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Comparison of a country's corruption level and delays in ports

A study of the effects corruption has on delays in ports

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Abstract

The second-best theory of corruption includes predictions that corruption may be introduced as a second-best option in dealing with burdensome bureaucracy, leading to more efficiency. One of the predictions in the theory postulates that on average, paying for a better position in a queue (bribes) should be negatively correlated with time delays, meaning that paying bribes would reduce waiting time in a queue. Further, the theory on corruption predicts that the relationship between paying bribes and time delays should vary across companies, with those companies having the highest opportunity cost of waiting as well as lower costs of corruption being more willing to pay for a better position in the queue, and thereby shortening the waiting times.

This master's thesis examines the relationship between bribes and waiting times in ports and investigate the heterogeneity across firms depending on their home country's corruption level.

Our data are inconsistent with the prediction that corruption shortens waiting times. According to the specifications in this master's thesis, all else equal, companies paying bribes in ports experience longer waiting times when exporting and/or importing. Further, our specifications indicate that the level of corruption in a company's home country is in fact associated with shorter waiting times. The results in this master's thesis are at odds with the second-best theory but do produce evidence that paying companies from more corrupt countries wait less than paying companies from less corrupt countries. This implies that companies from more corrupt home countries may possess a competitive advantage over companies from less corrupt home countries when encountering corruption in ports.

Key words: International trade, Corruption, Time delays.

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1. Introduction

1.1 Motivation and purpose

The shipping and ports industry play a crucial role in several large economies all over the globe. The international shipping industry is responsible for the carriage of around 90% of the world trade value (ICS, 2019). It connects and influences all corners of the world and are connected to all industries in some way or form. As companies grow and expand into other global markets, shipping becomes an integral part of their day to day operations.

One large issue for shipping companies is that they almost systematically are asked to pay some sort of fee or unformal gift to access ports and/or to be able to clear customs in certain countries. We met with a senior executive in a large European shipping company, who confirmed that there exists a great number of challenges related to what he referred to as illegitimate claims. These types of claims can come in shapes of tariffs, customs requirements, shortage, and invoices for administrative services. Refusing to pay such claims, often results in large delays. He reported that one day of operating one of their vessels costs between USD 30.000 to USD 50.000. This tells us that if a shipment is delayed, this would inflict large costs on the company[1]. But how much of the delays in ports can be connected to such corruption? And can payments of such illegitimate claims accelerate the time spent in port, so that delays are mitigated? These questions are part of the larger understanding regarding the role of corruption in private sector development. Currently there are a lot of papers and studies that conclude on the negative effect corruption has on the economy, including slowing down economic growth by distorting incentives, increase transaction costs and aggravating uncertainty, leading to misallocation and underinvestment (Murphy, Shleifer, & Vishny, 1991) (Shleifer & Vishny, 1993) (Rose-Ackerman, 1997) (Svensson, 2000). Yet there also exists a large amount of papers and studies on corruption that tells a different story. This literature shows that corruption may have the effect to enhance efficiency by enabling circumvention of burdensome business regulations and/or by incentivise bureaucrats or public government officials to work harder due to payments from bribes (Leff, 1964) (Organski, 1969) (Lui, 1985) (Lien, 1986)

[1] Informant A, personal interview, 01.02.2019.

In this master's thesis, we investigate the same issues by examining the relationship between paying a bribe and waiting times in ports. We are using firm-level data from The World Bank Enterprise Surveys, to more specifically, test two predictions in the model of the second-best theory of corruption. The first prediction states that firms paying bribes in ports should get through ports faster than companies not paying such bribes. The theory further predicts that this relationship is heterogeneous across companies, with companies with a higher opportunity cost of waiting, being more willing to pay bribes, and consequently face shorter waiting times. Søreide (2016) predicted that a company's willingness to pay a bribe is largely dependent on the cost of corruption. So if the relationship between paying a bribe and time delays is heterogenous based on the company's willingness to pay, this implies that companies with lower costs of corruption should go through ports faster. Andvig and Moene (1990) predicted that the cost of corruption may vary with the level of corruption, indicating that the higher levels of corruption, leads to lower cost of corruption (because companies from more corrupt countries are facing lower transaction costs for bribes, smaller chances of detection and lower consequences of being caught). The purpose of this study is to examine if companies paying bribes have an advantage when encountering corruption in ports. To do this, we use econometrical analysis based on data from the World Bank Enterprise Surveys to establish causality between paying bribes and waiting times in ports.

The World Bank Enterprise Surveys have been conducted in 145 different countries across 2006 - 2019 and are well suited for analyzing the association between corruption and time delays. It contains company-specific data on corruption in different aspects of their business, from clearing ports to other regulatory requirements such as applying for various permits in a country.

This study will contribute to the existing empirical literature on the second-best theory in terms of using an up-to-date data sample and investigating the possible effects of corruption on the competition aspects between companies in ports. In addition, it would complement and broaden economic theory in regards to how corruption distorts economic growth and impedes world trade.

2. Delays

2.1 Definition of delays

D. Hummels, Minor, Reisman, and Endean (2007) asked the question; why don't countries trade more? In their research they found that in discussions about trade barriers, the focus usually lies on tariffs. However, Clemens and Williamson (2002) found that average import tariffs worldwide dropped from 8,6 to 3,2 percent between 1960 and 1995. D. Hummels et al. (2007) then studied; if perhaps nontariff barriers where the prime obstacle to trade and focused specifically on the nontariff trade barrier; Time delays. In their study, they combined estimates of per day time costs with data on days lost to customs delays and port clearance and found that customs delays prove a far greater barrier to trade than applied tariffs. In their study, they define time delays as time spent in ports. In our master thesis, we are going to use the same definition. We define time delays as the total time spent in port for both importers and exporters as they both spend time in ports and are affected by the same aspects.

There is a wide range of causes for time delays, and one of them are corruption. We want to study the effects corruption has on time delays in ports. Therefore, our main variables in this master thesis is the average time companies spend in ports for exporting and importing.

2.2 Cost of time

Because of large operating costs associated with vessels, we understand that there is a substantial cost associated with waiting times for shipping companies. If a vessel is delayed in port, this could potentially mean large losses for the company. In addition to increased operating costs, delays are also associated with large opportunity costs for the company. If the vessel is delayed in a port, it won't be able to deliver other shipments as fast as if the vessel wasn't delayed. The shipment could be some place more profitable instead of being stuck in port. D. L. Hummels and Schaur (2013) stated that lengthy shipping times often result in inventory-holdings and depreciation cost on shippers. Inventory-holdings include both capital cost of the goods in transit, as well as the need to hold large buffer-stock inventories at the final destination to accommodate for the variations in arrival times. Depreciations captures any reason that newly produced goods might be preferable than older goods. This could be that some technology is rapidly getting obsolete compared to new technology, or simply that when transporting fresh fruit for example, the longer the shipment stays in transit, the less fresh the fruit gets. D. L. Hummels and Schaur (2013) estimated that each day in transit is worth 0,6 to 2,1 percent of the value of the good being transported. Even though they identify the value of time saving from transport modal choice, their estimates also give some information about policies and sources of technological change that speed up the transit time. For example, imposing strict port security procedures could significantly slow the flow of goods, however, streamlining elaborate customs procedures or investing in more efficient port infrastructure speeds up the flow of goods. This means that we can consider time spent in ports to include several aspects where there is a possibility of increased time delays and thereby increased costs. Djankov, Freund, and Pham (2010) investigate this possibility using product-specific estimates of per day time cost taken from an earlier draft of D. L. Hummels and Schaur (2013). They find that countries with long customs delays see reduced trade volumes, and the largest reduction in trade occur in the most time sensitive products.

Taken these findings into account, we can determine that time delays are not only costly for the specific firm through operating costs, but it is also costly for countries and consumers as delays tends to decrease the amount of trade and slow down speed to market of goods.

2.3 Delays in ports

When we examine delays in ports, we consider two different areas of where delays can occur: Delays in customs and delays in port. Delays in customs include all the possible time delays that can occur in customs. This include, but are not limited to, excessive inspections of cargoes, redundant and poorly coordinated procedures, poor communication and information management, low-skill levels among staff and corruption. Delays in ports include all the possible time delays that can occur in the port itself. This include, but are not limited to, lower port efficiency and port quality (ex. a port that has a newer and more modern infrastructure may process cargoes faster that ports with an underdeveloped infrastructure) (Freund, Hallward-Driemeier, & Rijkers, 2016), corruption and infrequent service: smaller, poorer nations distant from major trade lanes receive fewer, less frequent calls from ocean liners (D. Hummels, Lugovskyy, & Skiba, 2009).

Our dependant variable, time spent in ports for exporters and importers, cover both the time aspects in ports as well at the time aspects in customs. The variables measure the average number of days that it took from the time the establishment’s goods arrived at the ports until the time these goods cleared customs, meaning that the variable cover both areas of time delays: Delays in customs and delays in ports.

3. Corruption

3.1 Definition of corruption

Corruption is deeply normative and has been a subject of major dispute and long-running debate (J.S, 1967) (Philp, 1997; Thompson, 1993). Nowak (2001) pointed out that with no international legal definition, the definitions of corruption vary across countries and disciplines. Due to intergovernmental organizations, such as the OECD, and their efforts to implement international conventions, we now see more harmonized laws and regulations on the subject (Søreide, 2016). An example of such a convention is the OECDs Convention on Combating Bribery of Foreign Public Officials.

A common definition of corruption is "the abuse of public power for private benefits" (Bank, 1997). This definition only considers the power of public entities. However, as Rose-Ackerman (1998) pointed out, corruption also exists between the interface of public and private sector. NORAD (2013) stated that "Corruption applies to any transactions between the public and the private sectors where public goods are illegally converted into private benefits". This states that corruption is not only limited to the public sector, but also includes the private sector, where large corporations have a substantial role in how public goods can be distributed fairly.

It is necessary to define corruption to have a starting point to tackle the problem. An important consideration when defining corruption, is the difference in societies. Johnston (2006) pointed out that the terms "abuse", "public", "private" and even "benefit" can lead to various degrees of ambiguity depending on the country and society. The need for a more common definition and understanding of corruption's diverse forms, is necessary to craft a targeted response and also to measure how anticorruption measurements work in practice (Søreide, 2016).

According to Søreide (2016) there are four conditions that have to be in place for corruption to happen. It requires that the decision maker:

i) Control monetary or non-monetary values
ii) Have discretionary authority to make decisions
iii) Offer biased decision making unhindered by the risk of detection (and reaction) as well as the moral costs

iv) Encounter counterparts willing to pay for biased decisions (unhindered by risk and moral costs.

The different criteria can be met on various levels, depending on the arenas they occur. The more they are met, the higher the risk of corruption. Opportunities to seize benefits through some form of power misuse differs across countries, sectors and organizations. These characteristics will often contribute in determining the size of the bribe. Whether opportunities for corruption are present, does not only depend on the individual, but also on the extent to which the environment allows corruption to endure (Søreide, 2014). An example is formulated in Klitgaard (1988), stating that "Corruption equals Monopoly plus Discretion, minus Accountability". This formulation is used to identify and analyze situations conducive to bureaucratic corruption. By having monopoly power or de facto monopoly power, the decision maker possesses an opportunity to create fictive shortages to exploit situations where he or she can extract bribes (Søreide & Rose-Ackerman, 2017). In addition, if the decision maker possesses discretionary power, the decision maker may choose among the bidders, and thereby increase the bribe amount. Lack of accountability will often lead to elimination of the decision makers perceived risk of detection, as well as moral costs. This is a typical situation where corruption is more likely to endure.

Taken these four criteria into consideration, a useful definition of corruption could be; "a trade in decisions that should not be for sale" (Søreide, 2016). By using this perspective, corruption can be viewed as a deal between two (or several) parties. Without an individual with delegation authority willing to sell a decision, and without a buyer willing to pay for it, there will be no deal. The scarcer values that are controlled by the decision maker, the higher the price of the payment. This catches both the collusive and compensational nature of corruption, and hints at the negative consequences (Søreide, 2016). The compensation is the price for the moral costs as well as the risk regarding a deviation from the intuitional specific rules and virtues. This is illustrated in Figure 1:

Figure 1: A trade in decisions:

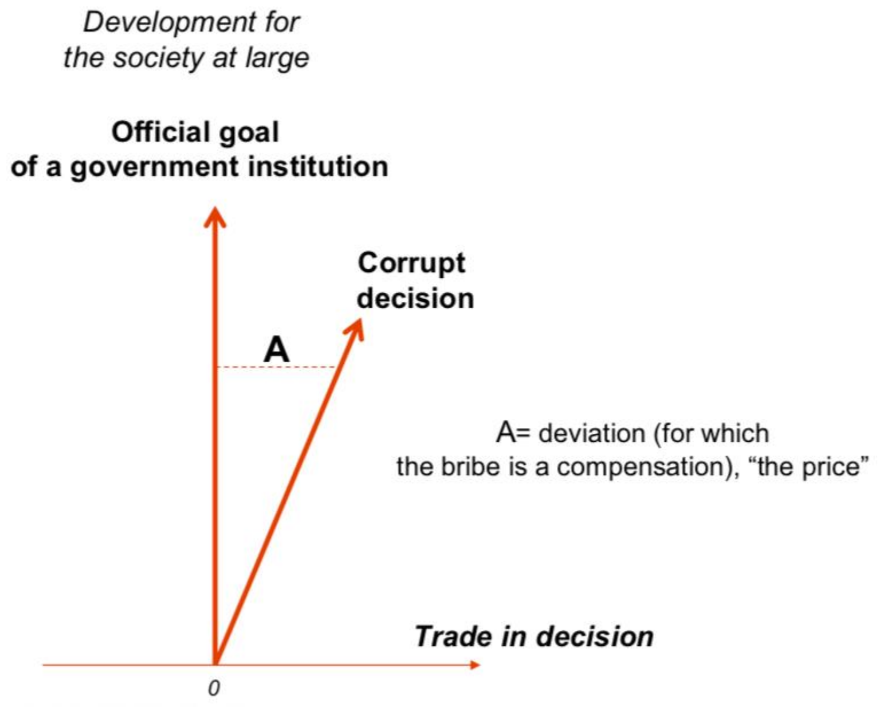

Figure 1: Definition of corruption: «A trade in decision that shouldn't be for sale" (Søreide, 2016)

By defining corruption as a trade in decisions that should not be for sale, we can consider the asymmetric allocations of bargaining powers between the parties involved. By understanding this relationship, it is easier to identify the degree of extortive and collusive corruption. The level of corruption in a transaction will be determined by a variety of elements within the environment of the "deal" (Søreide, 2016). This environment includes the involved parties' individual traits and incentives, institutional qualities, the characteristics of the sector/market which the deal exists within, politics, state administration and the criminal justice system, as well as the level of opportunities and mutual trust between the parties involved. In order to determine the level of corruption, we need to assess these elements. This is illustrated in Figure 2:

Figure 2: Corruption as a "Deal":

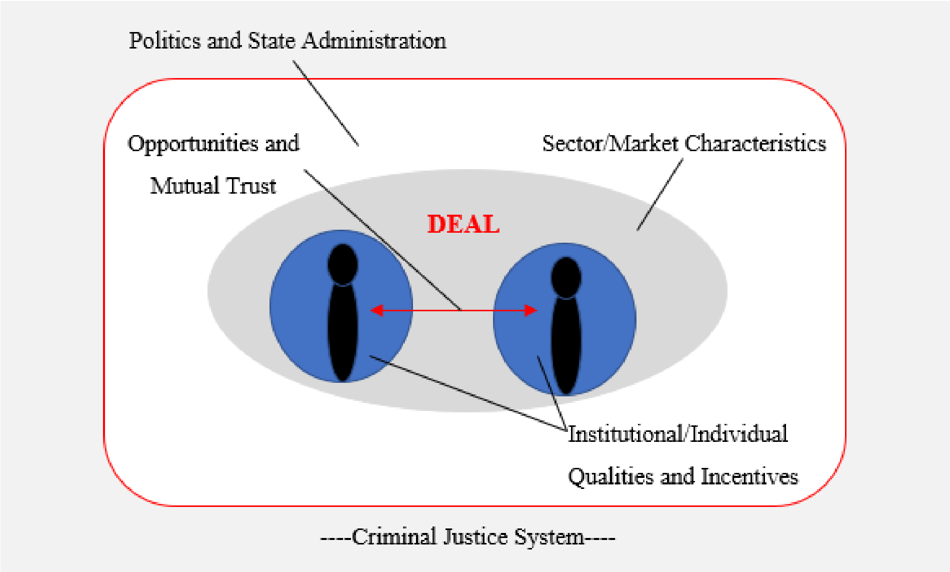

Figure2: Source: The authors remake of the model described in (Søreide, 2016).)

