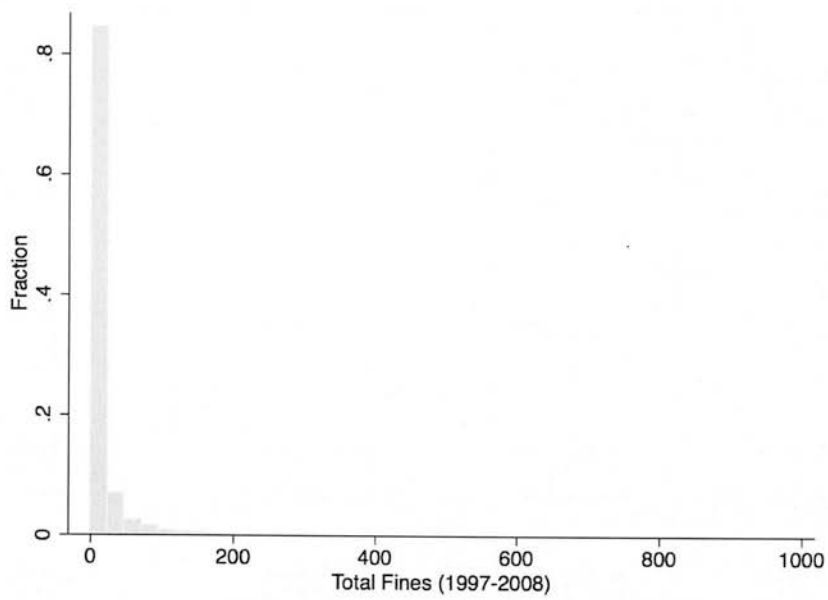
Table B.2: T-test on mean difference between capitals and other towns

<i>Town characteristics</i>		
Town Population	-6369811.7***	(-184.75)
Town GDP per capita (Rs'0000)	-1.134***	(-4.38)
Town GVA Agriculture (Rs'0000)	0.921	(1.48)
Town GVA Industry (Rs'0000)	-3206.8***	(-135.55)
Town GVA Services (Rs'0000)	-11739.9***	(-162.74)
Town GVA Industry (Rs'0000)	-1125.2***	(-181.01)
Taxes (Rs'0000)	-2911.9***	(-152.17)
Total Employment (2000)	-1803346.2***	(-185.55)
Informality Rate	0.167***	(5.58)
<i>Inspections</i>		
Office	-0.973***	(-29.56)
Regional Office	-0.985***	(-39.20)
Inspectors	-106.2***	(-90.86)
Regional Inspectors	-94.20***	(-60.91)
Total Fines	-6844.1***	(-266.86)
Fine: Breaks	-904.1***	(-290.27)
Fine: FGTS	-1036.1***	(-237.24)
Fine: Working Hours	-689.2***	(-234.93)
Fine: Health & Safety (NR)	-1305.7***	(-143.56)
Fine: Other	-1511.5***	(-281.98)
Fine: RAIS	-12.17***	(-84.03)
Fine: Worker Registration	-715.1***	(-254.14)
Fine: Wage	-604.5***	(-265.56)
Fine: Health & Safety	-5.255***	(-31.01)
Fine: Seguro Desemprego	-0.829***	(-35.48)
Fine: Child Labour	-7.868***	(-36.58)
Fine: Transport	-51.81***	(-193.44)
<i>Political characteristics</i>		
Electorate	-4575532.3***	(-94.94)
Gov. Margin	5.575	(0.97)
May. Margin	-8.488*	(-2.15)
Pres. Margin	2.011	(0.35)
Mayor & Gov. Aligned	0.0860	(0.97)
Gov. & Pres. Aligned	-0.0232	(-0.25)
Mayor & Pres. Aligned	-0.0793	(-1.03)
Mayor, Gov. & Pres. Aligned	0.0925	(1.56)
Mayor Term Limit	0.0158	(0.20)
Governor Term Limit	-0.0116	(-0.13)
Observations	17976	

Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

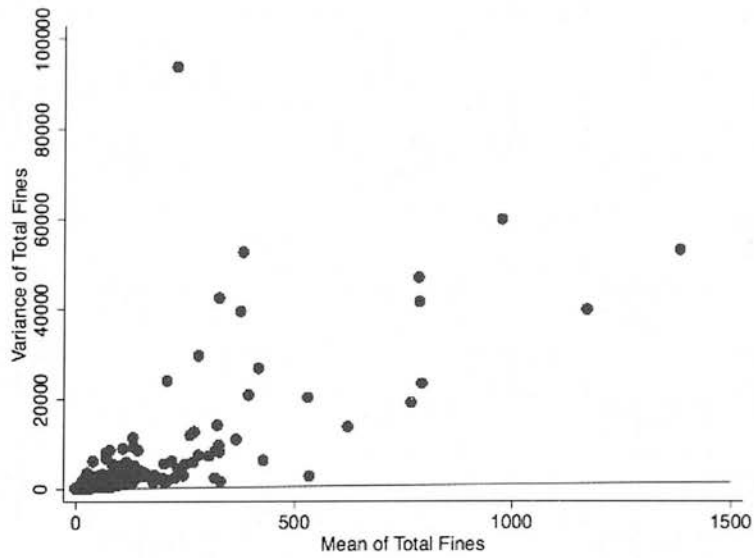
Notes: The data on town characteristics apart from the population data refer to the year 2000 or 2007 only and were obtained from the web pages of the national statistical offices IBGE and IPEA. The data on inspections were obtained directly from the Brazilian Ministry of Labour (MTE), and the electoral data from the Electoral Tribunal (TSE). See main text for further data description.

Figure B.2: Histogram of dependent variable



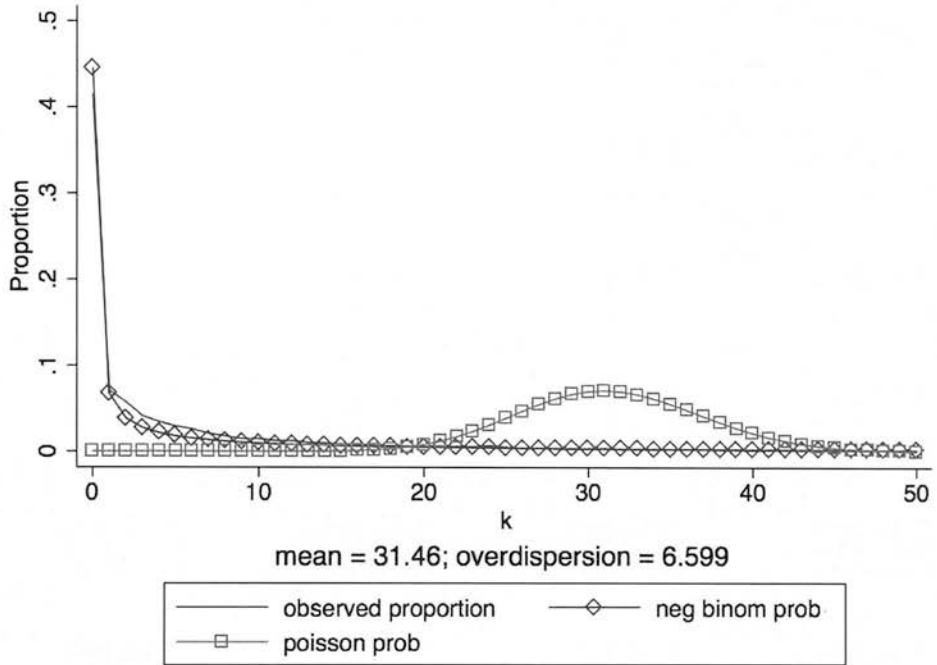
Source: The annual data on total number of fines distributed at a town level from 1997 to 2008 were obtained directly from the Brazilian Ministry of Labour (MTE). The sample is truncated at 1,000 for expositional purposes

Figure B.3: Dependent variable mean-variance relationship



Source: The annual data on total number of fines distributed at a town level from 1997 to 2008 were obtained directly from the Brazilian Ministry of Labour (MTE). Outliers are excluded for expositional purposes.

Figure B.4: Dependent variable distribution on Poisson, Negative Binomial and Observed



Source: The annual data on total number of fines distributed at a town level from 1997 to 2008 were obtained directly from the Brazilian Ministry of Labour (MTE).