For example, there is a higher risk of corruption if the level of competition in the market, as well as performance bonuses to senior management are high, combined with low institutional qualities and poor enforcement systems (Taylor, 2016).

Based on this, we could define corruption in our master thesis as "a trade in decisions that should not be for sale". This speaks to both the discretionary powers of port and customs officers, as well as their control of the non-monetary value; time. We want to study the effects of corruption on time delays in ports. Therefore, our main control variable in this master thesis is a dummy for whether a company paid for a better position in the port queue, proxied by the response to whether or not the companies was expected to pay a bribe when dealing with port officials. Bribes is a classic transaction between two or several parties and may unfold between both public and/or private entities, and thus are covered by all the definitions mentioned.

3.2 Cost of corruption in the maritime industry

The World Trade Organization, WTO, has estimated that the value of merchandise, exported by WTO-members in 2019, was 19.8 trillion USD (Organization, 2019). With the increasing globalization, there has been a surge in global trade, where the maritime industry plays an important role. However, because of all the different interactions with government, custom and/or port officials, there is found to be an increased risk of taking part of corrupt activities. The United Nations (UN) estimated that corruption can add 10 % or more to the cost of doing business internationally (Deloitte, 2015).

In addition, a study by the Organization for Economic Cooperation and Development (the OECD) in 2014 showed that the transportation and storage industry is second in relation to where bribes are most paid (OECD, 2014). One of the reasons for this, is that there are several jurisdictions and stakeholders involved in a single shipment. Secondly, corruption and bribery can be a matter of contention depending on the society, and certain types of corruption may be socially accepted in some parts of the world. Therefore, fighting corruption sometimes mean challenging the social norm of some countries (Watch, 2012).

The shipping sector is said to have a unmatured anti-corruption compliance culture (Chambers, 2015). However, we are witnessing more actions towards a better compliance culture in the sector. A good example is The Maritime Anti-Corruption Network, which had over a hundred registered members in 2018 (MACN, 2019). Looking at these initiatives against corruption, it is fair to state that most companies experiencing some type of corruption in their maritime operations, view this as a competitive restraint rather than an advantage.

Furthermore, an empirical study done in 2008, investigated how bureaucrats set bribes in ports, and whether these payments imposed significant economic costs (Sequeira & Djankov, 2008). The study looked at bribe payments at ports of Southern Africa, and found that bribes are often product-specific, frequent and substantial. Bribes represented up to 14% increase in total shipping costs for a standard 20ft. container, and a 600% increase in the monthly salary for a port official. Further, the study identified three leading effects: diversion, congestion and reduced port revenues. First, the diversion effect explained that shipping companies tend to divert to less corrupt ports. The study found that some firms chooses to travel, on average, an additional 322 kms – more than doubling their transportation costs – just to avoid ports with a high level of corruption. The costs associated with re-routing were eight times higher than the actual bribe payment, showing that some shipping companies are willing to divert from the uncertainty of bribe payments (Shleifer & Vishny, 1993). Secondly, the re-routing resulted in a congestion in the least corrupt ports, which contributed to more imbalanced flows which added to the total transportation costs. Finally, the corruption at ports resulted in less revenue to the ports.

Taken these findings into account, we can determine that corruption is not only costly for the specific firm through increased trade costs, but it is also costly for countries and consumers as corruption tends to decrease the amount of trade and lead to congestion in non-corrupt ports, which again may lead to longer waiting times.

3.3 Corruption in ports

Ferreira, Engelschalk, and Mayville (2007) stated that weak institutions, poor governance and under resourced customs services are the main cause to the lack of control in many African ports. Corruption involves various agents, including port operators and custom officials. The lack of adequate supervision creates opportunities for corruption to endure. As described in section 3.1, this can result in discretionary power, which makes corruption easier to implement.

This is illustrated by Sequeira and Djankov (2014), who examined in great detail the ways in which corruption in ports emerge. By studying two different ports; Maputo and Durba in South Africa, they found that the port officials with shorter time horizon, broader discretionary powers and more frequent interactions with companies, are more likely to engage in corruption. The study distinguished between two categories of port officials with different opportunities to extract bribes: customs officials, with a full access to information of the shipments and wide discretionary powers, and port operators, with less information and less discretionary powers. These results illustrate the importance of discretionary powers and the control of scarce monetary or non-monetary values, such as time.

In this master thesis, we want to examine the effects corruption has on time delays by studying the queues of vessels in ports. We have established that time delays in ports can have a variety of different causes, and corruption is one of them. Corruption within the different port processes contribute to delays. Delays imposes increased cost for companies in the form of waiting times, increased opportunity costs as well as operation costs. By examining the queues, we can try to understand the effects of corruption on time delays found in ports.

4. Theory and Hypothesis

In our research we found two highly relevant theories in the literature that attempts to explain the relationship between corruption, productivity and economic growth. There is an extensive amount of empirical evidence on these theories, using different types of data, methods and countries. Some of the empirical literature on the subject has shown to proof different results. In the following, we explain the two theories and why these are relevant to our study.

4.1 The distortion theory of corruption

The distortion theory of corruption states that corruption tends to distort allocation of resources through an increase in the returns to rent-seeking relative to productive activities (Baumol, 1996). An economy or a business environment that is exposed to high levels of corruption, may encourage economic agents to reduce interactions with official authorities and/or the state, and delaying expansion and resort to operating in informal sectors of the economy. Corruption and large informal economies tends to make entry of new firms difficult (Djankov, La Porta, Lopez-de-Silanes, & Shleifer, 2002). This corroborate the arguments made in (Baumol, 1996). However, the arguments made by Djankov et al. (2002) are irrelevant when we are talking about institutions that are “natural monopolies”. This is because whether there is corruption or not, the state would not permit private investments in these institutions. A good example is ports, which contains both customs and port administrations. No private entity or individual would be allowed to have a private customs or port administration service for the country.

According to the distortion theory, corruption distorts the allocation of entrepreneurial talents by ensuring that the entrepreneur devotes greater efforts to obtaining licenses and preferential access to the market than to improve productivity. Corrupt business environments tend to affect technological progress and investment. Resources meant for investments in key infrastructures that is instrumental for efficient public institutions, such as ports and customs, will be diverted into private pockets, and individuals or institutions that benefit from such activities, will lobby to retain regulatory cumbersome that do encourage corruption.

Many of the empirical studies conducted on the distortion theory of corruption conclude that corruption retards economic growth, by distorting incentives, increasing transaction costs and aggravating uncertainty, leading to misallocation and underinvestment (Murphy et al., 1991) (Shleifer & Vishny, 1993) (Rose-Ackerman, 1997) (Mauro, 1995) (Svensson, 2000).

The literature consists of extensive theoretical analysis on the relationship between regulations, corruption, and bureaucratic efficiency. For example, Rose-Ackerman (1975) considered the relationship between market structure and the incidence of corrupt dealings in the government contracting process. Rose-Ackerman (1999) investigated how high levels of corruption limit investment and growth, and can lead to ineffective government. Cadot (1987) introduced a model for the allocation of permits by officials. They systematically analyzed the implication of different informational assumptions. Shleifer and Vishny (1993) introduced two propositions about corruption; (1) the structure of government institutions and of the political process are very important determinants of the level of corruption, and (2) the illegality of corruption and the need for secrecy make it much more distortionary and costly than its sister activity, taxation. Acemoglu and Verdier (2000) looked into how government intervention creates room for corruption by transferring resources from one party to another. Freund et al. (2016) examined the relationship between request for bribes and the time it takes to complete various regulatory requirements getting different permits. Onogwu (2018) analyzed the effect of corruption on the efficiency of customs service in a few selected African countries.

Time delays directly affects firm performance and are suitable for assessing the effectiveness of a government, both within and across countries. In addition, there is an ample evidence stating that impact of regulation on economic outcomes is contingent on its implementation, and that time delays impedes trade (Clemens & Williamson, 2002) (D. L. Hummels & Schaur, 2013) (D. Hummels et al., 2007) (Djankov et al., 2010).

In this master's thesis, we are examining the effects of corruption on time delays in ports. Ports are so called "natural monopolies" and the service providers administrating these institutions possesses high levels of discretionary powers to allocate resources as they see fit, deciding which shipment that goes through the port first and last. This imposes a queueing process on the shipments. To examine the effect corruption has on time delays in ports, we consider this queueing process by looking at the framework of another theory of corruption; "the second-best theory".

4.2 The second-best theory of corruption

The second-best theory is mostly known for the name "Grease-the-wheels". This theory postulates that firms, corporations, organizations or countries with a large amount of bureaucracy, corruption becomes the second-best option in dealing with burdensome regulatory requirements. Some would argue that governments create distortions by having a high level of bureaucracy. Corruption can therefore be a tool that helps eliminate these distortions and increase the smoothness of the institutions. The second-best theory states that, given a problem, the introduction of another problem will help to eliminate the earlier problem (Onogwu, 2018). An example is that time delays imposes increased costs on companies. When a shipment is arriving at port, it must go through bureaucratic processes in both the port, as well as the customs. These processes impose time delays on the shipment. By introducing the problem of corruption, this could speed up the processes and eliminate the time delays.

Since we are examining port queues, it is useful to consider the theoretical framework of the "Grease-the-wheels" -model, that was provided by Lui (1985). He had a hypothesis stating that the size of bribes by different companies represents the opportunity cost of not engaging in corruption related activities. The efficiency of the company could say something about their ability and willingness to buy red tape. He stated that more efficient companies were more able or willing to buy less effective red tape, which was reflected in less "time tax".

Because we are examining the effects of corruption on the bureaucratic harassment of time delays in ports, we have interpreted Lui (1985)'s model to better apply to the port analogy.

Postulating an economic model for queuing, were the expected time that a company, paying bribe x, spends in a queue is given by function:

$$W(x) = \frac{r}{m[1 - rB(x^*) + rB(x)]^2} \quad (1)$$

Where r is defined as the average amount of companies, m, multiplied by the average service time (1/u); (r $= (\frac{m}{u})$). x^* represents the maximal bribe payment received (making the payer of this amount place in front of the queue). The distribution function of x is given by $B(x)$, such that $B(x^*)$ is the proportion of companies who choose to stay in the queue. The queuing model assumes that companies arrive at the end of the queue. At the other end of the queue, there is a service provider. In our case, this service provider may be a port agent, such as a port officer or a customs officer, providing some sort of service to the company (ex. port access or customs clearance). Each company may have a different value of time, v. The cumulative distribution function of the value of time, v, is represented by $A(v)$, and it is assumed that this is known to the company. When companies come to the end of the queue, there is two paths that can be chosen. Either choose to not join the queue or pay a bribe, x, to the port agent to receive a better position in the queue. The company will be placed in front of those who bribes $x' < x$ and behind those who bribe $x'' \geq x$. Further, Lui (1985) proposes that for any given $A(v)$, the bribing function $x(v)$ results in an social optimal queue if $x(v)$ is a strictly increasing function of v. The intuition behind this is; to minimize the average value of time costs of the queue, we need to rank companies according to their values of time so that companies with higher values of time are placed in front of those with lower values, and therefore are served first. Since the queuing rule is to rank companies according to x, it is necessary to also rank them according to v for any $x(v)$ that is a strictly increasing function of v. Since the rankings of x is the same as the ranking of v, we have:

$$B[x(v)] = A(v) \tag{2}$$

Then it follows that:

$$B'(x)x'(v) = A'(v) \tag{3}$$

To guarantee social optimality, we include a restriction that $x'(v) > 0$, so that $x^* = x(v^*)$, and therefore

$$B(x^*) = A(v^*) \tag{4}$$

Each company has a given value of time v and want to optimize the net gain by receiving the specific service. For example, a shipping company would want to maximize the net gain of exporting goods to a given country. This implies that they also would want to maximize the net gain of accessing the port or clearing customs for the specific country they are exporting to. Therefore, they would want to maximize

$$\max_x G = P - [x + vW(x)] \tag{5}$$

were G being the expected net gain and P is the monetary value of the specific service that the company seeks to obtain (ex. port access or clearing customs). The term in the square bracket represents the expected total cost of joining the queue, which include a bribe, x, plus the value of time multiplied with the expected time the company spends in the queue.

Given equation (1), we can also write this as:

$$\max_{x} G = P - x - \frac{vr}{m[1 - rB(x^*) + rB(x)]^2} \tag{6}$$

The first order condition then becomes:

$$\frac{dG}{dx} = -1 + \frac{2r^2 vB'(x)}{m[1 - rB(x^*) + rB(x)]^3} = 0 \tag{7}$$

which we equal to zero in order to find the value x that maximizes (or minimizes) the net gain G. We write this more explicit by substitute equation (2), (3) and (4) into equation (7):

$$x'(v) = \frac{2r^2 vA'(v)}{m[1 - rA(v^*) + rA(v)]^3} \tag{8}$$

To solve this, we integrate it with respect to v:

$$x = \int \frac{2r^2 vA'(v)dv}{m[1 - rA(v^*) + rA(v)]^3} + K \tag{9}$$

where K is a constant to be determined.

To determine whether equation (9) represents the value x that maximizes or minimizes the net gain G, we derive the equation again in order for us to determine if

$$\frac{d^2G}{dx^2} < 0 \ or \ \frac{d^2G}{dx^2} > 0$$

$$\frac{d^2G}{dx^2} = \left(\frac{2r^2 v}{m}\right) \frac{[1 - rB(x^*) + rB(x)]B''(x) - 3r[B'(x)]^2}{[1 - rB(x^*) + rB(x)]^4} \tag{10}$$

To simplify this, we use equation (7) to get expressions for B’(x) and B’’(x):

$$\frac{d^2G}{dx^2} = \frac{-1}{x'(v)v} \tag{11}$$

Equation (11) is negative for $v > 0$. By assumption, negative values of v are not allowed, because this would indicate that the company have negative value of time. Thereby, we find that the value x given in equation (9) gives a maximum net value G. If $v = 0$, we see from equation (6) that the maximum of G occurs at the lowest permissible value of x, indicating that if companies have a value of time equal to 0, the company would want to pay as little as possible to better its position in the queue. We also see that given equation (8), an increase in the value of time v, would result in an increase in the bribe x. This makes sense as companies with a larger value of time would seek to get through the queue as fast as possible, and therefore be more willing to pay for a better position. However, equation (8) is only positive if the queue does not get infinitely long, because then the term $\mathrm{rA}(\mathrm{v}^*)$ must be less than 1, and therefore $x'(v)$ must be positive.