## B.2 Empirical results

Table B.3: Labour fines and electoral cycles

<i>Dep. Variable:</i>	(1)	(2)	(3)	(4)
<b>Total Fines</b>	NB	NB	OLS	OLS
Election Year	-0.002 (0.016)		0.511 (0.437)	
Municipal Election		-0.498 (1.546)		-0.509 (0.522)
General Election		0.224 (1.497)		1.439 (0.930)
Constant	-0.618 (0.0298)***	11.10 (4.129)***	160.0 (38.87)***	159.7 (38.71)***
Observations	16428	17976	17976	17976
Log Likelihood	-39038.8		-97009.6	-97008.1
Time trend	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Town Fixed Effects	Yes	Yes	Yes	Yes

Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

*Notes:* Controls include town population and a state-level measure of job contract terminations. These data were obtained from the web pages of the national statistical offices IBGE and IPEA. The data on inspections were obtained directly from the Brazilian Ministry of Labour (MTE), and the electoral data from the Electoral Tribunal (TSE). See main text for further data description. Note that Column (2) uses Random rather than Fixed Effects. Explanations provided in text.

Table B.4: Political motivations and labour fines: Margin of votes, partisan alignment and term limits

<i>Dep. Variable:</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Total Fines</b>	NB	NB	NB	NB	NB	NB	NB
May. Margin	-0.000463 (0.0000563)						
Gov. Margin		-0.00268 (0.000417)***					-0.00239 (0.000470)***
Pres. Margin			-0.0000807 (0.000380)				
May-Gov Aligned				-0.0475 (0.0229)**		-0.0467 (0.0245)*	
May-Pres Aligned				0.0123 (0.0261)			
Governor Term Limit					0.172 (0.0190)***		0.175 (0.0254)***
Mayor Term Limit					0.0236 (0.0236)	0.0192 (0.0280)	
May-Gov*Mayor Term Limit						-0.00131 (0.0515)	
Gov.Margin*Gov. Term Limit							-0.000520 (0.000705)
Constant	-0.610 (0.0307)***	-0.617 (0.0295)***	-0.589 (0.0378)***	-0.609 (0.0311)***	-0.653 (0.0292)***	-0.603 (0.0301)***	-0.662 (0.0321)***
Observations	16424	16278	16278	16428	16428	16428	16278
Log Likelihood	-39031.0	-38865.8	-38886.2	-39036.6	-38999.2	-39036.4	-38830.0
Time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Town Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Notes: Controls include annual town population and a state-level measure of job contract terminations. These data were obtained from the web pages of the national statistical offices IBGE and IPEA. The data on inspections were obtained directly from the Brazilian Ministry of Labour (MTE), and the electoral data from the Electoral Tribunal (TSE). See main text for further data description.



Table B.5: Targeting of towns along the electoral cycle

<i>Dep. Variable:</i>	(1)	(2)	(3)	(4)
<b>Total Fines</b>	NB	NB	OLS	OLS
Municipal Election	-0.0254 (0.0232)	-0.0293 (0.0208)	-0.888 (0.768)	-0.588 (0.530)
General Election	0.0212 (0.0202)	0.0253 (0.0248)	1.455 (0.935)	1.348 (0.992)
May-Gov Aligned	-0.0450 (0.0249)*		-1.394 (1.372)	
Munic.*May-Gov Aligned	-0.00435 (0.0447)		1.578 (1.675)	
Gov. Margin		-0.00241 (0.000458)***		-0.0965 (0.0459)**
General*Gov. Margin		-0.000946 (0.000771)		-0.0331 (0.0252)
Constant	-0.612 (0.0310)***	-0.623 (0.0306)***	160.1 (38.76)***	160.5 (38.75)***
Observations	16428	16278	17976	17742
Log Likelihood	-39034.7	-38863.7	-97007.5	-95842.9
Time trend	Yes	Yes	Yes	Yes
Town Fixed Effects	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

*Notes:* Controls include annual town population and a state-level measure of job contract terminations. These data were obtained from the web pages of the national statistical offices IBGE and IPEA. The data on inspections were obtained directly from the Brazilian Ministry of Labour (MTE), and the electoral data from the Electoral Tribunal (TSE). See main text for further data description.

Table B.6: Robustness checks

<i>Dep. Variable:</i>	(1)	(2)	(3)	(4)	(5)
<b>Total Fines</b>	NB	OLS	OLS	ZINB	ZINB
main					
Municipal Election	-0.0244 (0.0198)	-0.527 (0.503)	1.579 (1.247)	-0.0381 (0.0220)*	-0.200 (0.0657)***
General Election	0.0365 (0.0197)*	0.589 (0.718)	-0.308 (0.955)	-0.0261 (0.0228)	0.00990 (0.0424)
Gov. Margin	-0.00121 (0.000410)***	-0.103 (0.0426)**	-0.127 (0.0453)***	-0.00169 (0.00128)	-0.00314 (0.00128)**
May-Gov Aligned	-0.0173 (0.0220)	-0.655 (1.372)	-0.457 (1.343)	-0.104 (0.0484)**	-0.0948 (0.0482)**
Governor Reelection	0.194 (0.0184)***	-1.001 (2.809)	-0.647 (3.149)	0.0996 (0.0444)**	0.113 (0.0573)**
Constant	-0.658 (0.0308)***	161.3 (39.60)***	165.9 (40.38)***	2.041 (0.151)***	0.531 (0.480)
inflate					
Constant				1.995 (0.141)***	1.993 (0.141)***
lnalpha					
Constant				0.666 (0.139)***	0.659 (0.141)***
Observations	16254	17742	17742	17742	17742
Log Likelihood	-38298.1	-95842.7	-95833.7	-50519.3	-50486.6
Capitals Included	No	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	No	No	Yes	No	Yes
Town Fixed Effects	Yes	Yes	Yes	No	No
Controls	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

*Notes:* Controls include annual town population and a state-level measure of job contract terminations. These data were obtained from the web pages of the national statistical offices IBGE and IPEA. The data on inspections were obtained directly from the Brazilian Ministry of Labour (MTE), and the electoral data from the Electoral Tribunal (TSE). See main text for further data description.

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# Taxation and Informality in a Dual Sector Probabilistic Voting Model

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### Abstract

Up to 70% of urban workers in developing countries are employed in the shadow economy, which is largely characterised by high poverty and underemployment rates. Yet these countries also tend to have low redistributive taxation. This chapter builds the first probabilistic voting model with endogenous sector allocation in a dual sector economy. It is used to explore the interaction between relative returns to formal sector production, determined by labour productivity and the quality of institutions, and the demand for a redistributive public good in a majoritarian system. The model predicts that low tax rates are an optimal response by voters to low productivity premia from formal activity. Predicted informality share decreases and taxation increases as the *relative* productivity of formal employment rises. Moreover, improvements in institutional quality generate greater increases in redistribution and reductions in informality in countries with lower productivity.

*Keywords:* Informal Sector, Public Policy, Probabilistic Voting;

*JEL codes:* D72, O17.

## 4.1 Introduction

Informality is widespread, particularly in the developing world where it is characterised by low quality jobs and high poverty rates. Schneider et al. (2010) find a 38.7% average share of GDP produced in the shadow economy across 98 developing countries in 2007 up from 36.6 in 1999, whilst the World Bank estimates that in 2007, 54 percent of total urban employment in Latin America and Caribbean was informal.<sup>1</sup> In the same report, the World Bank finds that poverty and informality are positively correlated in a sample of 43 developing countries. Yet cross country studies reveal that democratic governments tend to be smaller and taxation rates lower in countries with larger informal sectors.<sup>2</sup> Such stylised facts contradict the established notion that a higher tax burden on the formal sector drives economic activity underground, which emerges from dual sector models with exogenous policy, and challenges the intuition from voting models that a greater share of the poor in the electorate should lead to more redistribution.

This chapter provides the first theoretical framework integrating a probabilistic voting model in a dual economy setting where agents endogenously choose their sector of activity. Endogenising both economic and political mechanisms enables the model to explain the negative correlation between taxation and informality rates found in cross-country data. This relation is attributed to differences in institutional quality.

The model makes use of few and standard assumptions to derive this result. All agents consume the public good, which is financed by an endogenous tax on formal sector workers. The returns to working formally are increasing in an agent's ability, so expected pre-tax income in the formal sector is proportional to ability, whereas in the unofficial economy income is fixed, as is commonly assumed in dual sector models. When returns to informality are relatively high, or equivalently when a large share of agents have a low expected premium from formalisation, more agents choose unofficial work and vote to maximise the level of public good. On the contrary, when more agents are better off working formally, the incentive to reduce the tax burden on the formal sector is greater. Yet, in the equilibrium of the model higher taxes are chosen the larger the share of agents who have positive premia from formalisation. This is due to a type of Laffer curve effect caused by the existence of an informal sector: The elasticity of

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<sup>1</sup>See Fajnzylber et al. (2007)

<sup>2</sup>Regarding the link with taxation, Aruoba (2010) find that tax rates and the size of the informal sector are significantly negatively correlated (coefficient of -0.47) in a sample of 33 countries, whilst Hatipoglu and Ozbek (2011) find a significant negative correlation between redistribution and informal sector size, also using cross country data.

formalisation to taxation falls with the share of agents who can benefit from formality. In other words, as institutional quality improves and the *relative* benefits of formality become more widespread a smaller proportion of potential contributors to the public good choose to relocate to the informal sector for a given tax rise. On the political side, voters who know their own ability and the distribution of abilities in the population vote for the politician whose policy platform grants them highest expected utility from private and public good consumption. The probabilistic model is used to aggregate preferences and no distortions to the political process are introduced in order to focus on the economic factors underlying the relation between taxation and informality in a majoritarian democracy. In equilibrium, the tax rate that maximises politicians' probability of being elected equates marginal benefit from aggregate public good consumption with marginal cost of taxation borne by the formal sector. As a result, the tax rate is increasing and informality rate is decreasing in the relative productivity of official activity. The negative relation between taxation and informality found in cross country studies results from an optimal choice by social welfare maximising politicians in countries that differ in their institutional quality. Finally, comparative statics on the distribution of ability show that improvements in institutional quality lead to greater increases in redistribution for a given informality share in countries with a lower distribution of productivity in the workforce, in the sense of first order stochastic dominance.

This chapter relates to the budding literature that models a dual economy with endogenous choice of sector to study the interaction between policy and sector size. The closest related article, which also endogenises both policy and sector choice is Hatipoglu and Ozbek (2011), in which the authors use a computable general equilibrium model to make similar predictions to this chapter's. Endogenising the decision of how much to redistribute as a median voter problem and embedding it within a labor-leisure choice framework, they find that an increase in the relative returns to unofficial activity leads to a decrease in redistribution and an increase in the informal sector size. Although their model relies on a more sophisticated labor market mechanism, more assumptions are required to generate results which corroborate the stylised facts outlined above. Moreover, they model the choice of tax rate as a function of the sector choice of the median voter, which compels them to vary the political weights of rich and poor or the distribution of skills in order to generate several discrete and non-comparable equilibria in which the median voter is employed in a different

sector. As a result, they must make an educated guess of the median voter's identity when calibrating their model with cross-country data. In contrast, this chapter provides a continuous prediction of the equilibrium policy through the use of a probabilistic voting model which completely endogenises the interplay between tax rate and sector sizes, generating a sort of Laffer curve as described above.

The rest of the literature which uses models with *exogenous* policy choice relies on the assumption that the public good gives rise to a productivity premium in the formal sector in order to generate strategic complementarities from formalisation which cause the negative link between taxation and informality in equilibrium. Ihrig and Moe (2004) study the evolution of informal sector size toward a steady state in a dynamic investment model, using the Johnson et al. (1997) framework which considers such a productivity enhancing public good. Similarly, Dessy and Pallage (2003) model the allocation of firms to the formal and informal sectors in a two-period heterogenous-agents model where a tax levied on formal sector firms finances a public good that is accessible only to the formal sector where it generates a productivity premium. However, in assuming that the policy choice is exogenous, these models cannot explain the choice of low redistributive taxation in democratic countries with high informality rates.

Finally, inequality is also a key factor in determining the size of the informal sector. Chong and Gradstein (2007) study the marginal effect of income inequality on the level of informality. Their model also features a premium from formalisation that depends on institutional quality, reflected by the degree of legal enforcement and property rights protection. They test their theoretical predictions, finding empirical support for the fact that a rise in income inequality leads to an increase in informality by lowering relative benefits from formality for the poor, particularly as institutions become weaker.<sup>3</sup> Mishra and Ray (2011) find corroborative evidence using a large firm-level dataset. They also provide a more in-depth explanation of two channels through which inequality in wealth/income fosters informality. In the presence of barriers to entry into formality and imperfect credit markets, a greater share of wealth constrained entrepreneurs cannot afford to join the formal sector and produce informally. Alternatively, profitability in the informal sector might be high if barriers to entry prevent efficient wealth constrained entrepreneurs to produce formally, leading the competing formal sector to be relatively inefficient. Income inequality is not central to this chapter

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<sup>3</sup>A rise in Gini from Mexican (0.49) to Brazilian (0.57) levels correlates with a 3 to 9 percentage point increase in informality.

so it does not feature explicitly in the model. However, the share of agents of the population who cannot profitably produce in the formal sector, which can be taken as a reflection of higher inequality, drives informality rates up and taxation down in the present model.

The main contribution of chapter 4 is its theoretical framework: It is the first probabilistic voting model in a dual economy setting with endogenous sector choice, allowing a parsimonious study of the relation between informality rate and policy choice. The model explains the difference in returns to informality between countries by the interaction between institutional quality and productivity distribution in line with a large body of research, which is reviewed below.

The rest of the paper is organised as follows: Section 2 introduces the model and justifies its assumptions, Section 3 derives the equilibrium policy and sector distribution and provides some comparative statics results, and Section 4 concludes.

## 4.2 Model Setup

### 4.2.1 Model assumptions

Consider an economy with two sectors  $J = \{F; I\}$ , respectively a formal and an informal sector. A population of mass 1 of risk-neutral agents are characterised by an idiosyncratic ability level  $\alpha_i$  that follows a uniform distribution on  $[\underline{\alpha}, \underline{\alpha} + 1]$  where  $\underline{\alpha} \geq 0$ .<sup>4</sup> Agents can work in the official economy where firms have access to more productive technologies and management techniques and can accumulate physical capital more easily so that workers' ability matters. Therefore formal sector workers are assumed to earn their marginal product  $\alpha_i$  and pay income tax at rate  $\tau$ :

$$y_i^F = (1 - \tau)\alpha_i \quad (4.1)$$

Alternatively, they can join the informal sector<sup>5</sup>. Following Schneider et al. (2010), informality is defined as the illegal production of legal goods and services that would normally enter gross national product calculations, hence excluding the household economy and criminal activities. This form of informal employ-

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<sup>4</sup>Countries with higher levels of human capital or better technology allowing for more efficient formal sector production have higher  $\underline{\alpha}$ , so that their productivity distribution dominates less developed countries' distribution in the sense of first order stochastic dominance.

<sup>5</sup>Note that in this model, agents' choice is stripped to the simplest decision to join either the formal or the informal sector. Agents do not have the choice of not working, nor is a distinction made between joining wage employment or entrepreneurship.



ment is largely associated with poverty and underemployment<sup>6</sup> to the extent that workers of larger more productive firms that hide part of their activity from the authorities for the purposes of tax evasion are not counted as informal agents.<sup>7</sup> Informal firms tend to operate on a small scale, using labor-intensive technology, generating low revenues that do not allow for capital accumulation. Production thus tends to be inefficient both because firms have to remain small to not attract the government's attention, and because they lack access to efficient credit markets<sup>8</sup> and to modern production technology. Therefore, agents are assumed to receive low fixed income  $\mu \in [\underline{\alpha}, 1 + \underline{\alpha}]$  if they choose the informal sector:

$$y_i^I = \mu \quad (4.2)$$

**Remark 4.1** *If  $\mu > \underline{\alpha}$ , some agents have a negative productivity premium from formalising irrespective of the tax rate and will always choose to produce informally. When  $\mu = \underline{\alpha}$  full formalisation is possible and occurs if  $\tau = 0$ .*

On the one hand, it is assumed that informal sectors exist in countries with very high quality institutions ( $\mu = \underline{\alpha}$ ) but only due to the taxation cost imposed on formal producers. Countries with poor quality institutions ( $\mu > \underline{\alpha}$ ) on the other hand have a 'structural' informal sector, a positive share of their workforce that cannot profitably join the formal sector irrespective of the taxation rate. In general, the difference ( $\alpha_i - \mu$ ) can be thought of as the productivity premium that an agent  $i$  can earn by joining the formal sector rather than producing informally. As discussed in the introduction, it is sometimes assumed in the literature that the size of this productivity premium depends on the public good in order to generate strategic complementarities between the share of agents who produce formally and the productivity premium they enjoy in the formal sector. Here this assumption is not required. Instead the size of this productivity premium depends both on the distribution of abilities and on the quality of institutions, such as the degree of contract enforcement and property rights protection,<sup>9</sup> captured in the model by the parameter  $\mu$ .