To determine v^*, we recall that x^* is the largest bribe paid by a company in the queue, and v^* is the corresponding value of time. For this company, the expected net gain must pe positive. Otherwise, he will not join the queue. So, as long as $v^* < v$ for another company, that is, some companies will not join the queue, the gain for the company with time value v^*, cannot be positive. Otherwise, companies with a value of time just above, will also join the queue. Hence, for $\mathrm{v}^* < \mathrm{v}, \mathrm{G}(\mathrm{x}^*) = \mathrm{P} - \mathrm{x}^* - \mathrm{vW}(\mathrm{x}^*) = 0$. From equation (1), we get that

$$x^* = P - \frac{v^* r}{m[1 - rB(x^*) + rB(x^*)]^2} \qquad (12)$$

$$= P - \frac{v^* r}{m}$$

By adding another assumption that $A(v)$ is a uniform distribution function from $v = 0$ to $v = v_1$, we get:

$$A(v) = Av \; for \; v \; \mathcal{E} \; [0, v_1] \qquad (13)$$

Then, we end up with a more explicit bribing function than shown in equation (9):

$$x = \int \frac{2r^2 vAdv}{m[1 - rAv^* + rAv]^3} + K \qquad (14)$$

Solving this bribe function gives:

$$x = \frac{1}{mA(1 - rAv^*)} - \frac{vr}{m(1 - rAv^* + rAv)^2} - \frac{1}{mA(1 - rAv^* + rAv)} + K \qquad (15)$$

We understand that the company with the lowest value of time does not pay any bribe. Because $x'(v) > 0$, other companies with higher values of time always pay higher bribes. If the company with the lowest value of time pays a positive bribe, it can always improve its gain by paying less without affecting the time he expects to spend in the queue. By looking at equation (15), we see that if $v = 0$ we get $x = 0$. This condition can be used for K. The bribing function now becomes

$$x = \frac{1}{mA(1 - rAv^*)} - \frac{vr}{m(1 - rAv^* + rAv)^2} - \frac{1}{mA(1 - rAv^* + rAv)} \qquad (16)$$

Now, if we substitute $v = v^*$ into equation (16), we obtain:

$$x^* = \frac{1}{mA(1 - rAv^*)} - \frac{v^* r}{m} - \frac{1}{mA} \qquad (17)$$

If we combine equation (12) and (17), we end up with an expression for v^*:

$$v^* = \frac{mPA}{rA(1 + mPA)} \qquad (18)$$

Which is simplified by defining $z = mPA$:

$$v^* = \frac{z}{rA(1 + z)} \qquad (19)$$

By assuming that $Av_1 = 1$, we write equation (19) as:

$$v^* = \frac{zv_1}{r(1 + z)} \qquad (20)$$

The condition that $v^* < v_1$ is therefore equivalent to

$$r > \frac{z}{1 + z} \qquad (21)$$

In other words, equation (19) holds if equation (21) is true. If (21) holds we have that $v^* < v_1$ (only some companies join the queue), and we can substitute equation (19) into equation (16) and obtain this bribing function:

$$x = \frac{1}{mA}\left(1 + z - \frac{rAv}{\left\{\left[\frac{1}{(1+z)}\right] + rAv\right\}^2} - \frac{1}{\left[\frac{1}{1+z}\right] + rAv}\right) \tag{22}$$

And by supposing that r $\leq \frac{z}{(1+z)}$ (so we again have v$^* <$ v), we get that all companies decide to join the queue, and equation (22) becomes:

$$x = \frac{1}{mA(1-r)} - \frac{vr}{m(1-r+rAv)^2} - \frac{1}{mA(1-r+rAv)} \tag{23}$$

By using the same assumption as mentioned in equation (20), Av$_1 = 1$, we see that $x'(v)$ is positive for both equations (22) and (23), indicating that by increasing the value of time, we get an increase in bribe amount. Equation (22) and (23) express the bribe x in terms of the parameters m, r, A, P and the variable v. These expressions state that if a company know their own values of time, they can compute the optimal bribes they should pay.

Further, Lui (1985) also postulates a model to calculate the optimal speed of service in order to investigate the effects that different speeds of service have on the total net gain of the port agent. This model gives indications of what the port agent is most likely to do in a situation as described above.

By estimating the average bribe paid to the port agent by incoming companies:

$$\bar{x} = \int_0^{v*} x(v)Adv \tag{24}$$

where $x(v)$ is the bribing function given by (22) if $r \geq \frac{z}{(1+z)}$ and given by (23) if $r < \frac{z}{(1+z)}$. Since on the average there are m companies coming to the queue, the average bribe revenue is $m\bar{x}$. Now we study what happens to the average bribe revenue, $m\bar{x}$, if the service time, $\frac{1}{u}$ changes by one time-unit. We see that if we have $r < \frac{z}{(1+z)}$ (then $v^* = v_1$, and all companies join the queue), we get that $\frac{d\bar{x}}{dr} > 0$, since $r = \frac{m}{u}$, for fixed amount m. We also see that if we assume $r > \frac{z}{(1+z)}$, companies with $v > v^*$ will not join the queue and do not pay any bribe. By assuming this, we see that $\frac{d\bar{x}}{dr} < 0$.

By considering the effects of changing the speed of service on the average revenue received by the port agent per period of time, equation (22) and (23) indicates that if $r < \frac{z}{(1+z)}$, increasing the average service time per company, $\frac{1}{u}$, will cause the average bribe revenue received by the port agent to increase. However, if $r \geq \frac{z}{(1+z)}$, increasing $\frac{1}{u}$ will cause the average bribe revenue received by the port agent to decrease. This means that the port agent will have an incentive to speed up the service time, but if the service speed becomes too fast, then the value of time would be lower, and there wouldn't be any incentives for the companies to pay bribes. In places with burdensome regulations, we can imagine that the service speed is longer compared to places with less burdensome regulation. Therefore, port agents in places with more burdensome regulations have a better potential to receive a larger bribe revenue by speeding up the service times. Therefore, this indicates that more burdensome regulations will cause bribes to be more beneficial.

The second-best theory has not been without criticism. Kaufmann and Shang-Jin (1999) argued that Lui (1985) treated regulatory burden (such as delays or time spent in ports) as exogenous and independent of the incentives of port agents to take bribes. Because of this assumption, Kaufmann and Shang-Jin (1999) argued that Lui's theory was a partial equilibrium in nature, but may not hold in a general equilibrium.

The general problem with treating an endogenous variable as an exogenous is that the $Cov(\mu_i, x_i) \neq 0$ $(e.i.\ E(\mu_i|x_i) \neq 0)$. The variable, x_i, is thereby not an exogenous variable, but endogenous, indicating that the error term, μ_i, is not independent of the exogenous variable. The problem with this is that the coefficient of x_i may be biased, meaning that it may explain more than just the effect of variable x_i. For example, if the bureaucratic harassments (such as delays in ports) is treated as exogenous when it instead is endogenous, this implies that the observed effect (the coefficient) of the bureaucratic harassment is biased, and do not represent the true effect of this parameter.

Bardhan (1997) stated that in the second-best theory; it is usually presumed that a given set of distortions are mitigated or circumvented by the effects of corruption; but quite often these distortions and corruption are caused or at least preserved or aggravated by the same factors. He further stated that the distortions are not exogenous to the system and are instead often part of the built-in corrupt practices. It is possible to change and/or modify the incentives of the port agents using specific measures, hereby exploit the regulatory burdens of a country, endogenously. Kaufmann and Shang-Jin (1999) argues that even within a country, because the port agents have discretionary power with a given regulation, corrupt port agents can "customize" the nature and amount of harassments on companies to maximize the bribes. In other words; they would ask for bribe amounts according to the company's ability to pay. They postulated a model that builds on the insight that bureaucratic harassments may be endogenous instead of exogenous.

Because we are examining the effects of corruption on the bureaucratic harassment of time delays in ports, we have interpreted Kaufmann and Shang-Jin (1999)'s model to better apply to the port analogy. Their model is a Stackleberg game between a rent-seeking government official (in our case; a port agent, such as a port or customs officer), and a representative company k. The port agent moves first to impose time delays in order to maximize bribe intake, and the company which is the price taker, moves next to choose the bribe payment in order to maximize the after-bribe profit.

By using backward induction to solve the equilibrium levels of bribe and red tape, we examine the problem faced by the company:

Suppose b_k is the bribe amount company k must pay to the corrupt port agent, and π_k is the profit the company would have achieved without any time delays from the port agent. Let h_k be the (nominal) time delay that the port agent imposes on the company. We make the nominal time delay company-specific to emphasize that the port agent has discretion over the actual implementation of a given time delay. In other words, the time delay can be customized.

Further, Kaufmann and Shang-Jin (1999) makes a distinction between effective or "real" time delays (the time delay that a company actually faces after paying a bribe) and the nominal time delay (the time delay announced by the service provider before the company pays the bribe). The "real" time delay, r_k, is given by the nominal time delay that the port agent imposes on the company, h_k, minus a function that describes how bribe payments helps to reduce the "real" time delay, $s(b_k)$:

$$r_k = h_k - s(b_k) \tag{25}$$

By assuming that $s'(b_k) > 0 \; and \; s''(b_k) < 0$, we see that by holding the nominal time delay, h_k, constant, more bribery leads to lower effective time delay, but there is a decreasing return to paying bribes. We notice here that a narrow version of the second-best theory – that is, if nominal time delay is constant, then bribery and effective time delay are negatively correlated – holds by assumption.

To simplify, Kaufmann and Shang-Jin (1999) assume that the pre-bribery profit, π_k, is predetermined. The representative company's objective is to maximize its post-bribe and post-delay profit, which is given by

$$\Pi_{k,a} = g(r_k)\Pi_\mathrm{k} - b_k \tag{26}$$

The first order condition yields an implicit function that relates the optimal amount of bribe company k would pay (if without any constraint on the maximum bribe) and the nominal rate of time delay, h:

$$-g_r(h_k, b_k)\Pi_k s_b(b_k) = 1 \tag{27}$$

This defines an optimal bribery schedule:

$$b_k = B(h_k) \tag{28}$$

By differentiating the first-order condition, we can see that the bribery schedule is upward-sloping:

$$\frac{db_k}{dh_k} = \frac{g''(r_k)\, s'(b_k)}{g''(r_k)\,\left(s'(b_k)\right)^2 - g'(r_k)\, s''(b_k)} > 0 \tag{29}$$

Which means that the longer nominal time delays imposed on the company, the higher bribes do the company find optimal to give.

The above bribery schedule assumes that the company must tolerate any level of time delays and give bribes accordingly. However, as mentioned in section 3.2 on the cost of corruption, the diversion effect demonstrated that companies tend to divert shipping routes to less corrupt countries. This indicate that a more relevant case would be that every company has an exit option and therefore a maximum time delay it is willing to tolerate. Suppose h_k^* denotes the maximum time delay that company k would tolerate. That is, it can commit not to tolerate anything above h_k^* because of the characteristics of the company, the industry it is in, or the source country it is from. With this assumption, the company will no longer solve the unconstrained problem stated above. This means that the actual bribe the company will be willing to pay is:

$$b_k = min[B(h_k^*), B(h_k)] \tag{30}$$

Further, Kaufmann and Shang-Jin (1999) solves the problem faced by the port agent:

By assuming that the port agent sets the time delay, h_k, (for example port delays or customs delays) solely for the purpose of extracting bribe payments, and that the port agent's utility function is an increasing function of bribe intake, the port agent would impose just enough delays to induce the firm to pay the maximum amount of bribe it is willing to tolerate, namely $b_k^* = B^{-1}(h_k^*)$. In equilibrium, the company would pay exactly b_k^*. This implies that nominal time delay and bribery are positively correlated across firms.

By examining the relationship between the effective time delay and the bribery in equilibrium we get that:

$$\frac{dr_k^*}{db_k^*} = \frac{dh_k^*}{db_k^*} - s_k(b_k^*) \tag{31}$$

We see that equation (31) must be positive, which indicates that companies paying more bribes not only face higher nominal time delays, but also have to deal with higher rate of "real" time delay. This is contradictory to the second-best theory, and we see from Kaufmann and Shang-Jin (1999)'s model that if we allow burdensome regulations, such as time delays to be endogenously chosen by corrupt port agents, the port agent may charge according to the company's "ability to pay" by raising the nominal time delay. This would mean that we should see a positive, rather than a negative, correlation between the "real" time delay and bribes in equilibrium across companies.

Summarized, the second-best theory generally postulates three predictions; firms confronted with high levels of corruption, should get things done faster, given that all other variables stay the same. It also states that this relationship is heterogeneous across both firms and countries, with firms with a higher opportunity cost of waiting being willing to engage in corrupt activities and consequently facing shorter waiting times, and bribing being more beneficial when regulations is considered to be burdensome, in such a way that the relationship between the level of corruption and waiting times should be stronger in countries considered to have more burdensome regulations. By examining the theoretical framework in (Lui, 1985) on the second-best theory, we see that firms with a higher value of time is more willing to pay for a better position in the queue. Even though the empirical evidence in (Lui, 1985) proved corruption to enhance efficiency, (Kaufmann & Shang-Jin, 1999) is a good example of empirical evidence proving the opposite results, stating that paying bribes lead to inefficiency and longer time delays. Kaufmann and Shang-Jin (1999)'s theory was, however, criticized for not assessing heterogeneity.

4.3 Heterogeneity

According to the second-best theory, the relationship between bribes and time delays is heterogeneous, depending on firm's ability and willingness to pay and avoid bribes. In this master's thesis, we are studying the relationship between paying bribes and the speed through ports, and concentrate on the parts of Lui (1985)'s model that addresses the heterogeneity, depending on a company's willingness to pay.

Freund et al. (2016) assessed this heterogeneity by using a simple interaction model, interacting a proxy for bribe demands with a proxy for productivity, size and magnitude of bribes. They found that policy implementation times was longer for larger, more productive firms, but shorter for companies with increased magnitude of bribes. Thus, the effects in the study was not statistically significant, and therefore, the null hypothesis that more productive and/or larger firms are not able to get things done faster could not be rejected. However, there seems that examining the relationship between a home country's level of corruption and time delays in ports has been neglected to date.

Empirical explanations on the determinants of a country level of corruption was provided by Søreide (2016), stating that the level of corruption and its consequences depends on the reasons why corrupt acts occur and the frequency with which these reasons are presented. Although corruption may occur in many different situations, there are three criteria that are found in most corrupt countries: unchecked state administrative authorities; government regulation of the private sector; secrecy in the world of business; and unchecked political spending (Søreide, 2016).

As in any other markets, a company's willingness to pay depends on the value at stake for the buyer, including monetary and nonmonetary values. In our master's thesis, we are specifically looking at the nonmonetary value of time. As we have illustrated with the help of Lui (1985)'s framework for the second-best theory; companies having a higher value of time (ex. large opportunity costs of waiting in ports) are more willing to pay for a better position than companies with a value of time close to zero. Søreide (2016) further explains that the willingness to pay will also depends on the cost, which in a corruption setting refers to the risk for the company of getting caught and the consequences that the company will face if caught. Therefore, in order to examine a company's willingness to pay, it is necessary to consider the risks and consequences of corruption.

The framework of the second-best theory provided by Lui (1985), explained that companies has a given value of time v and wants to optimize the net gain by receiving a specific service. For example, a shipping company would want to maximize the net gain of exporting goods to a given country. This implies that they also would want to maximize the net gain of accessing a port or clearing customs.

According to Lui (1985)'s model, the company would want to solve the maximization problem in equation (5): $\max_x G = P - [x + vW(x)]$. Building on this model, we can express the expected net profits of paying for a better position in a port queue for company i, as

$$G_i = P_i - [x_i + v_i W(x)] \tag{32}$$

Where G is company i's net profit of paying for a better position in a queue, P is company i's total value of going through a port, and the square bracket represents the total cost of joining a port queue. We see that the total cost of joining a queue is expressed as the bribe amount, x, paid by company i, plus the value of company i's time, v, multiplied with the expected time that a company, paying bribe x, spends in a queue, $W(x)$.