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<sup>6</sup>See Gërkhani (2004).

<sup>7</sup>This distinction with pure tax evasion is important as the fiscal preferences of voters in the informal sector is understood to coincide with that of low income agents.

<sup>8</sup>See Straub (2005), Mishra and Ray (2011).

<sup>9</sup>See Dessy and Pallage (2003); Chong and Gradstein (2007) for example.

## 4.2.2 Choice of sector

Empirical evidence shows that people engage in shadow economic activity for a variety of reasons. Schneider et al. (2010) identify the burden of direct and indirect taxation, high labour market regulations and the state of the official economy as drivers of informality. Broadly speaking, workers are either excluded from formal employment due to high barriers to entry, including the tax burden, or choose to exit formality because of its low benefits relative to informal activity.<sup>10</sup> The key parameter in the choice of sector is therefore the net relative returns from formal versus informal activity. This is in the simplest way what determines the allocation of workers across sectors in this model: Agents sort into the sectors by comparing their net expected returns from working in each for a given tax rate.<sup>11</sup>

**Proposition 4.1** *For a given tax rate and returns to informality  $\mu$ , there exists a threshold productivity level  $\tilde{\alpha}(\tau, \mu)$  such that all agents with ability  $\alpha_i \geq \tilde{\alpha}(\tau, \mu)$  produce formally and all agents with ability  $\alpha_i < \tilde{\alpha}(\tau, \mu)$  enter the informal sector. This threshold is increasing in  $\mu$  and in  $\tau$ .*

**Proof.** For a given distribution of abilities, there is an agent with ability  $\tilde{\alpha}(\tau)$  who is indifferent between the two sectors:

$$y_i^F(\tilde{\alpha}) = y_i^I(\tilde{\alpha})$$

$$\tilde{\alpha}(\tau, \mu) = \frac{\mu}{(1 - \tau)} \quad (4.3)$$

For a given institutional quality  $\mu$ , all agents with ability  $\alpha_i \geq \tilde{\alpha}(\tau)$  receive higher after-tax returns by producing formally so enter the tax-paying formal sector, and all agents with ability  $\alpha_i < \tilde{\alpha}(\tau)$  enter the informal sector. The derivatives of (4.3) with respect to  $\mu$  and  $\tau$  are positive, indicating that this threshold is increasing both in  $\mu$  and in  $\tau$ .

■

From Proposition 4.1 we can see that an informal sector exists if  $\tilde{\alpha}(\tau, \mu) > \underline{\alpha}$ , that is  $\tau > 1 - \frac{\mu}{\underline{\alpha}}$ .<sup>12</sup> Moreover, from Remark 4.1 we know that for  $\mu \geq \underline{\alpha}$  and

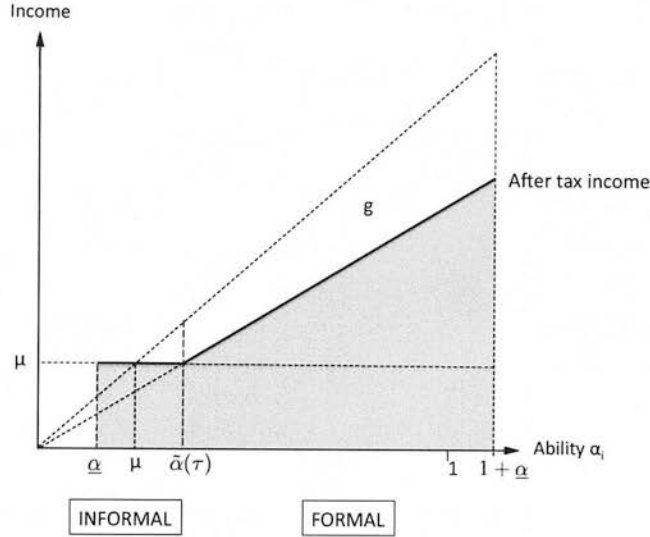
<sup>10</sup>See the excellent Fajnzylber et al. (2007) report on the informal sector.

<sup>11</sup>Loayza (1997) makes a similar assumption, with the difference that informal sector firms enjoy public services which they do not contribute to, leading to costly congestion of public goods. In this model, informal sector agents also enjoy the public good but it is non-rival so does not suffer from congestion.

<sup>12</sup>It can be shown that this will always be the case in equilibrium. See Proposition 4.3.

$\tau > 0$  the informal sector is heterogeneous, including an “upper-tier” of relatively more skilled agents who have ability  $\mu < \alpha_i < \tilde{\alpha}$  but work informally due to the tax burden and a “structural informal sector” composed of unskilled free-entry jobs for agents with ability  $\alpha_i < \mu$ .<sup>13</sup> This is shown in Figure 4.1 below. The size of the formal sector is  $\int_{\tilde{\alpha}}^{\alpha+1} di = 1 + \underline{\alpha} - \tilde{\alpha}$ , and  $\int_{\underline{\alpha}}^{\tilde{\alpha}} di = \tilde{\alpha} - \underline{\alpha}$  is the share of agents working informally.

Figure 4.1: Sectoral distribution of agents



Proposition 4.1 also argues that higher relative returns to informality  $\mu$  and higher taxation rates  $\tau$  encourage producers into the informal sector, consistent with the literature, which identifies various determinants of the former. In a cross country study, Djankov et al. (2002) find that barriers to entry, including the number of procedures, official time and cost of starting a firm in the formal sector are very high in most of the 85 countries sampled and significantly correlated with larger informal economies. Regulations cause substantial increases in formal sector labour costs, which can be shifted onto the employees. This reinforces workers’ incentives to join the informal sector. Friedman et al. (2000); Johnson et al. (1998, 1999) also identify enforcement of regulation as a key factor in determining its impact on the allocation of resources towards informality. Enforcement of labour regulations constrains firm size by raising labour costs causing firms to employ less labour and produce on a smaller scale, and by raising the probability of detection of informal firms, which is increasing in firm size.<sup>14</sup> This

<sup>13</sup>See Fields (2005) for an inventory of dual economy models and informality types.

<sup>14</sup>Using data from Brazil, Almeida and Carneiro (2009) find that a 1% increase in enforcement leads to a 0.47% reduction in average employment per firm, 0.48% decline in output and 0.46%

evidence is robustly found in other studies. Using an integrated micro-economic dataset on firms from many developing countries Dabla-Norris et al. (2008) compare the relative significance of informality causes. They identify legal quality as the single most significant factor that affects the size of the informal sector by acting on informal entrepreneurs' probability of detection. Just as the informal sector is heterogeneous, so too are the impact of these factors. Dabla-Norris et al. (2008) show that finance constraints are more likely to lead small firms into the shadow economy, whereas large firms are put off formality by legal obstacles. The impact of credit market efficiency is also investigated by Straub (2005) who looks into the role of credit market institutions in the allocation of firms across sectors when information asymmetries related to credit can be overcome by formal sector but not informal sector firms. He shows that when access to the formal sector is costly, the endogenous allocation of firms across sectors depends on their initial level of capital, the cost of entry to formality and relative efficiency of credit markets, which depends on various institutional parameters. Countries with better institutions have more efficient formal credit markets and smaller informal sectors as a consequence. To keep matters simple, none of these parameters feature explicitly in the present model, but their effect on the results can easily be related to the parameters of the model. For example, the tax rate in the model can also reflect labour costs caused by other taxes or regulations that are passed on to the employees, in as much as these contribute to funding the public good that is redistributive through its universal consumption.

The size and composition of the informal sector depend on the relative magnitude of the tax rate and quality of institutions for a given distribution of abilities. This relative magnitude is determined by the choice of policy in the political equilibrium. Next we turn to the political building block of the model.

### 4.2.3 Policy preferences and voting

Agents' preferences are quasi-linear. An agent  $i$  gets utility from private consumption and from a public good  $g$ :

$$W_i = c_i + H(g) \tag{4.4}$$

where  $c_i = \max \{ \mu, (1 - \tau)\alpha_i \}$  and preferences over the public good are assumed to be concave.  $g$  is a redistributive public good financed by the direct tax  $\tau$  on the incomes of formal sector agents *only*. The balanced budget condition

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fall in sales.

requires that:

$$g = \int_{\bar{\alpha}}^{1+\alpha} \tau \alpha_i d\alpha = \tau \frac{(1 + \underline{\alpha})^2 - \tilde{\alpha}^2(\tau)}{2}. \quad (4.5)$$

Voters choose equilibrium policies (here  $\tau$  and  $g$ ) through an election in which two candidates compete by offering a policy platform. Voting behaviour is modelled using a probabilistic voting model (see Lindbeck and Weibull (1987)). Agents' choice of candidate is determined by their preferences over the policies proposed by both candidates and by ideology (orthogonal to the policy dimension). Agent  $i$  votes for candidate A if:

$$W_i^J(\tau^A, g^A) > W_i^J(\tau^B, g^B) + \iota_i + \delta \quad (4.6)$$

where  $\iota_i$  is an idiosyncratic ideological bias towards candidate B that follows a uniform distribution with density  $\phi$  on  $\left[-\frac{1}{2\phi}; \frac{1}{2\phi}\right]$ . Note that this parameter determines the political weight of a group of agents in a probabilistic voting model, as it defines how responsive voters in this group are to a shift in policy platform towards their bliss point. In this chapter, this parameter is distributed uniformly over the whole population, in order to focus purely on the welfare maximising taxation choice under different levels of institutional quality. An interesting extension involves allowing this parameter to vary across formal and informal sector, modelling explicitly the factors that determine its relative density in each sector, in order to study other political economy effects of informality. Finally,  $\delta$  is an aggregate relative popularity shock that affects all voters in the same way and is distributed uniformly on  $\left[-\frac{1}{2\psi}; \frac{1}{2\psi}\right]$  with density  $\psi$ .

The timing is:

1. Political platforms are announced:  $[\tau^A, g^A]$  and  $[\tau^B, g^B]$ . At this time the candidates know the distributions for  $\iota_i^J$  and  $\delta$ .
2. Actual value of  $\delta$  is realised and all uncertainty is resolved.
3. Election occurs.
4. The winner implements her platform.

To determine the platforms chosen by the candidates at stage 1, let us identify the swing voter in each sector, that is the agent  $i$  with an ideological bias  $\iota_i$  that makes her just indifferent between the two candidates, given her choice of sector and the proposed policies:

$$v^J = W_i^J(\tau^A, g^A; \alpha_i) - W_i^J(\tau^B, g^B; \alpha_i) - \delta$$

$$v^J = \max \{ \mu + H(g^A), (1 - \tau^A)\alpha_i + H(g^A) \} \\ - \max \{ \mu + H(g^B), (1 - \tau^B)\alpha_i + H(g^B) \} - \delta$$

As we have seen in the previous section, sector shares are given by the threshold ability  $\tilde{\alpha}(\tau)$ , which is itself a function of the equilibrium policy choice, with all agents  $i$  with ability  $\alpha_i \leq \tilde{\alpha}(\tau)$  in the unofficial economy and a share  $\int_{\tilde{\alpha}}^{\underline{\alpha}+1} di = 1 + \underline{\alpha} - \tilde{\alpha}(\tau)$  of agents working officially. In the informal sector, income is independent of ability so agents' policy preferences are heterogeneous only in ideology as preferences for public good are identical. The indifferent agent in the political equilibrium is the agent whose ideological bias makes her indifferent between voting for A and voting for B given the announced policies. This threshold ideological bias in the informal sector is given by:

$$v^I(g^A, g^B, \delta) = H(g^A) - H(g^B) - \delta \quad (4.7)$$

Therefore candidate A's vote share from informal sector agents is the share of informal agents in the population times the probability that these agents have an ideological bias  $v_i \leq v^I(g^A, g^B, \delta)$ :

$$\pi_A^I = (\tilde{\alpha}(\tau) - \underline{\alpha}) \phi \left( H(g^A) - H(g^B) - \delta + \frac{1}{2\phi} \right) \\ \pi_A^I = (\tilde{\alpha}(\tau) - \underline{\alpha}) \left( \frac{1}{2} + \phi [H(g^A) - H(g^B) - \delta] \right) \quad (4.8)$$

In the formal sector, agents have different preferences over policies depending on both ability and ideological heterogeneities. For all  $\alpha_i$  such that  $\tilde{\alpha}(\tau) \leq \alpha_i \leq \underline{\alpha} + 1$ , there exists a  $v^F(\alpha_i, \tau^A, g^A, \tau^B, g^B, \delta)$  such that an agent with ability  $\alpha_i$  and ideology  $v^F$  is indifferent between A and B. Therefore, the share of formal voters voting for candidate A is given by:<sup>15</sup>

$$\pi_A^F = (1 + \underline{\alpha} - \tilde{\alpha}(\tau)) \left[ \frac{1}{2} + \phi \left( \frac{1}{2}(\tau^B - \tau^A)(1 + \underline{\alpha} + \tilde{\alpha}(\tau)) \right. \right. \\ \left. \left. + H(g^A) - H(g^B) - \delta \right) \right] \quad (4.9)$$

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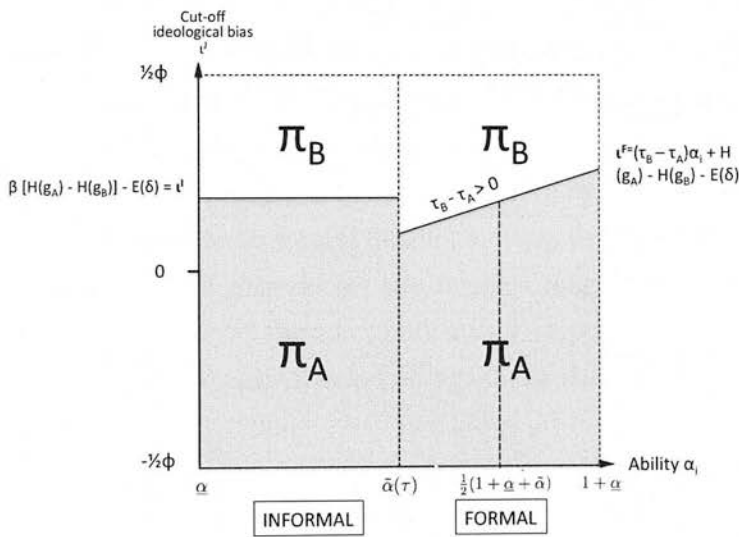
<sup>15</sup>See Appendix for derivation.

Candidate A's total vote share is the sum of votes she obtains from each sector. Combining (4.8) and (4.9), this is given by:

$$\pi_A = \frac{1}{2} + \phi \left[ \frac{1}{2} \left( (1 + \underline{\alpha})^2 - \tilde{\alpha}(\tau)^2 \right) (\tau_B - \tau_A) + (H(g^A) - H(g^B)) - \delta \right] \quad (4.10)$$

Notice from equation (4.10) that voters in the informal sector vote solely based on the level of public good provision and ideology, whereas the share of formal sector voters choosing politician A depends also on the private idiosyncratic cost of taxation, which is a function of their ability. This is shown in Figure 4.2, which is drawn for the case where  $\tau_B > \tau_A$ .

Figure 4.2: Politicians' vote share in each sector



Equation (4.10) can be used to find the politician's optimal choice of policy.