Based on this expression, heterogeneity may be explained intuitively. Andvig and Moene (1990) explained that in countries with higher levels of corruption, the risk of detection can easily be mitigated by further corruption. For example, if a corrupt company has been caught bribing by another corrupt entity, the company may bribe the other entity for not reporting the case. Based on this, we can imagine that companies from home countries with higher levels of corruption may have a lower risk of getting caught. Also, as mentioned in section 3.2, certain types of corruption may be socially accepted in some countries, meaning that the consequences that a company will face if caught, may also be lower in more corrupt home countries. This would imply that companies from more corrupt home countries have a lower cost associated with every corrupt unit, and therefore are more willing to pay for a better position in the port queue. Alternatively, companies from more corrupt home countries may have more experience from corrupt contexts, which allows them to more effectively influence through bribery. This implies that companies from more corrupt home countries, may have a different relation, $W(x)$, making the expected time spent in ports shorter for these companies.

If proven accurate, this would mean that one dollar of bribes paid by companies from high corrupt home countries would be more worth than one dollar of bribes paid by companies from low corrupt home countries. This further implies that the expected net profits of paying for a better position in a port queue, would be higher for companies from more corrupt home countries.

If this is the case, we clearly see a competitive advantage for companies from more corrupt countries and may postulate the hypothesis that company's from more corrupt countries possess a competitive advantage when encountering corruption in ports.

4.4 Hypothesis

Do companies from more corrupt countries possess a competitive advantage over companies from less corrupt countries when encountering corruption in ports? This question is part of a larger debate regarding the role of corruption in private sector development. This master thesis revisits the issue on whether corruption can enhance efficiency by examining the relationship between paying a bribe and the time it takes to clear ports.

Regarding waiting times in ports, the second-best theory predicts that, all else equal, those who pay bribes are likely to go through port administrations and customs faster. So, in total, they experience shorter time spent in ports. However, an important implication of the second-best theory is heterogeneity in the relationship between bribes and time delays across companies. The theory predicts that the firms with the highest opportunity cost of waiting, is expected to be more willing to pay to decrease waiting times. The willingness to pay is also dependent on the cost (Søreide, 2016), and companies from more corrupt home countries seem to have a lower cost associated with every corrupt unit, leading to the expectation that companies from more corrupt home countries are more willing to pay in order to decrease waiting times. In addition, companies from more corrupt home countries seem to be more able to effectively influence through bribery, making the expected time spent in ports shorter for these companies.

Hypothesis #1: Given that the second-best theory predicts that, all else equal, those who pay bribes are likely to go through ports faster, we postulate the hypothesis that if companies pay for a better position in the port queue, this should decrease the time spent in ports for both exporters and importers.

Hypothesis #2: Based on the queueing model provided by Lui (1985), as well as our reasoning in section 4.3, we expect the level of corruption in a company's home country, to be negatively associated with a company's waiting time in ports. We postulate the hypothesis that companies from more corrupt home countries should be expected to have shorter waiting times in ports than companies from less corrupt countries.

However, these hypotheses may not hold if the port agent imposes time delays on the company based on their ability to pay. We have seen from Kaufmann and Shang-Jin (1999)'s model that if we allow time delays in ports to be endogenously chosen by corrupt port agents, the port agent may charge according to the company's "ability to pay" by raising the nominal time delay. This would mean that we should see a positive, rather than a negative, correlation between bribes and the "real" time delay across companies.

5. Data and Empirical Method

5.1 The Enterprise Surveys (The World Bank)

The World Bank Enterprise Surveys are the main data source used in this master thesis. The survey has been conducted in 145 countries. Figure 3 demonstrates that corruption is considered one of the largest obstacles of doing business by the managers participating in the Enterprise Surveys.

Figure 3: Obstacles of Doing Business:

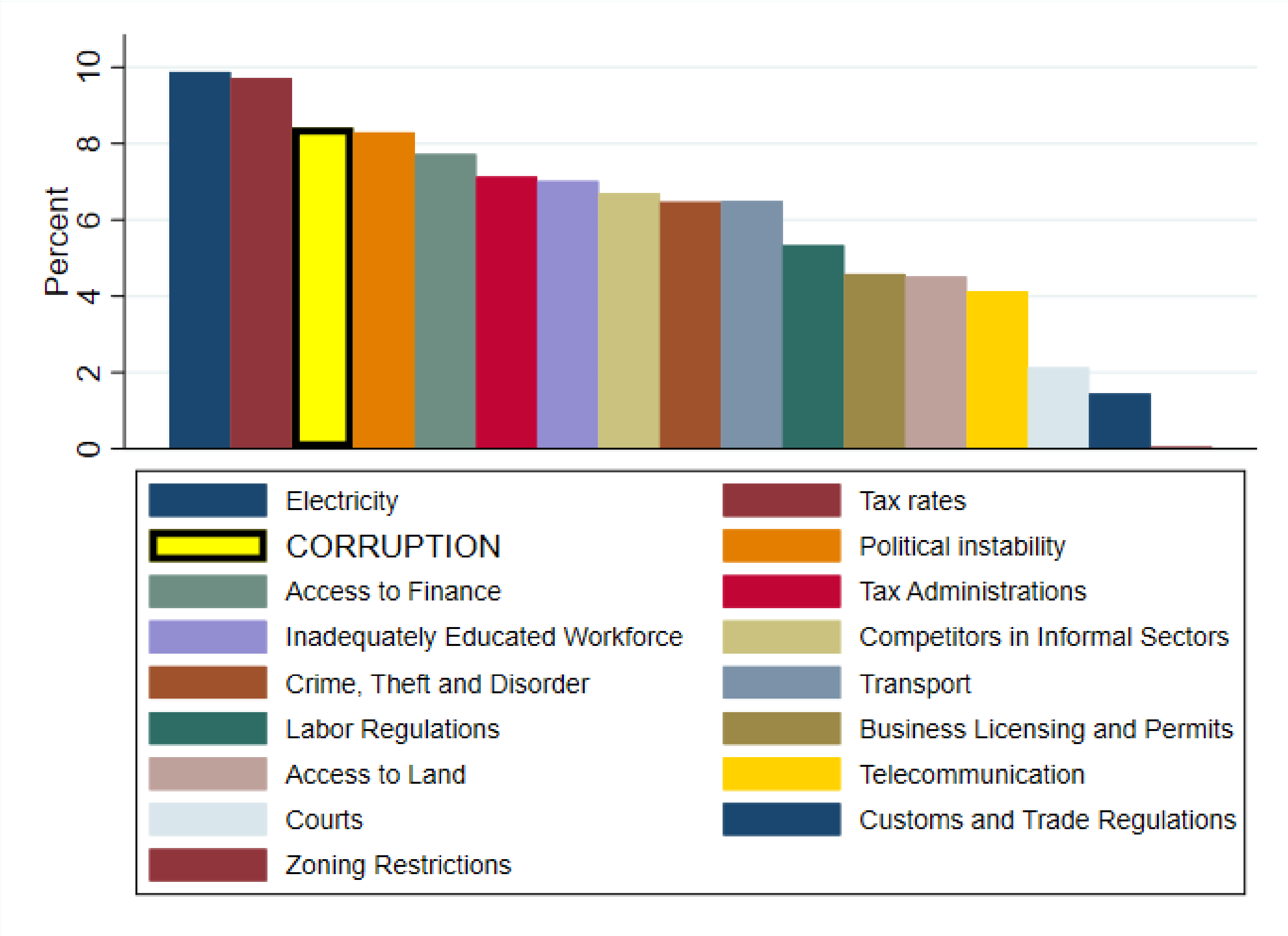

Figure 3: Source: The World Bank Enterprise Survey, various years

The Enterprise Surveys are well suited for analysing the association between the level of corruption and delays. The data includes detailed information on firm characteristics as well as questions on a set of time delays in ports, whether extra payments or gifts (bribes) were requested, and the time it took to complete the processes in ports. Our key dependant variable is the average amount of time companies spend in ports. The surveys also ask if there was requested or expected an informal payment or gift in the process of clearing customs. The answer to these questions will be our key explanatory variables. The descriptive statistics in Table 1 suggest that demands for such side payments are somehow prevalent with 10,6% and 9,9% of firms reporting that they have been expected to pay a bribe when clearing ports exporting and/or importing respectively.

Table 1: Descriptive Statistics:

Variables	Obs	Mean	Std.Dev	Min	Max
Time delays Exporting	18,482	6.583	10.56	0	213
Time delays Importing	24,029	12.25	18.38	0	365
Time delays Constr. Permit	14,935	69.81	115.9	0	2,190
Time delays Operating License	31,197	29.84	115.7	0	9,999
Time delays Electrical License	17,649	36.30	80.09	0	2,920
Bribes related to Constr. Permit	18,098	0.198	0.398	0	1
Bribes related to Oper. License	32,618	0.159	0.366	0	1
Bribes related to Electric License	19,843	0.157	0.363	0	1
Bribes related to Exporting	3,588	0.106	0.308	0	1
Bribes related to Importing	5,484	0.0988	0.298	0	1
Paid informal payments	25,144	0.256	0.436	0	1
Labor	145,090	3.251	1.391	0	11.07
Capital per worker (log)	44,172	13.03	3.248	-5.165	28.20
Output per worker (log)	128,228	13.53	2.926	-3.401	29.00
Management’s experience	142,041	17.55	11.20	0	100
Firm age	143,971	25.75	16.21	1	349
Public	145,000	0.0499	0.218	0	1
Private	145,000	0.415	0.493	0	1
Partnership	145,000	0.0876	0.283	0	1
Limited Partnership	145,000	0.0854	0.279	0	1
Sole Proprietorship	145,000	0.344	0.475	0	1
Foreign Owners	143,516	0.108	0.310	0	1
Exporter	144,111	0.169	0.375	0	1
Importer	51,848	0.486	0.500	0	1
ISO certified	141,498	0.227	0.419	0	1
Formally registered	124,804	0.883	0.322	0	1
Government contract	123,702	0.177	0.382	0	1
Time spent with regulators	134,914	0.655	0.475	0	1
Visited by tax officials	144,270	0.586	0.492	0	1
Externally financed	140,860	0.358	0.479	0	1
Financial Statement Audited	143,187	0.513	0.500	0	1
Performance bonuses	6,144	0.440	0.496	0	1
Est. separated from HQ	27,778	0.202	0.401	0	1
Home Corruption level Exporting	69,301	10.83	12.50	0	79.17
Home Corruption level Importing	58,490	11.01	9.758	0	38.20
Corrupt courts	132,124	0.567	0.495	0	1
Law/Regulations not predictable	24,781	0.551	0.497	0	1
Burdensome labor regulations	143,735	0.123	0.329	0	1
Burdensome tax administration	142,313	0.214	0.410	0	1
Political instability	141,451	0.331	0.471	0	1
Burdensome trade regulations	132,456	0.147	0.355	0	1
Burdensome courts	133,139	0.147	0.354	0	1

Source: Authors’ analysis based on data from the World Bank’s Enterprise Surveys.

A possible weakness in the data is the fact that our key dependant variable only represents corruption in regard to clearing customs, and not necessarily the whole port process. Table 2 presents a description of our main variables used in this master thesis:

Table 2: Description of main variables:

Variables	Variable Description	Measure	Survey Explanation:
		Independent Variables:	
Time delays Exporting:	How many days it takes to clear ports exporting	The average amount of days a company spend in port while exporting.	In the last fiscal year, when the company exported goods directly, the average number of days that it took from the time the company's goods arrived to their main point of exit (port) until the time these cleared customs.
Time delays Importing:	How many days it takes to clear ports importing	The average amount of days a company spend in port while exporting.	In the last fiscal year, when the company imported goods, the average number of days that it took from the time the company's goods arrived to their main point of entry (port) until the time these cleared customs.
		Key Explanatory Variables:	
Bribes related to Exporting:	Dummy for corruption related to clearing ports exporting	=1 If the company encountered corruption in ports while exporting - Proxy for paying for a better position in ports while exporting	In clearing exports through customs, informal gift/payment expected or requested? Yes/No
Bribes related to Importing:	Dummy for corruption related to clearing ports importing	=1 If the company encountered corruption in ports while importing - Proxy for paying for a better position in ports while importing	In clearing imports through customs, informal gift/payment expected or requested? Yes/No

		Interaction Variables:	
Home Corruption level - Exporting	Proportion of corruption in port when exporting, sorted by a company's home country.	Corruption level-specific variance. Measured by percent of companies reporting corrupt encounters when exporting, sorted by home country.	In clearing exports through customs, informal gift/payment expected or requested? – Sum of "yes" answers sorted by the company's home country.
Home Corruption level - Importing	Proportion of corruption in port when importing, sorted by a company's home country.	Corruption level-specific variance. Measured by percent of companies reporting corrupt encounters when importing, sorted by home country.	In clearing imports through customs, informal gift/payment expected or requested? – Sum of "yes" answers sorted by the company's home country.
		Firm Control Variables:	
Labor:	Proxy for form size	The amount of full-time employees in the company: size-specific variance	Num. permanent, full-time employees at end of last fiscal year
Capital per worker (log):	Proxy for capital intensity	Log of Capital intensity as capital divided by labor. Capital intensity-specific variance	Cost for establishment to re-purchase all of its machinery + cost for establishment to re-purchase all of its land and buildings. designed to ascertain the market value of the company's capital.
Management's experience:	Managements experience expressed in years	Managements experience level. Experience-specific variance	How many years of experience working in this sector does the top manager have?
Firm age:	The company's age	The age of the company as the current year (2019) minus the establishment year. Age-specific variance	Year establishment began operations
Public:	Dummy for whether the company is publicly traded	=1 if company is public. Ownership-specific variance	Legal status of the firm
Private:	Dummy for whether the company is a private limited liability company	=1 if company is private. Ownership-specific variance	Legal status of the firm
Partnership:	Dummy for whether the company is a partnership	=1 if company is a partnership. Ownership-specific variance	Legal status of the firm
Government contract:	Dummy for whether the company is doing business with the government	=1 if company has a government contract. Public interaction-specific variance.	Government contract secured (or attempted) in the last 12 months? Yes/No
Time spent with regulators:	Dummy for whether the company has spent time with regulators in the last fiscal year	=1 if company spent time with regulations. Regulator interaction-specific variance.	What % of senior management time was spent in dealing with govt regulations?

Country, Sector, Year Dummies:			
Country:	Country Dummy	Country-specific variance	N/A
Year:	Year Dummy	Year-specific variance	N/A
Sector:	Sector Dummy	Sector-specific variance	N/A

*These are the variables used in our main models. A complete list and description of all variables can be found in the Appendix 4.

Even if the data contains large amounts of data on time delays and corruption, it does contain a limited number of observations regarding corruption and delays in ports. This makes it difficult to control for firm-fixed effects. We are therefore not able to assess whether the identifications are based on variation in the incidence of corruption across different types of port situations, such as imports, and exports made by the same firm. However, the data enables us to study heterogeneity by means of interaction designs.

With the available cross-sectional data, we are not able to establish causality. We do not have precise information under what circumstances bribes are being initiated, by whom, and when the requests are made. We also lack information about firms' and bureaucrats' subjective expectations. In addition, there are some issues when working with data on corruption. This is due to the fact that corruption is a hidden phenomenon. Corruption is considered a crime in most countries and markets. Therefore, it may exist incentives to keep data on the subject hidden. The enterprise surveys contain data on incidences of bribes and questions regarding annual amount of informal payments made by the entities. There is a possibility that the individuals answering these surveys may have alternative motives when answering. For example, information that indicates a firm to be corrupt is considered bad as it may harm the reputation of the company (Botn, Dahl, & Kurtmollaiev, 2015). Therefore, it is a possibility that the answering individual of the entity will not answer the survey truthfully regarding the questions of corruption. The data includes answering options such as "refuse to answer" or "don't know". These represent proof that the data may somehow be subjective towards the motives of the answering individuals.