### 4.3 Equilibrium policy and sector distribution

In a majoritarian system, A's probability of winning, denoted  $p_A$ , is the probability that  $\pi_A \geq \frac{1}{2}$ :



$$\begin{aligned}
p_A &= Prob \left[ \pi_A \geq \frac{1}{2} \right] \\
&= \frac{1}{2} + \psi \left[ \frac{1}{2} \left( (\underline{\alpha} + 1)^2 - \tilde{\alpha}^2(\tau) \right) (\tau_B - \tau_A) + (H(g^A) - H(g^B)) \right]
\end{aligned}$$

Rearranging and taking the derivative with respect to taxation, we obtain the following equation:

$$\frac{\partial p_A}{\partial \tau_A} = \psi \left[ \left( \frac{1}{2} \left( (\underline{\alpha} + 1)^2 - \tilde{\alpha}^2 \right) - \frac{\tau}{1 - \tau} \tilde{\alpha}^2 \right) H_g - \frac{1}{2} \left( (1 + \underline{\alpha})^2 - \tilde{\alpha}^2 \right) \right]. \quad (4.11)$$

Equation (11)<sup>16</sup> shows how an increase in tax affects a politician's probability of winning, by increasing the cost of formality, causing a reallocation of agents towards the informal sector, and a non-monotonic effect on the level of public good. The first bracket shows the non-monotonic change in public revenue caused by a tax increase: Government revenue increases by the amount of taxable income (first term) but total taxable income is reduced (second term) due to taxation inefficiencies, which here are due to formal output moving to the informal sector. The direction of the effect will depend on the relative magnitude of these two forces. This term is multiplied by the marginal utility of public goods. Finally, the last term shows the private cost of taxes to agents in the formal sector.

**Proposition 4.2** *For each  $\mu \in [\underline{\alpha}, 1 + \underline{\alpha}]$ , there is a unique equilibrium tax rate  $\tau^*(\mu) \in [0, 1]$  which is compatible with a positive supply of formal labour. This optimal tax rate is a monotonically decreasing function of the relative returns to unofficial economic activity  $\mu$ .*

**Proof.** Noticing that  $\tilde{\alpha}$  is a function of tax  $\tau$  and shadow returns  $\mu$ , we can write the following necessary condition as a function  $M(\tau; \mu, \psi, \underline{\alpha})$ :

$$\frac{\partial p_A}{\partial \tau_A} = 0 \equiv M(\tau; \mu, \psi, \underline{\alpha})$$

which implicitly defines the equilibrium tax rate  $\tau^*(\mu, \underline{\alpha})$ . The second order condition evaluated at  $\tau^*(\mu, \underline{\alpha})$  is negative:

$$M_\tau < 0 \quad (4.12)$$

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<sup>16</sup>See Appendix for derivation.

$\forall \mu \in [\underline{\alpha}, \underline{\alpha} + 1]$  implying that there is a unique solution to this problem for each exogenous value of  $\mu$ .

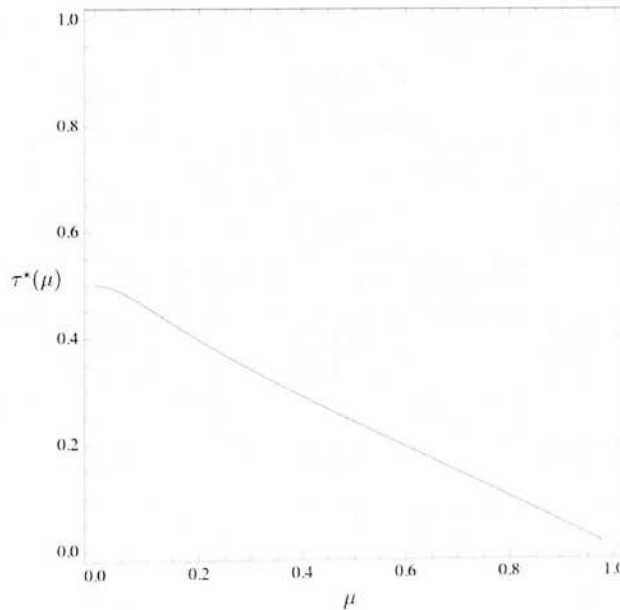
Moreover, evaluating :

$$\tau_{\mu}^* = -\frac{M_{\mu}}{M_{\tau}} < 0 \tag{4.13}$$

From (12) and (13) we deduce Proposition 4.2. ■

Proposition 4.2 is depicted in Figure 4.3 below, drawn for the case  $\underline{\alpha} = 0$ . The tax rate chosen in equilibrium increases as the quality of institutions improves, that is as  $\mu - \underline{\alpha}$  falls. To understand why, notice that on the one hand all voters want a tax rate that maximises redistribution,<sup>17</sup> and on the other hand those voters operating in the formal sector have a lower bliss point, as they are burdened with the tax. The tax rate that maximises public good provision is decreasing in  $\tilde{\alpha}$ , because as institutional quality weakens formal workers find it less profitable to produce formally at each tax rate and so are more likely to move to the unofficial sector where they do not contribute to the public good. In the limit when  $\mu - \underline{\alpha} = 1$  the public good maximising tax rate is 0. This explains the negative relation between tax and informal sector in equilibrium.

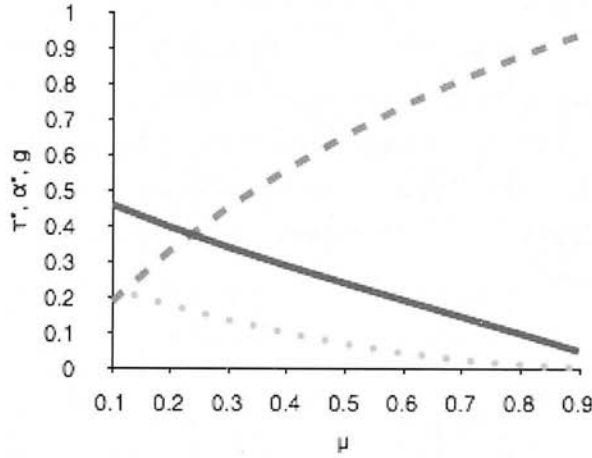
Figure 4.3: Equilibrium tax rate as a function of relative returns to informality (drawn for  $\underline{\alpha} = 0$ )



<sup>17</sup>The public good, and therefore redistribution, is maximised at the rate of:  $\tau^{gmax} = \frac{(1+\underline{\alpha})^2 - \tilde{\alpha}^2}{(1+\underline{\alpha})^2 + \tilde{\alpha}^2}$ .

The results of this model are in line with the evidence that governments in countries with low enforcement or poor institutional quality are smaller, implying that institutional quality and redistribution are complements. Comparative statics on the equilibrium using the functional form  $H(g) = \sqrt{g}$  and varying the returns to informality are shown in Figure 4.4, where  $\mu$  the inverse of institutional quality is measured on the horizontal axis.

Figure 4.4: Equilibrium tax rate (blue solid line), informality share (green dashed) and public good (yellow dotted) as relative returns to informality increase.



The dashed green line represents the equilibrium share of informality in the workforce, the solid blue line is the equilibrium tax rate on income and the resulting redistributive public good level is depicted in the dotted yellow line. For a given distribution of abilities, the graph shows that the informal sector grows and taxation decreases in equilibrium when the quality of institutions worsens and relative returns to informality increase accordingly. These comparative statics support the evidence that countries with large informal sectors tend to have lower taxation and smaller governments. This model suggests that this is not only due to the constraint informality puts on governments' fiscal capacity, but also to the demand for redistribution from voters in the informal sector interacting with the effect that institutional quality has on the elasticity of formality to taxation.

Moreover from this Proposition 4.2 and Remark 4.1 we can deduce the following proposition:

**Proposition 4.3** *In equilibrium there is always an informal sector for all  $\underline{\alpha} > 0$ ,*

including when  $\mu = \underline{\alpha}$ .