However, the data contains high levels of details on both time delays and bribes, which enables us to control for an extensive set of observable determinants of corruption. The data set allows us to test the predictions in the second-best theory regarding time delays in ports for both exporters and importers. It also allows us to test for heterogeneity which may help us understand if the level of corruption of a company's home country may result in shorter time delays, and thereby give companies from more corrupt countries an advantage when encountering corruption at ports.

5.2 Collecting data

The data used in this master's thesis, has been collected from The World Bank Enterprise Surveys Database (Bank, 2019). The data is available online, but it requires access by submitting a request to use the data in specific research. Access was granted by the World Bank on august 23rd 2019.

5.3 Econometric Framework

Our empirical strategy is to test the effects of corruption on time delays in ports, which implies testing the predictions in the second-best theory discussed above. This was done in regards to different policy implementations by Freund et al. (2016). Building on the baseline model of this study, we want to test the same effects related to ports. The prediction we are focusing on, is related to the "grease"-effect of corruption; does corruption imply an efficiency effect on the process found in ports, leading to shorter waiting times, and does a home country's level of corruption render companies more willing to pay for a better position in ports.

This next section explains how we test the predictions of the second-best theory and how we test for heterogeneity in the association between bribes and time delays. We present a simple OLS-model and an interaction model to test the heterogeneity associated with the level of a country's corruption level.

To examine the relationship between time delays and bribes, the time spent in ports, that is, the average number of days it takes to clear ports when exporting or importing, $Delay_{i,s,c,t}$, is modelled to be a function of firm characteristics $X_{i,s,c,t}$, a dummy indicating whether a company paid for a better position in the port queue, $Bribe_{i,s,c,t}$, proxied by the response to whether a bribe was expected when importing and/or exporting, country (α_C), sector, (α_S), year (α_Y) dummies, and a random error term $\varepsilon_{i,s,c,t}$:

$$Delay_{i,s,c,t} = \beta_0 + \beta_B Bribe_{i,s,c,t} + \beta_X X_{i,s,c,t} + \alpha_C + \alpha_S + \alpha_Y + \varepsilon_{i,s,c,t} \qquad (33)$$

The interpretation of the model is:

H_0: $\beta_B = 0$, Corruption is not correlated with time delays in ports.

H_{A1}: $\beta_B > 0$, Corruption is associated with longer time delays in ports. Which would be in accordance with the “Sand in the wheels” -theory.

H_{A2}: $\beta_B < 0$, Corruption is associated with less time delays in ports. Which would be in accordance with the “Grease the wheels” -theory.

If bribes are a means to get a better position in the port queue and hereby make the company go through ports faster, one would expect the incidence to be correlated with less time delays (i.e. $\beta_B < 0$). However, if corruption impedes efficiency, we expect bribe incidences to be associated with delays (i.e. $\beta_B > 0$).

There are some problems with this testing model. The relationship between bribes and delays could be driven by omitted characteristics on company-level impacting both the duration of time delays and the prevalence of bribes. An example of this is a company’s level of transparency, such that a company with less transparency would have an increased opportunity to bribe without being caught, as well as the port agents may spend more time in extracting information or documentation necessary to clear the company out of port. Another example that could cause time delays and bribery to be correlated, is complexity. More complex companies with poorer infrastructure could be more susceptible to corruption and face longer time delays. We can also imagine that firms that already have spent a serious amount of time in port, might be more willing to offer a bribe to get the shipment out of port. This opens for a reverse causation. Our bribe payment proxy asks specifically about whether there was a bribe expectation when clearing customs. This might be confused, leading participants to answer “yes” when the firm itself required to pay a bribe instead of the port agent. In addition, one might expect a positive correlation between time delays and bribes, simply because ships who have waited longer has an increased risk of being asked to pay a bribe.

We are also using subjective perception of bribe incidences and delay times, which increases our concerns for the model, because unobserved firm characteristics, such as the entrepreneur’s alternative motive with the surveys or their level of optimism or pessimism, could affect the perception of both the delay times and bribe incidences. Furthermore, companies that have experienced a bad encounter with port agents or customs officers, leading to longer time spent in ports, might be more dissatisfied and consequently more likely to complain about corruption (even if there was none).

To mitigate endogeneity concerns, we include a set of robustness checks. To start with, we include sector, country and year effects. If time delays are sector- or country-specific, this would control for congestion within sectors and/or countries. However, our sample of firms, both reporting average time spent in ports as well as encountering corruption in ports, is fairly small, and therefore we are not able to include all the effects that we want, such as firm fixed effects. This means that if time delays are company-specific, we are not able to control for congestion within firm as well as within sector, country and years.

To introduce the analysis on heterogeneity, we first examine the effect of higher levels of corruption in a company's home country on the choice to pay for a better position. The corruption level is proxied by the proportion of corrupt bureaucrats in a country. To examine this, we run a simple probit model with a binary indicator of whether a company paid for a better position, $Bibe_{i,c,s,t}$, as the dependant variable. As independent variables, we include a variable of the corruption level in a company's home country. We also include some firm controls to check if other characteristics may affect the decision on whether to pay for a better position in the queue or not;

$$\begin{aligned} Bribe_{i,s,c,t} = \beta_0 + \beta_H Home\ Corruption\ level_{i,s,c,t} + \alpha_C + \alpha_S + \alpha_Y \\ + \beta_X X_{i,s,c,t} + \epsilon_{i,s,c,t} \end{aligned} \quad (34)$$

If the corruption level of a company's home country is affecting the choice of whether to pay for a better position, we should expect β_H to be positive. A positive coefficient means that an increase in the corruption level leads to an increase in the predicted probability of paying for a better position in the queue.

According to the theories on the matter of efficiency effects of corruption, that is; "Grease the wheels" vs "Sand in the wheels", there has been some contradictory findings in the literature. These findings indicate that there are some firms that benefits from skipping the queue by paying bribes, and some firms that don't. To examine which firms that tends to benefit from paying for a better position in the ports, we build on the model of (Freund et al., 2016) addressing heterogeneity. According to the second-best theory, the relationship between bribes and time delays is heterogeneous, depending on firm's willingness and ability to pay and avoid bribes. To assess these possibilities (Freund et al., 2016) interacted the bribe indicators with an explanatory variable of productivity:

$$Policy\ times = \beta_B Bribe + \beta_P Productivity + \beta_{BP} Bribe * Productivity + \beta_X X + \varepsilon \tag{35}$$

We have demonstrated that the willingness and ability to pay for a better position also depends on the cost, and that the cost of corruption could be lower for companies from more corrupt countries. Therefore, building on Freund et al. (2016)'s model, we interact the bribe dummy with a proxy for the level of corruption in a company's home country, estimated as the proportion of corrupt encounters in ports for both exporters and importers. To the extent that this is a good proxy for the level of corruption in a company's home country, it allows us to test whether higher levels of corruption in a company's home country is associated with shorter time delays, meaning that firms from more corrupt countries benefit from corruption in ports. To test this, we use a simple interaction model:

$$\begin{aligned} Delay_{i,c,s,t} = \beta_0 + \beta_B Bribe_{i,c,s,t} + \beta_H Home\ Corruption\ level_{i,c,s,t} \\ + \beta_{BH} Bribe_{i,c,s,t} * Home\ Corruption\ level_{i,c,s,t} \\ + \beta_X X_{i,c,s,t} + + \alpha_C + \alpha_S + \alpha_Y + \varepsilon_{i,c,s,t} \end{aligned} \tag{36}$$

We have included a multiplicative term in our regression specification. To interpret this, we need to understand the effect of β_{BC}:

The average time delay for companies paying for a better position in ports (Paying Companies: PC) is given by:

$$\text{PC:} \quad \overline{Delay_{PC}} = \beta_0 + \beta_B + \beta_H Home\ Corruption\ level + \beta_{BH} Home\ Corruption\ level \tag{37}$$

We see that, since variable, $Bribe$, takes the value of 1 for companies paying for a better position, we are left with only the coefficient of β_B and $\beta_{BH} Home\ Corruption\ level$. By simplifying this, we get:

$$\overline{Delay_{PC}} = (\beta_0 + \beta_B) + (\beta_H + \beta_{BH}) Home\ Corruption\ level. \tag{38}$$

For the non-paying companies (nonPC), where variable, $Bribe$, takes the value of 0, we get:

nonPC: $$\overline{Delay}_{nonPC} = \beta_0 + \beta_H Home\ Corruption\ level. \quad (39)$$

We see that at effect of the $Bribe$ variable on our specification, β_B, represents the additional premium which companies paying for a better position would have over companies not paying for a better position, if they both were from a country with a corruption level equal to zero. If the corruption level was equal to zero, then both corruption level terms would disappear, and the only difference between paying companies and non-paying companies, would be β_B. This is the delay premium which paying companies have over non-paying companies, if their home country's corruption level was equal to zero.

The difference between the two terms including the corruption level variable, is essentially that the partial effect of corruption level for paying companies has been boosted by an amount equal to β_{BH}, relative to the non-paying companies. So, this means that if $\beta_{BH} > 0$, it means that the additional effect of one more level of corruption in a company's home country, is in fact greater for paying companies. If $\beta_{BH} < 0$; the additional effect of having one more level of corruption, on average, would cause a smaller increase in time delays for paying companies, than it would do for non-paying companies. The latter would also imply that if two companies arrive at the port, and both chooses to pay for a better position, the company from the highest corrupt country should expect shorter time delays, giving this company an advantage when encountering corruption in ports. This is illustrated in figure 4 and figure 5:

Figure 4: Average marginal effect of paying a bribe – Exporting

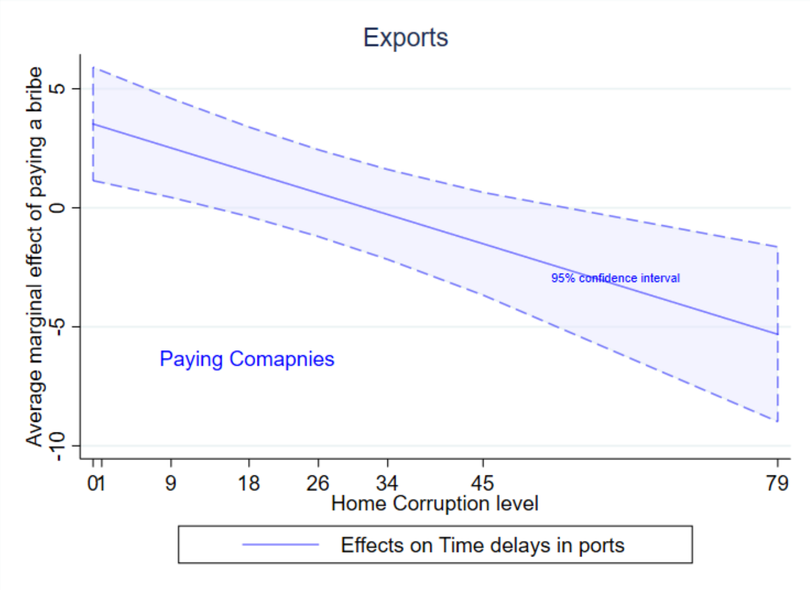

Figure 4. Average marginal effects of paying a bribe on time delays, by Home Corruption level when exporting estimated by: $\frac{dDelay}{dBribe} = \beta_B + \beta_{BH} * Home\ Corruption\ level$

Figure 5: Average marginal effect of pauing a bribe - Importing

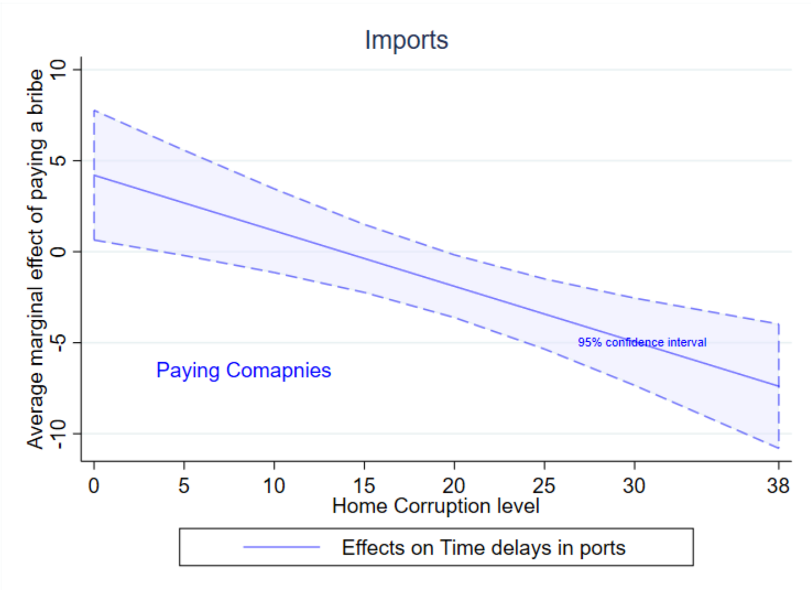

Figure 5. Average marginal effects of paying a bribe on time delays, by Home Corruption level when importing estimated by: $\frac{dDelay}{dBribe} = \beta_B + \beta_{BH} * Home\ Corruption\ level$

Therefore, the cross term in our regression specification means that by interacting our dummy variable, *Bribe*, with the continuous variable, *Home Corruption level*, it allows us to have different slopes of the Home Corruption level variable across the two different values which our *Bribe* variable can take on (1 or 0). This is illustrated by using a margins plot in figure 4 and figure 5:

Figure 6: Adjusted predictions of paying a bribe - Exporting

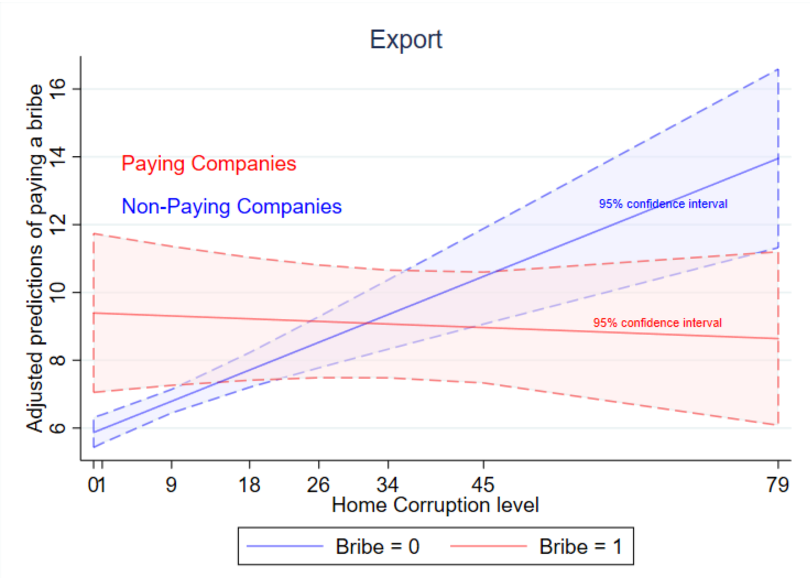

Figure 7: Adjusted predictions of paying a bribe - Importing

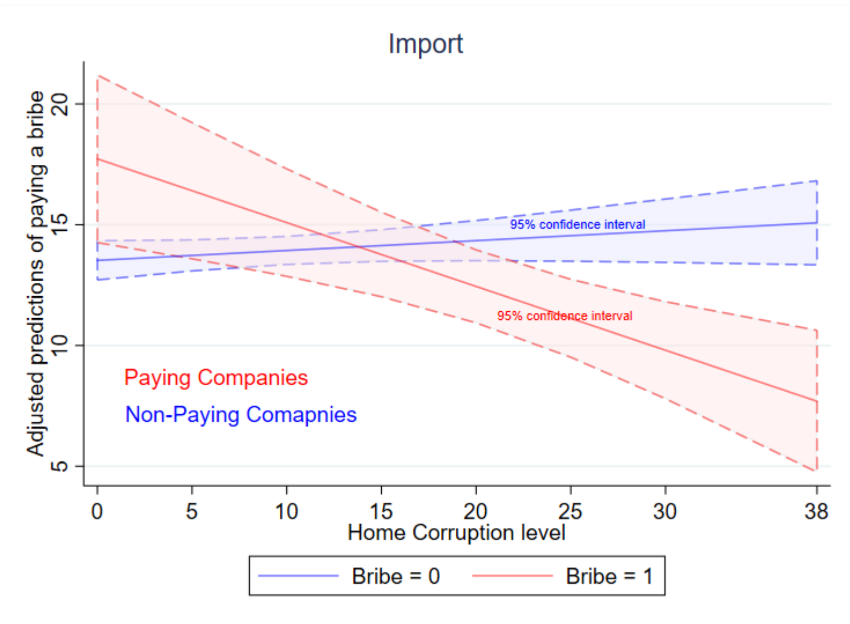

Figure 6 & 7. Adjusted predictions of paying a bribe on time delays, by Home Corruption level when exporting and importing. *Source:* Authors' analysis based on data from Enterprise Surveys, various years.