**Proof.** We know from Proposition 4.2 that the equilibrium tax rate  $\tau^*(\mu, \underline{\alpha})$  is decreasing in  $\mu$  for all  $\mu \in [\underline{\alpha}, 1 + \underline{\alpha}]$ . Moreover, by assumption we have  $\mu \geq \underline{\alpha}$ . Hence the highest possible equilibrium tax rate  $\tau^*(\mu, \underline{\alpha})$  for a given  $\underline{\alpha}$  is chosen when  $\mu = \underline{\alpha}$ . Yet we know that full formality can only prevail in equilibrium, ie  $\tilde{\alpha} = \underline{\alpha}$ , if  $\tau^* \leq 1 - \frac{\mu}{\underline{\alpha}}$ . Yet if  $\mu = \underline{\alpha}$ , this necessary condition is equivalent to  $\tau^* = 0$ . Hence this implies that the maximum tax rate  $\tau^*(\mu, \underline{\alpha})$  for a given  $\underline{\alpha}$  equals zero, so that for all  $\mu > \underline{\alpha}$  we should have  $\tau^* < 0$ , which is impossible. ■

Finally, comparative statics are performed on the equilibrium by shifting the distribution of abilities. This allows to compare the equilibrium taxation rate in countries with different productivity distributions maintaining the quality of institutions, hence the relative returns to informality  $\mu - \underline{\alpha}$ , fixed. More interestingly, it also allows to compare the effect of institutional quality on redistribution and informality across countries with different productivity distributions, ie. different  $\mu - \underline{\alpha}$ . This exercise involves intractable equations, so I provide the results of a simulation below which give rise to the following Remark 4.2:

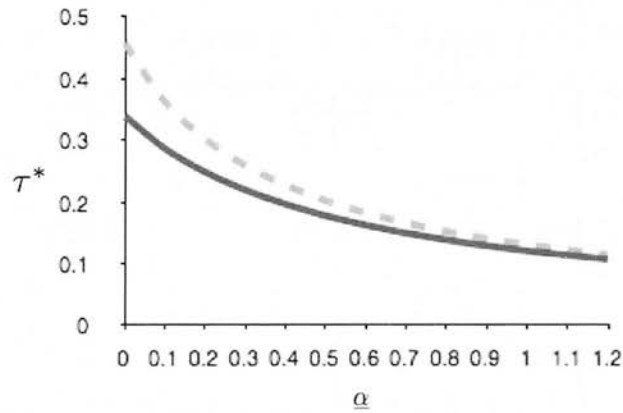
**Remark 4.2** *As  $\underline{\alpha}$  increases the equilibrium taxation rate  $\tau^*(\mu, \underline{\alpha})$  falls monotonically for a fixed level of institutional quality  $\mu - \underline{\alpha}$ . Moreover, at lower levels of  $\underline{\alpha}$  an improvement in institutional quality leads to a greater rise in the equilibrium tax rate and a greater fall in the informality share  $\tilde{\alpha} - \underline{\alpha}$ .*

From Proposition 4.2 we know that the taxation rate chosen in equilibrium decreases with  $\mu$  because as  $\mu$  increases, the taxation rate at which agents move into informality falls for all  $\underline{\alpha}$ . Agents' preference for the public good drives them to reduce the equilibrium tax rate in order to limit the move of producers into the informal sector. Moreover, from the above result we know that the taxation rate chosen in equilibrium is a decreasing function of  $\underline{\alpha}$ . This is because the marginal utility of public good consumption  $H(\cdot)$  is diminishing where as the marginal utility of private consumption is constant. Hence the extra productive capacity of an economy with higher productivity leads agents' optimal taxation rate to fall. This is what drives the final result of Remark 4.2. As  $\underline{\alpha}$  rises, agents prefer a lower taxation rate, therefore the effect that a rise in  $\mu$  has on the optimal taxation rate (described in Proposition 4.2), which is driven by a desire to minimise the move of formal agents into the informal sector, is weaker. Hence differences in

$\mu$  lead to greater differences in equilibrium taxation rate  $\tau^*(\mu)$  and informality share  $\tilde{\alpha}(\mu, \tau^*)$  at lower levels of  $\underline{\alpha}$ .

The comparative statics result from Remark 4.2 is derived by simulating the model for different values of  $\mu - \underline{\alpha}$  and varying  $\underline{\alpha}$ . The results of this simulation using the same functional form  $H(g) = \sqrt{g}$  as in Figure 4 and varying  $\underline{\alpha}$  are depicted in Figure 5 below. Note that a rise in  $\underline{\alpha}$  implies first order stochastic dominance in the distribution of abilities. The equilibrium taxation rate obtained as the bounds of the ability distribution increase is drawn in the solid dark blue line for a relatively weak institutional quality  $\mu - \underline{\alpha} = 0.3$  and in the dashed yellow line for a country with higher enforcement  $\mu - \underline{\alpha} = 0.1$ .

Figure 4.5: Equilibrium tax rate  $\tau^*$  for relative informality returns  $\mu - \underline{\alpha} = 0.1$  (dashed yellow line) and  $\mu - \underline{\alpha} = 0.3$  (solid blue line) as  $\underline{\alpha}$  increases



The negative slope of both lines shows that the equilibrium taxation rate is a decreasing function of the bounds of the ability distribution, or equivalently that a country with labour productivity distribution that stochastically dominates another country's has lower equilibrium taxation. This is due to the quasi-linearity assumption for individual preferences. As the productivity of the workforce increases maintaining the relative returns to informality fixed, both private and public good production increase for all tax rates. Yet the utility derived by all agents from private consumption rises linearly with  $\underline{\alpha}$  whilst the marginal utility derived from the public good is diminishing, due to the concavity of the preferences for the public good. Therefore a lower taxation rate equates the marginal utility from private and public consumption at higher levels of  $\underline{\alpha}$ . Moreover, whilst  $\mu$  rises one-for-one with  $\underline{\alpha}$  by construct, the equilibrium informality rate  $\tilde{\alpha}^* - \underline{\alpha} \equiv \frac{\mu}{1-\tau^*} - \underline{\alpha}$  rises at a monotonically decreasing rate as  $\tau^*$  converges to zero. More interestingly, the gap between the two curves shrinks as the ability distri-

bution bounds rise, implying that in countries with a less skilled workforce and inferior technology, hence lower labour productivity, differences in institutional quality have a greater effect on the equilibrium taxation rate and informality share. This is because as productivity rises, the demand for redistribution is less salient, hence voters respond to a rise in  $\mu$  with a smaller reduction in the equilibrium taxation rate (as described in Proposition 4.2). This explains why as institutional quality improves, taxation increases by more at low levels of productivity. The importance of improvements in enforcement is greatest for countries with low labour productivity.

## 4.4 Conclusion

This chapter has drawn a very simple theoretical model that nonetheless endogenises both political and economic choices to explain some stylised facts found in cross country data. It is the first probabilistic voting model of its kind, where the choice of sector in a dual economy setting is endogenised and so is the choice of policy. Under political competition in a majoritarian system, candidates choose an income tax to maximise a utilitarian aggregate welfare function. The equilibrium tax monotonically decreases and the informal sector grows with the relative returns to informality as determined by the quality of institutions, yielding the negative relationship between redistribution and informality found in empirical studies. This is due to voters who have a preference for the public good choosing a lower tax rate in countries where the elasticity of formality to taxation is higher because of weak institutions and higher relative returns to unofficial activity. Moreover, the importance of institutions in the relation between taxation and informality is decreasing in the overall distribution of productivity. The model provides some explanation for the difference in returns to informality between countries, namely the interaction of institutional quality with the productivity distribution. A large body of research, which is reviewed in the introduction, provides complementary explanations for such differences.

The basic model set up in this chapter has promising extensions. In order to derive general results, the ideological bias is here assumed to be uniformly and independently distributed across groups. It would be interesting to vary the political weights in the model to see how distributions of power affect equilibrium policy in the presence of an informal sector, or to study other political economy effects of informality such as its link with corruption. Similarly, the distribution of abilities could be skewed to explore the effects of inequality on informality, as

in Mishra and Ray (2011). Following their approach, a more explicit modelling of enforcement with corruptible inspectors would then provide an interesting extension to explore the link between corruption and informality, which is salient in cross-country data.



## C.1 Derivation of (9)

The marginal formal sector voter has ideological bias:

$$\begin{aligned}\iota^F &= (1 - \tau_A)\alpha_i - (1 - \tau_B)\alpha_i + (H(g^A) - H(g^B)) - \delta \\ \iota^F &= (\tau_B - \tau_A)\alpha_i + (H(g^A) - H(g^B)) - \delta\end{aligned}$$

Therefore candidate A's vote share from the formal sector, the share of formal agents with an ideological bias  $\iota_i \leq \iota^F$  in the population, depends on the distribution of ability in the :

$$\pi_A^F = \int_{\tilde{\alpha}(\tau)}^{1+\underline{\alpha}} Prob[\iota_i \leq \iota^F(\alpha_i, \tau^A, g^A, \tau^B, g^B, \delta)] dF(\alpha_i)$$

$$\begin{aligned}\pi_A^F &= \int_{\tilde{\alpha}(\tau)}^{1+\underline{\alpha}} \frac{1}{2} dF(\alpha_i) + \phi(\tau_B - \tau_A) \int_{\tilde{\alpha}(\tau)}^{1+\underline{\alpha}} \alpha_i dF(\alpha_i) \\ &\quad + \phi \left[ \int_{\tilde{\alpha}(\tau)}^{1+\underline{\alpha}} (H(g^A) - H(g^B) - \delta) dF(\alpha_i) \right]\end{aligned}$$

$$\pi_A^F = (1 + \underline{\alpha} - \tilde{\alpha}(\tau)) \left[ \frac{1}{2} + \phi(H(g^A) - H(g^B) - \delta) \right] + \phi(\tau^B - \tau^A) \frac{(1 + \underline{\alpha})^2 - \tilde{\alpha}^2(\tau)}{2}$$

Rearranging yields (9).

## C.2 Derivation of (11)

Noticing that  $\tilde{\alpha}$  is a function of tax and shadow returns, we can write

$$p_A = \frac{1}{2} + \psi \left[ \frac{1}{2} \left( (1 + \underline{\alpha})^2 - \tilde{\alpha}^2(\tau) \right) (\tau_B - \tau_A) + (H(g^A) - H(g^B)) \right]$$

Candidate A takes B's platform as given and proposes a platform that maximises her probability of winning the election:

$$\frac{\partial p_A}{\partial \tau_A} = \frac{\partial}{\partial \tau_A} \left[ \psi \left[ \frac{1}{2} \left( (1 + \underline{\alpha})^2 - \tilde{\alpha}^2(\tau) \right) (\tau_B - \tau_A) + (H(g^A) - H(g^B)) \right] \right]$$

Both candidates are identical so the problem is a symmetric one, that is,  $p_A = 1 - p_B$  and candidates both maximise  $p_P R$  so they must choose the same platform in a rational expectations equilibrium. The equilibrium platform chosen by candidate A solves:

$$\psi \left[ -\frac{1}{2} \left( (1 + \underline{\alpha})^2 - \tilde{\alpha}^2(\tau_A) \right) + \frac{dH(g_A)}{d\tau_A} \right] = 0$$

where:

$$\frac{dH(g_A)}{d\tau_A} = H_g \left[ \frac{1}{2} \left( (1 + \underline{\alpha})^2 - \tilde{\alpha}^2 \right) - \frac{\tau}{1 - \tau} \tilde{\alpha}^2 \right]$$

Substituting this expression into the previous equation yields (11).

## CHAPTER 5

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### Conclusion

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This thesis compiles three essays on corruption and informality in the developing world. The first chapter focuses on the industrial organisation effects of favouritism in public procurement in the context of Paraguay. It is the first empirical microeconomic study to illustrate the fact that rent-seeking is costly for development by showing how entrepreneurs' economic incentives are distorted toward unproductive activities as the result of favouritism in the allocation of public contracts in Paraguay. Our findings highlight the importance of tackling corruption by shedding light on some of the large dynamic "hidden" costs of corruption over and above the static costs of bribery and embezzlement. We find that in Paraguay institutions with an important procurement activity are more likely to engage in corrupt dealings. As for firms, they have a greater probability of obtaining a contract directly through an exceptional procedure from an institution with which they have a strong contractual relation, both in terms of the total value and frequency of transactions, particularly when dealing with more corrupt State entities. Finally firms trading more with the public sector are found to be more profitable, even when controlling for their unobserved characteristics, reflecting the misallocation of talent towards this largely unproductive sector induced by favouritism. Large rents linked to the resale of imported goods to the State and the historical absence of an import-substitution strategy have contributed to make Paraguay one of the least industrialised economies in South America as, apart from the soybean and meat sectors, its entrepreneurs have systematically specialised in commercial intermediation, often with the public

sector as sole client, rather than in production. The costs of this productive atrophy and biased specialisation are reflected in the poor record of economic growth. Several policy implications emerge from this chapter. First, whilst the existence of an exceptional purchase mechanism is clearly needed to deal with cases of emergency, it is also important that a mechanism of checks and balances ensure its use remains exceptional. Second, more transparency in the allocation of contracts can be achieved by putting together a registry of State providers, including the names of the firm owners and members of the administration board. Third, the move towards greater transparency also includes better data keeping and diffusion. Provided good quality data, an analysis like this one could assess the state of competition in public contracts more frequently, which could also help to target monitoring efforts. These proposals were put to the Paraguayan government in a report which I wrote for Transparency International (Paraguay) and presented to the newly elected government in September 2008.

The second chapter analyses the political economy of labour regulatory enforcement in Brazil. In the context of the empirical political economy literature in Brazil, the analysis reveals that, contrary to other areas of the public sector, the work of the labour inspectorate in Brazil is not subject to political manipulation. I test firstly for electoral cycles in the imposition of labour fines, secondly whether labour regulations are selectively enforced according to political motivations and finally, I assess whether “pork barrel” strategies are used in order to sway voters. Electoral results are matched with a novel dataset of fines imposed on firms for labour infractions to test these considerations. First, the analysis finds that mayors’ and the president’s political interests are not significantly correlated with the distribution of fines, neither is the alignment of local politicians with governors or the president. Second, the appointment of a new governor is found to be a highly disruptive event for the inspectorate, as evidenced by the steep rise in the number of fines issues in governors’ second term. Third, towns where the governor received strong support in the last election have marginally fewer fines on average. This corroborates the evidence from the institutional analysis of the inspectorate, namely that a key channel for political influence on regulatory enforcement is through the regional inspectorate superintendents who are appointed by the state governors. However fourthly, in contrast with Ferraz (2007)’s findings in the context of environmental regulations in Brazil, the pattern of targeting does not vary significantly along the electoral cycle making it unlikely to be an electoral clientelism strategy.

The important reforms in the organisation of the labour inspectorate in Brazil

since the mid-1990s to guarantee more autonomy to the inspectors have probably had a positive effect in protecting them from the influence of powerful politicians. In this sense, the significant correlation between governors' political interests and the issuance of fines suggests that the appointment of the regional inspectorate director should also be kept independent of the political preferences of the governor. Nonetheless, the availability of other, more efficient and more effective means to sway voters in Brazil suggests that labour inspections are not so much at risk of clientelistic manipulation. In fact, fiscal transfers have received far more attention in the political economy literature precisely for this reason.

Finally, the fourth chapter builds a voting model in a dual sector economy to explain the relation between taxation and informality in cross-country data. Voters in countries with high informality rates tend to vote for lower redistribution and taxation rates. This is explained in the model by the poor quality of institutions in such countries, which cause the relative premium from formalising to be low. The elasticity of formal production to taxation is therefore lower where institutional quality is poor: For a given increase in the tax rate, more individuals will hide in the shadow economy. As a consequence, the welfare maximising tax rate is found to be lower than in countries where there are more benefits from formalising. Moreover, comparative statics on the level of labour productivity show that improvements in institutional quality are more important in countries with a less productive labour force, as they lead to greater increases in redistribution and reductions in the informality share.

The model integrates political mechanisms as well as economic features and in doing so shows the non-trivial interaction between informality and policy choice. More attention should be paid to this interaction when studying the determinants of informality, instead of taking policy choice as exogenous. Moreover, this chapter contributes a theoretical framework that is well adapted to studying political economy features of developing countries, where informality is a key characteristic of the economy.

Several projects and ideas for further research have germinated from work on this thesis. One in particular focuses on the relationship between informality and corruption, which has drawn increasing amounts of research interest lately.<sup>1</sup> One aspect that has however eluded the literature to date is the impact of informality on voting behaviour. In a democratic setting, I argue that widespread informality weakens the effectiveness of elections as a mechanism for selecting and disciplin-

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<sup>1</sup>See for example Friedman et al. (2000); Johnson et al. (1998, 1999); Mishra (2005, 2006); Mishra and Ray (2011).

ing politicians, essentially because informal voters receive an imperfect signal on politicians' types. This research would contribute to explaining the persistence of corruption alongside widespread informality in much of the developing world<sup>2</sup>.

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<sup>2</sup>See for example Mishra (2006) for an overview of the theoretical explanations to date for the persistence of corruption.

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