6. Discussions and findings

6.1 Basic results of corruption and time delays in ports

This section focuses on examining whether bribes are correlated with time delays in ports on average, whereas the next sections focuses on the heterogeneity associated with a company's willingness to pay for a better position based on the corruption level in a company's home country.

Our findings regarding the relationship between bribes and time delays can be found in Table 3. In this model we regress the self-reported time delays in ports on a host of firm controls. All specifications include sector country and year dummies to ensure identification is based on comparing companies within the same country, in the same sector in a given year. In the first specifications, we do not include any firm controls, but do include sector, country and year dummies. The main reason for this is the fear of having to few observations relating to delay times in ports. However, we do want to examine if there are other factors to time delays besides bribe payments. In the second specification, we include firm controls to assess whether we can identify other relationships that affect the time delays in ports. Standard errors are heteroscedastic robust and clustered by sector, country and year.

The results show that corruption is associated with time delays in ports when companies export. We do notice that the effect of corruption is opposite for when companies are importing. When importing, corruption is associated with shorter time delays in ports. However, or findings is not statistically significant on either level and, therefore, we are not able to reject the null hypothesis that corruption is not correlated with time delays.

The associated effects are economically meaningful; on average, companies that pay for a better position in ports must wait 2,68 days longer in ports when exporting, than companies not paying. Further, companies paying for a better position in port when importing, wait, on average, 0,45 days less in ports than companies not paying.

We also notice that capital intense companies, are facing especially longer time delays when exporting, and companies with more experienced management, seems to spend less time in ports when importing. A possible reason for this may be because the port agents are able to charge bribes according to the company's ability to pay, like demonstrated by Kaufmann and

Shang-Jin (1999). We can imagine that more capital intense companies possess higher abilities to pay than less capital intense companies, making the port agent impose larger time delays to extract larger bribes. More experienced managers may also be more experienced with ports processes, and therefore, better impose a more effective routine for the company, making them go through ports faster. However, none of the other variables are consistently statistically significant. Overall these specifications explain between 0,137 and 0,245 percent of the observed variance across firms. A robustness test of these findings can be found in Appendix 1.

Table 3: Time delays in ports

OLS - model				
Dependent variable: *Time delays Exportin/Import*				
	(1) Exporting No controls	(2) Exporting Firm Controls	(3) Importing No controls	(4) Importing Firm Controls
Bribes related to Importing			-1.124	-0.448
			(0.859)	(2.136)
Bribes related to Exporting	1.073	2.679		
	(0.898)	(2.125)		
Labor		-0.441		-1.194
		(0.444)		(0.692)
Capital per worker (log)		0.354**		-0.769
		(0.174)		(1.509)
Management's experience		0.00169		-0.197*
		(0.0656)		(0.0911)
Firm age		0.0699		-0.0302
		(0.0473)		(0.0501)
Public		-0.604		8.150
		(1.267)		(10.25)
Private		-0.0177		14.34
		(1.509)		(15.90)
Partnership		1.191		3.325
		(1.029)		(5.771)
Government contract		1.347		2.997
		(1.640)		(2.699)
Time spent with regulations		1.025		3.566
		(1.510)		(1.839)
Observations	3,132	586	4,789	114
R-squared	0.137	0.245	0.165	0.163
Sector dummies	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES

Note: *** p<0.01, ** p<0.05, * p<0.1
Standard errors are heteroscedastic robust and clustered by country, sector and year.
Source: Authors' analysis based on data from Enterprise Surveys, various years.

6.2 Which companies pays for a better position?

Table 4: Level of Corruption pr. Country: All services

Country	Corruption Proportion	Country	Corruption Proportion
Cambodia	69,42 %	China	11,93 %
Yemen	58,16 %	Burkina Faso	11,48 %
Congo	51,75 %	Bulgaria	11,27 %
Pakistan	46,37 %	Lithuania	10,97 %
Guinea	41,58 %	Guyana	10,00 %
Liberia	39,65 %	Vanuatu	9,94 %
Sierra Leone	39,62 %	Bosnia and Herzegovina	9,57 %
Bangladesh	38,10 %	North Macedonia	9,56 %
South Sudan	37,61 %	Suriname	9,46 %
Nigeria	36,62 %	Romania	9,34 %
Mali	35,17 %	Lesotho	8,82 %
Lao	34,95 %	Zimbabwe	8,44 %
Mauritania	34,32 %	Brazil	8,43 %
Chad	33,52 %	Ecuador	8,35 %
Myanmar	31,97 %	Costa Rica	8,06 %
Solomon Islands	31,40 %	Bolivia	7,99 %
Benin	30,70 %	Honduras	7,70 %
Kyrgyz Republic	29,85 %	Kosovo	7,51 %
Ghana	29,55 %	Guatemala	7,41 %
Tajikistan	28,52 %	Zambia	7,30 %
India	28,27 %	Argentina	7,29 %
Ukraine	27,50 %	Djibouti	7,14 %
Indonesia	27,45 %	Trinidad and Tobago	7,14 %
Iraq	26,90 %	Dominican Republic	6,98 %
Nepal	26,87 %	Nicaragua	6,65 %
Vietnam	26,35 %	Fiji	6,40 %
Gambia	25,97 %	Venezuela	6,18 %
Burundi	25,36 %	Eswatini	6,07 %
Afghanistan	25,20 %	Rwanda	5,35 %
Cameroon	24,78 %	Montenegro	5,33 %
Lebanon	23,93 %	Thailand	5,05 %
Mongolia	22,92 %	Jamaica	5,00 %
Timor-Leste	22,89 %	Turkey	4,80 %
Azerbaijan	22,63 %	Cape Verde	4,55 %
Kazakhstan	22,18 %	Poland	4,46 %
Egypt	20,79 %	Italy	4,41 %
Angola	20,58 %	Latvia	4,36 %
Ethiopia	20,47 %	Grenada	4,26 %
Albania	20,18 %	Namibia	4,22 %
Kenya	20,04 %	Croatia	4,16 %
Malawi	18,96 %	Czech Republic	4,07 %
Malaysia	17,26 %	Georgia	4,02 %
Papua New Guinea	17,24 %	West Bank and Gaza	3,78 %
Samoa	17,17 %	El Salvador	3,71 %
Niger	16,95 %	Colombia	3,64 %
Guinea Bissau	16,78 %	Botswana	3,54 %
Mozambique	16,39 %	Greece	3,48 %
Congo	16,00 %	Slovak Republic	3,48 %
Tanzania	15,94 %	Panama	3,29 %
Madagascar	15,87 %	Micronesia	3,13 %
Paraguay	15,83 %	Belarus	3,07 %

Gabon	15,79 %	Mauritius	2,80 %
Russia	15,73 %	Estonia	2,78 %
Central African	15,49 %	Hungary	2,55 %
Philippines	14,85 %	South Africa	2,52 %
Moldova	14,85 %	Chile	2,51 %
Uganda	14,52 %	Uruguay	2,02 %
Tonga	14,12 %	Slovenia	1,85 %
Togo	13,99 %	Sweden	1,79 %
Morocco	13,56 %	St Vincent and Grenadines	1,56 %
Bahamas	13,16 %	Bhutan	1,34 %
Gambia	13,14 %	St Kitts and Nevis	0,98 %
Uzbekistan	13,07 %	Jordan	0,93 %
Peru	13,00 %	Israel	0,86 %
Sierra Leone	12,75 %	Malta	0,70 %
Armenia	12,73 %	Antigua and Barbuda	0,00 %
Côte d'Ivoire	12,63 %	Barbados	0,00 %
Senegal	12,58 %	Belize	0,00 %
Sudan	12,57 %	Cyprus	0,00 %
Serbia	12,50 %	Dominica	0,00 %
Tunisia	12,50 %	Eritrea	0,00 %
Mexico	12,43 %	St Lucia	0,00 %
Sri Lanka	12,12 %		

Countries ranked from the most corrupt country, to the least corrupt country, measured by the proportion of companies within a country reporting to have been expected to pay a bribe in relation to gaining construction permits, operating licenses, electrical licenses, imports and exports.

Source: Authors' analysis based on data from Enterprise Surveys, various years.

Table 5: Level of Corruption pr. Country: Exports and Imports

EXPORTS		IMPORTS	
Country	Corruption proportion (exporting)	Country	Corruption proportion (importing)
Timor Leste	79,17 %	Lao	38,20 %
Sierra Leone	66,67 %	Myanmar	37,25 %
Guinea	50,00 %	Cameroon	37,04 %
Solomon Islands	45,45 %	Mali	30,56 %
Mali	43,48 %	Chad	26,67 %
Cambodia	42,86 %	Guinea	25,00 %
Liberia	42,86 %	Liberia	25,00 %
Myanmar	35,14 %	Albania	24,12 %
Lao	34,38 %	Gambia	22,22 %
Albania	26,80 %	Kyrgyz Republic	20,86 %
Vietnam	26,09 %	Sierra Leone	20,00 %
Philippines	19,91 %	Kenya	18,67 %
Egypt	19,08 %	Egypt	18,44 %
Kyrgyz Republic	17,95 %	Mozambique	17,86 %
Indonesia	17,89 %	Argentina	16,23 %
Kenya	16,79 %	Benin	15,63 %
Mozambique	15,00 %	Togo	15,63 %
Mongolia	13,64 %	Mongolia	13,87 %
Malaysia	13,16 %	Côte d'Ivoire	13,64 %
Gambia	11,11 %	Suriname	11,11 %
Nicaragua	11,11 %	Niger	10,00 %
Ethiopia	8,57 %	Honduras	9,30 %
Benin	8,33 %	Zimbabwe	8,97 %
Togo	7,41 %	Nicaragua	8,70 %
Ecuador	7,14 %	Paraguay	7,95 %
Cameroon	6,25 %	Ethiopia	7,75 %
Lesotho	6,25 %	Lesotho	7,69 %
Argentina	5,60 %	Montenegro	7,50 %
Zimbabwe	4,92 %	Russia	7,14 %
Russia	4,76 %	Guatemala	6,76 %
Italy	3,91 %	Bolivia	5,93 %
El Salvador	3,91 %	Ecuador	4,29 %
Uruguay	2,70 %	Uruguay	3,87 %
Guatemala	2,50 %	West Bank and Gaza	3,23 %
Greece	1,89 %	Bhutan	3,03 %
Peru	1,65 %	Peru	2,70 %
Turkey	1,38 %	Eswatini	2,63 %
Thailand	0,75 %	Italy	2,37 %
Colombia	0,72 %	Dominican Republic	2,22 %
Belarus	0,65 %	Turkey	2,04 %
Bhutan	0,00 %	El Salvador	1,99 %
Bolivia	0,00 %	Greece	1,42 %
Chad	0,00 %	Colombia	1,28 %
Cyprus	0,00 %	Belarus	0,00 %
Côte d'Ivoire	0,00 %	Cyprus	0,00 %
Dominican Republic	0,00 %	Malta	0,00 %
Eswatini	0,00 %		
Honduras	0,00 %		
Malta	0,00 %		
Montenegro	0,00 %		
Niger	0,00 %		
Papua New Guinea	0,00 %		

Paraguay	0,00 %	
Suriname	0,00 %	
West Bank and Gaza	0,00 %	

Countries ranked from the most corrupt country, to the least corrupt country, measured the proportion of companies within a country reporting to have been expected to pay a bribe in relation to imports and exports.

Source: Authors' analysis based on data from Enterprise Surveys, various years.

To set the stage for the following analysis on heterogeneity, we first study which country that possesses the largest level of corruption by examining the proportion of corrupt bureaucrats within specific services. First, we study the corruption level across a broad variety of services where decision-makers typically possesses high levels of discretionary powers. We include the services; application for construction permits, operating license, and electrical license, as well as direct imports and exports. These findings are reported in Table 4. Further, we concentrate the sample to include imports and exports only. Table 5, presents the level of corruption in ports sorted by the most corrupt country for imports and exports.

In the following, we examine the probability that a company pays for a better position in the queue, sorted by their home country. To do this, we run a simple probit model with a binary indicator of whether or not the company payed for a better position in regards to exporting and/or importing as the dependant variable. Our findings are presented in Table 6.

In the first and third specification, we do not include any firm controls other that the level of corruption in the company's home country. The main reason for this is the fear of having to few observations relating to delay times in ports. However, we do want to examine if there are other factors to bribe payments besides the corruption level. In the second and fourth specification, we include firm controls to assess whether we can identify other relationships that affect the choice of paying for a better position in ports. All specifications include sector, country and year dummies. Standard errors are heteroscedastic robust and clustered by sector, country and year.

Table 6: Who pays for a better position?

Probit Model Marginal Effects				
Dependant variable: Bribes related to Exporting/Importing				
VARIABLES	(1) Exporting No Controls	(2) Exporting Firm Controls	(3) Importing No Controls	(4) Importing Firm Controls
Home Corruption level Exporting	-0.00379* (0.00213)	0.0197*** (0.00425)		
Home Corruption level Importing			0.00704*** (0.00242)	0.0212*** (0.00522)
Labor		0.0132 (0.0109)		-0.0289 (0.0239)
Capital per worker (log)		-0.0204*** (0.00757)		0.0506*** (0.0170)
Management's experience		-0.00105 (0.00163)		0.00230*** (0.000228)
Firm age		-0.00270** (0.00125)		-0.00222*** (0.000551)
Public		0.0953 (0.0742)		0.136* (0.0712)
Private		0.00887 (0.0500)		
Partnership		-0.0233 (0.0435)		-0.0302 (0.0256)
Government contract		-0.0349 (0.0586)		0.0458** (0.0212)
Time spent with regulators		0.103*** (0.0371)		-0.0752 (0.0694)
Observations	3,307	548	5,002	103
Pseudo R2	0.198	0.219	0.130	0.300
Sector dummies	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES

Note: *** p<0.01, ** p<0.05, * p<0.1
Standard errors are heteroscedastic robust and clustered by country, sector and year.
Standard errors are reported in brackets.
Reported numbers are based on the marginal effects of the explanatory variable.
Source: Authors' analysis based on data from Enterprise Surveys, various years.

Overall, these models explain a moderate share of variance, with pseudo R^2s ranging from 0,130 to 0,300. The results yield a number of interesting associations. To start with, we see that capital intensity matters; the marginal effects calculated at the sample mean suggests that more capital intense companies are up to 5 percent more likely to pay for a better position in the queue when importing. However, this effect seems to be opposite for exporting, indicating that more capital intense companies are up to 2 percent less likely to pay for a better position when importing. Older companies are 0,2 percent less likely to pay, but companies with more experienced management are 0,2 percent more likely to pay. We also notice that there is a statistically significant association between paying for a better position and the time spent with regulators, as well as if companies are doing business with the government.

However, the most interesting findings in these data is that there is a statistically significant association between whether a company pays for a better position and the level of corruption in the company's home country. Companies from more corrupt countries are 1,2 and 1,1 percent more likely to pay for a better position when exporting and importing respectively. These findings are statistically significant on the 1 percent level, when including firm controls.

Note that the other variables are not systematically statistically significant predictors of companies paying for better positions. In particular, we do not find evidence for differential treatment of firms based on ownership and company size.

6.3 Heterogeneity: Time delays and the level of corruption

Now that we have investigated the effects of paying for a better position and demonstrated which firms that are more likely pay for a better position, we turn to the results of focal interest, notably whether the data demonstrate heterogeneity in the relationship between time delays and the level of corruption in a company's home country.

Table 7: Heterogeneity: Home Country's Corruption Level

OLS – model: *Interaction model*				
Depending variable: *Time delays*				
VARIABLES	(1) Exporting	(2) Exporting	(3) Importing	(4) Importing
Bribes related to Exporting	0.436	3.266		
	(1.198)	(3.319)		
Home Corruption level (Exports)	-0.0842**	0.0472		
	(0.0422)	(0.0827)		
Interaction term: Bribe* Home Corruption level (Exports)	0.0319	-0.0240		
	(0.0409)	(0.0626)		
Bribes related to Importing			-0.680	-6.343
			(1.956)	(4.837)
Home Corruption level (Imports)			-0.582***	3.050***
			(0.0996)	(0.325)
Interaction term: Bribe* Home Corruption level (Import)			-0.0256	0.832
			(0.0896)	(0.467)
Observations	3,132	586	4,789	114
R-squared	0.273	0.298	0.301	0.276
Sector dummies	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES
Firm Controls	NO	YES	NO	YES

Note: *** p<0.01, ** p<0.05, * p<0.1.
Standard errors are heteroscedastic robust and clustered on sector, country and year
Firm controls are Labor, Capital per worker, Management's experience, Firm age, Public, Private, Partnership, Government Contract and Time spent with regulations, ref. Table 2
Source: Authors' analysis based on data from Enterprise Surveys, various years

Table 7 explores whether the association between paying for a better position in a queue and time delays is heterogeneous across firms. All specifications include sector, country and year dummies, and the error term is heteroscedastic robust and clustered on sector, country and year. Overall, these models explain a moderate share of variance, with R^2s ranging from 0,273 to 0,301. In the first and third specification, the bribe indicator is interacted with the level of corruption in a company's home country to assess whether the impact of paying for a better position on time delays in ports varies with the level of corruption in a company's home country (perhaps because the cost of corruption in high corrupt countries is lower, so they are more willing to pay, or they are more able to effectively influence through bribery). We do not include firm controls in the first and third specification, in fear of having to few observations to make reasonable predictions. In the second and fourth specification, we include the same firm controls as our model in Table 3 and Table 6. When controlling for firm controls, the estimated interaction effects are positive for exporting companies, but negative for importing companies. When we include the firm controls, we notice that the estimated effects switch, meaning that they become negative for exporting companies and positive for importing companies. Although we end up with opposite effects for exporting and importing, the effects are not statistically significant on any of the levels. Therefore, we do not find evidence that companies from more corrupt home countries experience shorter waiting times in ports than companies from less corrupt countries.

We are aware of the possible weaknesses of a small amount of observations in our data set. Therefore, we found it necessary to include some robustness test for the model. The results of these robustness tests provide stronger evidences to our hypothesis postulating that companies from more corrupt home countries experience shorter waiting times than companies from less corrupt countries.

The results can be found in our appendix, Appendix 3.

7. Conclusion

In recent times, there has been an increasing availability of micro-data analysis and literature on the impact of corruption on firm-performance, its impact on efficiency and distortion of allocation of resources. It exists a large amount of literature contradicting the predictions growing from the second-best theory. In addition, there exists some literature trying to explain the heterogeneity in the association between paying for a better position and time delays, depending on firm's willingness to pay and avoid bribes. However, quantitative analysis on this subject in relation to a country's corruption level seems to be neglected to date. Yet, whether corruption is associated with accelerated port efficiency is at the very heart of the debate about whether corruption obstructs private sector development by diverting private companies away from corrupt ports, or instead enables it by allowing firms to mitigate the negative effects of burdensome bureaucracy. Time delays in ports may be a good metric for assessing public sector performance and delaying customs processes as well as other port services is a centralized area in which public officials have the opportunity to affect firm performance. This is also material in regards to the competition aspect between firms, as public officials opportunity to affect company performance may render bribing more efficient for some companies rather than others.

By using The World Bank's Enterprise Surveys from 145 countries, this master's thesis examines the effect corruption has on waiting times in ports and the possible heterogeneity in the relationship between corruption and waiting times, depending on the corruption level found in a company's home country.

To start with, we tested the effects of corruption on waiting times in ports and whether introducing the problem of bribes had an efficiency effect on the port process. Our data did not find significant evidence to support this hypothesis. The results in our main model regarding this hypothesis, was not statistically significant for either imports nor exports. Thus, we are not able to reject the null hypothesis that corruption is not correlated with time delays based on our main model, we can look towards the results of our robustness test, found in Appendix 2, and then reject the hypothesis. Instead of efficiency effects of corruption, we found the same results as Freund et al. (2016); an inefficiency effect of corruption, leading to longer waiting times in general. If we interpret the results of our robustness test to also apply to ports, we can make the conclusion that corruption is in fact associated with longer waiting times in ports.

Second, we investigated an often-overlooked implication of the second-best theory; heterogeneity across companies in the relationship between paying for a better position and waiting times, with the speed of service increasing with a company's willingness to pay. Our main model did not find significant evidence to support the hypothesis that paying companies from more corrupt home countries experience shorter waiting times in ports than paying companies from less corrupt countries. However, a robustness test of the model (found in Appendix 3) provided strong evidence that companies from more corrupt countries experience shorter waiting times when applying for a construction permit, operating license and/or electrical license. If we were to interpret these results to also apply to ports, we may keep the hypothesis that paying companies from more corrupt home countries experience shorter waiting times in ports than paying companies from less corrupt countries.

To sum up, although we cannot establish causality and must cognizant of the limitations of self-reported subjective cross-sectional data, our findings show that companies paying for a better position in ports tend to experience longer rather than shorter waiting times. These results are consistent with the existing empirical literature on the distortion theory of corruption and supports the "sand in the wheels" theory.

In addition, our findings confirm the hypothesis that paying companies from more corrupt countries experience shorter waiting times in ports than paying companies from less corrupt countries, confirming heterogeneity in the relationship between bribes and time delays across firms, depending on a company's home country corruption level.

Our results are highly relevant to the increased emphasis on world trade, with practical implications for private companies' decision-making process regarding determination of their international shipping routes. Companies competing against companies from high corrupt countries may be more aware of the competition advantages of such companies being more able to effectively influence through bribery, and thereby decrease their waiting times. These results also provide practical implications in regards to enabling ship owners to take better decisions when encountering corruption in ports. Even though it might seem profitable to pay to skip the queue, the results in this master's thesis proves otherwise. A possible political implication of our results is that international trade routes may be directed trough less corrupt countries in order for the trading companies to save cost of time. This would imply lower levels of international trade to the country, and slower economic growth.

Appendix

1. Robustness – Basic results: Hypothesis #1

Table 3.1: Time Delays for Exports & Imports as Log(1+Average days in ports)

2. OLS - model				
Dependent variable: *Log (1+Average days in port)*				
	(1) Exporting No controls	(2) Exporting Firm Controls	(3) Importing No controls	(4) Importing Firm Controls
Bribes related to Importing			-0.0403	0.208**
			(0.0437)	(0.0532)
Bribes related to Exporting	0.0307	0.0200		
	(0.0508)	(0.112)		
Labor		-0.0154		-0.0995**
		(0.0248)		(0.0326)
Capital per worker (log)		0.0216*		-0.120
		(0.0114)		(0.102)
Management's experience		-0.00298		-0.01000**
		(0.00381)		(0.00255)
Firm age		0.00453		-5.79e-05
		(0.00269)		(0.00239)
Public		-0.0481		0.661
		(0.159)		(0.866)
Private		-0.0954		0.529
		(0.0963)		(0.529)
Partnership		0.288***		-0.114
		(0.0958)		(0.288)
Government contract		0.0865		0.109
		(0.101)		(0.143)
Time spent with regulations		-0.0309		0.0236
		(0.0725)		(0.129)
Observations	3,132	586	4,789	114
R-squared	0.273	0.295	0.300	0.276
Sector dummies	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES

Note: *** p<0.01, ** p<0.05, * p<0.1
We take log (1+Time delays in ports): We use this transformation to allow for observations which reported clearing time to be zero
Standard errors are heteroscedastic robust and clustered by country, sector and year.
Source: Authors' analysis based on data from Enterprise Surveys, various years.

A possible data weakness is that some companies has reported clearing times to be zero or less. In order to account for this weakness, we transform our dependent variable, $Delay_{i,s,c,t}$, to $Log(1 + Average\ days\ in\ port)$. This allows for observations which reported clearing time to be zero. Everything else in Table 3.1 is identical to Table 3.

The results of this robustness test show that corruption is associated with time delays in ports. However, we only find a statistically significant association for corruption and time delays for imports. The results for exports are not statistically significant, and, therefore, we are not able to reject the null hypothesis that corruption is not correlated with time delays in ports for exports. For imports, we find that the association is statistically significant on the 5 percent level and robust when including proxies for firm characteristics.

The associated effects are economically meaningful; on average, companies that pay for a better position in ports must wait 1,03 and 1,23 times longer in ports when exporting and importing respectively, then firms not paying; note that we take the exponent of the coefficients associated with corruption to arrive at these comparisons. We also notice that companies organized as partnerships, are facing especially longer time delays when exporting, Larger companies, as well as companies having more experienced management, seems to spend less time in ports when importing. However, none of the other variables are consistently statistically significant. Overall these specifications explain between 27 and 30 percent of the observed variance across firms.

Further, we include a robustness tests, where we look into the same model, but for other areas:

Table 3.2: Time Delays in other areas – dependent variable, Time delays = Average days spent.

OLS - model			
Dependent variable: *Time delays*	(1) Construction Permit	(2) Operating License	(3) Electrical License
Bribes related to Construction Permits	21.15*** (4.560)		
Bribes related to Operating Licenses		16.03*** (3.865)	
Bribes related to Electrical Permits			11.37 (7.535)
Observations	3,365	5,507	3,388
R-squared	0.239	0.308	0.239
Sector dummies	YES	YES	YES
Country dummies	YES	YES	YES
Year dummies	YES	YES	YES
Firm controls	YES	YES	YES

Note: *** p<0.01, ** p<0.05, * p<0.1.
Standard errors are heteroscedastic robust and clustered by country-year.
Firm controls are Labor, Capital per worker, Management's experience, Firm age, public, private, Partnership, government contract and Time spent with regulations, ref. Table 2.
Source: Authors' analysis based on data from enterprise Surveys, various years.

As we have mentioned, our data includes a very low amount of observations regarding corruption in ports. Therefore, we want to investigate whether we can observe the same associations as in Table 3, and possibly strengthen the robustness of our results. We look towards other areas where corrupt agents may control scarce values that involves a qualification steered allocation. Building on the same robustness test as Freund et al. (2016), Table 3.2 repeats the same analysis as we did in Table 3, only for time delays regarding construction permits, operating licenses and electrical licenses. We include the same firm controls as in Table 3, as well as sector, country and year dummies. Standard errors are heteroscedastic robust and clustered by sector, country and year.

Column 1 reports the effect corruption has on time delays regarding construction permits, column 2 for an operating license and column 3 for an electrical license. We notice that the effect of corruption is positively associated with time delays and statistically significant for operating licenses and operating licenses. Further we want to account for the weakness that some firms reported zero average days to obtain such licenses.

In Table 3.3, we transform the dependent variables in this robustness test, to account for observations that reported average days of obtaining a construction license, an operating license and/or an electrical license to be zero:

Table 3.3: Time Delays in other areas – dependent variable, Time delays = Log(1+Average days spent).

OLS - model			
Dependent variable: *Log (1+Average days):*	(1) Construction Permit	(2) Operating License	(3) Electrical License
Bribes related to Construction Permits	0.360*** (0.0536)		
Bribes related to Operating Licenses		0.404*** (0.0421)	
Bribes related to Electrical Permits			0.338*** (0.0651)
Observations	3,365	5,507	3,388
R-squared	0.239	0.308	0.239
Sector dummies	YES	YES	YES
Country dummies	YES	YES	YES
Year dummies	YES	YES	YES
Firm controls	YES	YES	YES

Note: *** p<0.01, ** p<0.05, * p<0.1.
Standard errors are heteroscedastic robust and clustered by country-year.
Firm controls are Labor, Capital per worker, Management's experience, Firm age, public, private, Partnership, government contract and Time spent with regulations, ref. Table 2.
Source: Authors' analysis based on data from enterprise Surveys, various years.

In this table, each of the effect of corruption is significantly and positively associated with time delays. This is in accordance with the results found by Freund et al. (2016) and supports the associations found for exports in Table 3. By taking the exponent of the coefficients, we get that companies engaging in corruption when applying for a construction license, operating license or an electrical license tends to wait 1.43, 1.50 and 1,40 times as long as firms that did not engange in corruption. We clearly see that corruption may increase the waiting times instead of decreasing it.

2. Robustness – Basic results: Hypothesis #2

Table 7.1: Time Delays in other areas – dependent variable, Time delays = Average days spent. No Firm Controls

OLS – model: *Interaction model*			
Depending variable: *Time delays*			
VARIABLES	(1) Construction Permit	(2) Operating License	(3) Electrical License
Bribes related to Constr. Permit	69.16*** (9.015)		
Home Corruption level Construction Permit	6.245*** (2.351)		
Interaction term: Bribe* Home Corruption level Construction Permit	-1.306*** (0.269)		
Bribes related to Oper. License		36.15*** (6.137)	
Home Corruption level Operating License		-0.707 (0.754)	
Interaction term: Bribe* Home Corruption level Operating License		-1.021*** (0.258)	
Bribes related to Electric License			31.75*** (5.338)
Home Corruption level Electrical License			1.121 (1.002)
Interaction term: Bribe* Home Corruption level Electrical License			-0.729*** (0.196)
Observations	13,923	28,483	16,586
R-squared	0.135	0.063	0.118
Sector dummies	YES	YES	YES
Country dummies	YES	YES	YES
Year dummies	YES	YES	YES
Firm Controls	NO	NO	NO

Note: *** p<0.01, ** p<0.05, * p<0.1.
Standard errors are heteroscedastic robust and clustered on sector, country and year.
Firm controls are Labor, Capital per worker, Management's experience, Firm age, public, private, Partnership, government contract and Time spent with regulations, ref. Table 2.
Source: Authors' analysis based on data from Enterprise Surveys, various years

Table 7.2: Time Delays in other areas – dependent variable, Time delays = Average days spent. Including Firm Controls

OLS – model: *Interaction model*			
Depending variable: *Time delays*			
VARIABLES	(1) Construction Permit	(2) Operating License	(3) Electrical License
Bribes related to Constr. Permit	48.07***		
	(13.04)		
Home Corruption level Construction Permit	-2.535		
	(5.705)		
Interaction term: Bribe* Home Corruption level Construction Permit	-1.002**		
	(0.410)		
Bribes related to Oper. License		39.41***	
		(12.79)	
Home Corruption level Operating License		-2.840	
		(2.796)	
Interaction term: Bribe* Home Corruption level Operating License		-1.129**	
		(0.465)	
Bribes related to Electric License			59.76***
			(19.28)
Home Corruption level Electrical License			7.110*
			(3.815)
Interaction term: Bribe* Home Corruption level Electrical License			-2.258**
			(1.108)
Observations	3,365	5,507	3,388
R-squared	0.184	0.139	0.170
Sector dummies	YES	YES	YES
Country dummies	YES	YES	YES
Year dummies	YES	YES	YES
Firm Controls	YES	YES	YES

Note: *** p<0.01, ** p<0.05, * p<0.1.
Standard errors are heteroscedastic robust and clustered on sector, country and year.
Firm controls are Labor, Capital per worker, Management's experience, Firm age, public, private, Partnership, government contract and Time spent with regulations, ref. Table 2.
Source: Authors' analysis based on data from Enterprise Surveys, various years

As we have mentioned, our data includes a very low amount of observations regarding corruption in ports. Therefore, we want to investigate whether we can observe the same associations as in Table 7, and possibly strengthen the robustness of our results. We look towards other areas where corrupt agents may control scarce values that involves a qualification steered allocation. Table 7.1 and 7.2 repeats the same analysis as we did in Table 7, only for time delays regarding construction permits, operating licenses and electrical licenses. Both tables include sector, country and year dummies, and the standard errors are heteroscedastic robust and clustered by sector, country and year. In Table 7.1, we do not include any firm controls to resemble the same test as the first and third specification in Table 7. In contradiction to Table 7, we notice that the estimated interaction effects are negative and statistically significant on the 1 percent level when not including firms controls; the null hypothesis that companies from more corrupt countries are not able to get through ports faster must be rejected. This implies that paying companies from more corrupt countries have an advantage over paying companies from low corrupt companies when encountering corruption in ports.

In Table 7.2, we include the same firm controls as in Table 7. We see that the estimated interaction effects are still negative and statistically significant on the 5 percent level. This implies stronger evidence that paying companies from more corrupt countries have an advantage over paying companies from low corrupt companies when encountering corruption in ports.

The null hypothesis that companies from more corrupt countries are not able to get through ports must be rejected, also when including firm controls.

To account for the same problems regarding companies reporting to have waited less than zero days for the various services, we repeat the models presented in Table 7.1 and 7.2 but transform the dependant variable in the same way as in Table 3.1; We transform our dependent variable, $Delay_{i,s,c,t}$, to $Log(1 + Average\ waiting\ days\ for\ the\ respective\ sevices)$. The results are shown in Table 7.3 and 7.4. The interaction effects are still negative and statistically significant on the 1 percent level, providing the same evidence as Table 7.1 and 7.2.

Table 7.3: Time Delays in other areas – dependent variable, Time delays = Log(1 + Time delays). No Firm Controls

OLS – model: *Interaction model*			
Depending variable: *Log(1 + Time delays)*			
VARIABLES	(1) Construction Permit	(2) Operating License	(3) Electrical License
Bribes related to Constr. Permit	0.674***		
	(0.0677)		
Home Corruption level Construction Permit	0.0154		
	(0.0269)		
Interaction term: Bribe* Home Corruption level Construction Permit	-0.00790***		
	(0.00239)		
Bribes related to Oper. License		0.638***	
		(0.0489)	
Home Corruption level Operating License		0.0461***	
		(0.0136)	
Interaction term: Bribe* Home Corruption level Operating License		-0.0109***	
		(0.00172)	
Bribes related to Electric License			0.621***
			(0.0664)
Home Corruption level Electrical License			-0.00971
			(0.0163)
Interaction term: Bribe* Home Corruption level Electrical License			-0.0117***
			(0.00223)
Observations	13,923	28,483	16,586
R-squared	0.211	0.255	0.198
Sector dummies	YES	YES	YES
Country dummies	YES	YES	YES
Year dummies	YES	YES	YES
Firm Controls	NO	NO	NO

Note: *** p<0.01, ** p<0.05, * p<0.1.
Standard errors are heteroscedastic robust and clustered on sector, country and year.
Firm controls are Labor, Capital per worker, Management's experience, Firm age, public, private, Partnership, government contract and Time spent with regulations, ref. Table 2.
Source: Authors' analysis based on data from Enterprise Surveys, various years

Table 7.4: Time Delays in other areas – dependent variable, Time delays = Log(1 + Time delays). including Firm Controls

OLS – model: *Interaction model*			
Depending variable: *Log(1 + Time delays)*			
VARIABLES	(1) Construction Permit	(2) Operating License	(3) Electrical License
Bribes related to Constr. Permit	0.617***		
	(0.138)		
Home Corruption level Construction Permit	-0.0410		
	(0.0639)		
Interaction term: Bribe* Home Corruption level Construction Permit	-0.00957*		
	(0.00493)		
Bribes related to Oper. License		0.602***	
		(0.0904)	
Home Corruption level Operating License		0.0361	
		(0.0419)	
Interaction term: Bribe* Home Corruption level Operating License		-0.00959***	
		(0.00362)	
Bribes related to Electric License			0.789***
			(0.129)
Home Corruption level Electrical License			0.0220
			(0.0316)
Interaction term: Bribe* Home Corruption level Electrical License			-0.0211***
			(0.00497)
Observations	3,365	5,507	3,388
R-squared	0.238	0.308	0.239
Sector dummies	YES	YES	YES
Country dummies	YES	YES	YES
Year dummies	YES	YES	YES
Firm Controls	YES	YES	YES

Note: *** p<0.01, ** p<0.05, * p<0.1.
Standard errors are heteroscedastic robust and clustered on sector, country and year.
Firm controls are Labor, Capital per worker, Management's experience, Firm age, public, private, Partnership, government contract and Time spent with regulations, ref. Table 2.
Source: Authors' analysis based on data from Enterprise Surveys, various years

3. Description of all variables:

Variables	STATA name	Variable Description	Measure	Survey Explanation:
Time delays Exporting*:	eportdays	How many days it takes to clear ports exporting	The average amount of days a company spend in port while exporting.	In the last fiscal year, when the company exported goods directly, the average number of days that it took from the time the company's goods arrived to their main point of exit (port) until the time these cleared customs.
Time delays Importing*:	iportdays	How many days it takes to clear ports importing	The average amount of days a company spend in port while exporting.	In the last fiscal year, when the company imported goods, the average number of days that it took from the time the company's goods arrived to their main point of entry (port) until the time these cleared customs.
Bribes related to Exporting**:	eportgift	Dummy for corruption related to clearing ports exporting	=1 If the company encountered corruption in ports while exporting - Proxy for paying for a better position in ports while exporting	In clearing exports through customs, informal gift/payment expected or requested?
Bribes related to Importing**:	iportgift	Dummy for corruption related to clearing ports importing	=1 If the company encountered corruption in ports while exporting - Proxy for paying for a better position in ports while importing	In clearing imports through customs, informal gift/payment expected or requested?
Paid informal payments:	bribeamount	Dummy for reporting a perceived annual amount of informal payments	=1 If a company reported an annual amount of informal gifts of payments regardless of type of service.	Companies are sometimes required to make gifts or informal payments to public officials to "get things done" with regard to customs, taxes, licenses, regulations, services etc. On average, what percent of total annual sales, or estimated total annual value, do establishments like this one pay in informal payments or gifts to public officials for this purpose?

Countryonly:	countryonly	ID Variable for country	Which home country of the company we are looking at	Country
Yearonly:	yearonly	ID Variable for year	The fiscal year of the company we are looking at	Year
Country:	i.countryonly	Country Dummy	Country-specific variance	N/A
Year:	i.yearonly	Year Dummy	Year-specific variance	N/A
Sector:	i.sector	Sector Dummy	Sector-specific variance	N/A
Labor:	lnLtot	Proxy for form size	The amount of full-time employees in the company – size-specific variance	Num. permanent, full-time employees at end of last fiscal year
Capital per worker (log):	log_capital_per_worker	Proxy for capital intensity	Capital intensity as capital divided by labor. Capital intensity-specific variance	Cost for Establishment to Re-Purchase All of Its Machinery + Cost for Establishment to Re-Purchase All of Its Land and Buildings. Designed to ascertain the market value of the company's capital.
Output per worker (log):	L_output_pr_worker	Proxy for productivity	Productivity as annual sales divided by labor. Productivity-specific variance	Last Fiscal Year, what were the company's total annual sales? / num. permanent, full-time employees at end of last fiscal year
Management's experience:	b7	Managements experience expressed in years	Managements experience level. Experience-specific variance	How many years of experience working in this sector does the top manager have?
Firm age:	firm_age	The company's age	The age of the company as the current year (2019) minus the establishment year. age-specific variance	Year establishment began operations
Public:	public	Dummy for whether the company is publicly traded	=1 if company is public. Ownership-specific variance	Legal status of the firm
Private:	private	Dummy for whether the	=1 if company is private.	Legal status of the firm

		company is a private limited liability company	Ownership-specific variance	
Partnership:	partnership	Dummy for whether the company is a partnership	=1 if company is a partnership. Ownership-specific variance	Legal status of the firm
Limited Partnership:	limitedpartner	Dummy for whether the company is a limited partnership	=1 if company is a Limited Partnership. Ownership-specific variance	Legal status of the firm
Sole Proprietorship:	solepropship	Dummy for whether the company is a sole proprietorship	=1 if company is a Sole Proprietorship. Ownership-specific variance	Legal status of the firm
Foreign Owners:	foreign	Dummy for whether the company has foreign owners	=1 if the company has foreign owners. Ownership-specific variance	% Owned by private foreign individuals, companies or organizations
Exporter:	exporter	Dummy for whether the company directly exports goods	=1 if the company directly exports goods. Direct export-specific variance	% Of Sales: direct exports
Importer:	importer	Dummy for whether the company directly imports goods	=1 if the company directly imports goods/supplies. Direct import-specific variance	Were any of the material inputs and supplies imported directly?
ISO certified:	ISO	Dummy for whether the company has an ISO-certificate	=1 if the company is ISO-certified. Visibility-specific variance: A company that is ISO-certified has gone through processes including various audits, meaning its business are more visible.	Does establishment have an internationally-recognized quality certification?
Formally registered:	formal	Dummy for whether the company is formally registered within their home country.	=1 if the company is formally registered. Visibility-specific variance. Informal companies can operate much more freely as they are not monitored by stakeholders as much as formal registered companies.	In what year was this establishment formally registered?
Government contract:	government_contract	Dummy for whether the company is doing business with the government	=1 if company has a government contract. Public interaction-specific variance.	Government contract secured (or attempted) in the last 12 months?
Time spent with regulators:	time_regulations	Dummy for whether the company has spent time with regulators in the last fiscal year	=1 if company spent time with regulations. Regulator interaction-specific variance.	What % of senior management time was spent in dealing with govt regulations?

Visited by tax officials:	visited_taxofficials	Dummy for whether the company was visited by tax officials in the last fi	=1 if the company was inspected by tax officials. Control by officials-specific variance.	Over the last 12 months, was this establishment inspected by tax officials?
Externally financed:	ext_financed	Dummy for whether the company was externally financed	=1 if the company is externally financed. Finance-specific variance. To test whether externally financed companied engage in corruption more often.	Establishment has a line of credit or loan from a financial institution?
Financial Statement Audited:	audited	Dummy for whether the company's financial statement was audited	=1 if FS is audited. External check-specific variance. Test if companies with more external checks engage more or less in corruption.	Financial Statements checked & certified by external auditor in last fiscal year?
Performance bonuses:	bonus	Dummy for whether the company has performance bonus schemes for management	=1 if there were performance bonuses. Incentive-specific variance. Test if incentives trigger more corruption	Was there performance bonuses based on production targets?
Est. separated from HQ:	separate	Dummy for whether the company was separated from the headquarters	=1 if company was located separate from HQ. HQ control-specific variance. Test if the variance is explained by having less control from HQ.	Type of establishment: Establishment physically separated from HQ and other establishments of the same firm or Establishment physically separated from HQ but with other establishments of the same firm
Home Corruption level - Exporting	corruptionlevel_ex	Proportion of corruption in port when exporting, sorted by a company's home country.	Corruption level-specific variance. Measured by percent of companies reporting corrupt encounters when exporting, sorted by home country.	In clearing exports through customs, informal gift/payment expected or requested? – Sum of "yes" answers sorted by the company's home country.
Home Corruption level - Importing	corruptionlevel_im	Proportion of corruption in port when importing, sorted by a company's home country.	Corruption level-specific variance. Measured by percent of companies reporting corrupt encounters when importing, sorted by home country.	In clearing imports through customs, informal gift/payment expected or requested? – Sum of "yes" answers sorted by the company's home country.

Corrupt courts:	corruptcourt	Dummy variable for companies reporting a corrupt court system in their country.	=1 if company reported strongly disagree and disagrees with the statement. Court-specific variance	Some statements that describe the courts and the way government officials interpret laws and regulations that affect this establishment's business. For each statement, please tell me if you Strongly disagree, tend to disagree, Tend to agree, or Strongly agree. "The court system is fair, impartial and uncorrupted"
Law/Regulations not predictable:	notpredictable	Dummy for whether the company finds the laws and regulations not predictable	=1 if company reported strongly disagree and disagrees with the statement. Regulation-specific variance	Some statements that describe the courts and the way government officials interpret laws and regulations that affect this establishment's business. For each statement, please tell me if you Strongly disagree, tend to disagree, Tend to agree, or Strongly agree. "Government officials' interpretations of the laws and regulations affecting this establishment are consistent and predictable.".
Burdensome tax administration:	taxobs	Dummy for companies reporting that tax administration is a Major or very Severe obstacle of their operations	=1 if company reported tax administrations to be a major or very severe obstacle of doing business. Burdensome bureaucracy-specific variance	List some of many factors that can affect the current operations of a business, please look at this card and tell me if you think that each factor is No Obstacle, a Minor Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment.

Political instability:	politicobs	Dummy for companies reporting that political instability is a Major or Very Severe obstacle of their operations	=1 if company reported tax administrations to be a major or very severe obstacle of doing business. Burdensome bureaucracy-specific variance	List some of many factors that can affect the current operations of a business, please look at this card and tell me if you think that each factor is No Obstacle, a Minor Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment.
Burdensome trade regulations:	customsobs	Dummy for companies reporting that customs regulations is a Major or Very Severe obstacle of their operations	=1 if company reported tax administrations to be a major or very severe obstacle of doing business. Burdensome bureaucracy-specific variance	Do you think that customs and trade regulations are No Obstacle, a Minor Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment?
Burdensome courts:	courtobs	Dummy for companies reporting that courts is a Major or Very Severe obstacle of their operations	=1 if company reported tax administrations to be a major or very severe obstacle of doing business. Burdensome bureaucracy-specific variance	List some of many factors that can affect the current operations of a business, please look at this card and tell me if you think that each factor is No Obstacle, a Minor Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment.

* The variables for Time delays relating to other regulatory policies, such as construction permits, operating license and electrical license are identical.

** The variables for Bribe relating to other regulatory policies, such as construction permits, operating license and electrical license are identical.

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