An Empirical Study of Corruption in Ports

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AN EMPIRICAL STUDY OF CORRUPTION IN PORTS*

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Abstract

We generate an original dataset on bribe payments at two competing ports in Southern Africa that allows us to take an unusually close look at the relationship between bureaucratic organization, bribe-setting behavior and the costs corruption imposes on users of public services. We find that the way bureaucracies are organized can generate different opportunities for bureaucrats to engage in "collusive" or "coercive" types of corruption. We then observe how firms adjust their shipping and sourcing strategies in response to different types of corruption. "Collusive" corruption is cost-reducing for firms, increasing usage of the corrupt port, while "coercive" corruption is cost-increasing, reducing demand for port services. Our findings therefore suggest that firms respond to the opportunities and challenges created by different types of corruption, organizing production in a way that increases or decreases demand for the public service.

Keywords: Corruption; Transport; Bureaucracies; Ports; Trade Costs
JEL Classification Numbers: D21, D61, D73, K42, L91, O12, O55, R41.

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I Introduction

Reducing trade costs has the potential to substantially increase income and improve welfare in trading countries, particularly in the developing world where these costs are highest (Frankel and Romer, 1999; Rodriguez and Rodrik, 2001; Obstfeld and Rogoff, 2001). In recent years, a significant portion of aid efforts has been devoted to reducing trade costs and improving trade logistics, ranging from investments in physical transport infrastructure to the modernization of transport bureaucracies.[1] However, some categories of trade costs have proven more difficult to identify and reduce than others. Recent research has suggested that corruption in port and border post bureaucracies can significantly raise the cost of trade (Clark et. al, 2004; Yang, 2008), and even dampen the returns to investments in physical transport infrastructure that are currently under way in the developing world (Maachi and Sequeira, 2009). But the absence of data on the mechanics of actual bribe payments in ports has made it difficult to measure the magnitude of corruption, to understand why it emerges and to identify how it can affect firm behavior and the demand for port services.[2]

This paper is an empirical study of the anatomy of corruption in port bureaucracies. In particular, we analyze how the structure of bureaucratic agencies and the way they compete in the provision of services are important determinants of the level, the type and the economic costs corruption imposes on users.

From a theoretical perspective, the way bureaucrats set bribes and the mechanisms through which bribe-setting affects the economy are ambiguous. Shleifer and Vishny (1993) first proposed that the industrial organization of government organizations could affect the level of bribes in the economy. In a recent test of this model, Olken and Barron (2009) use micro-data on bribe payments to police roadposts in Indonesia to find evidence that the level of bribes is determined by the organizational structure of the "market" for corruption,

[1] In 2008, the World Bank allocated over 20% of its budget to "aid for trade", targeting in particular trade-related infrastructure in over 35 countries worldwide.

[2] In South Africa and Mozambique alone, over 50% of firms reported having to pay bribes to transport bureaucracies in 2007 (Enterprise Survey, World Bank).

namely the elasticity of demand for each public official's services, and the degree to which corrupt agents can coordinate with each other in setting bribes.

How bribe setting behaviors affect the economic costs of corruption has been a matter of more debate. Some authors argue that bribes can be set to allow private agents overcome cumbersome regulations, and to create direct incentives for bureaucrats to perform, resulting in an improvement in overall allocative efficiency (Leff, 1964; Huntington, 1968; Lui, 1985). Others contend that the imperative of secrecy in bribe payments and the strategic preferences of bureaucrats typically lead to a distortion in the allocation of private and public resources, which increases the overall efficiency costs of corruption (Krueger, 1974; Klitgaard, 1991; Shleifer and Vishny, 1992; Shleifer and Vishny, 1993; Rose-Ackerman, 1999). In this paper, we combine these two questions. Motivated by standard industrial organization theories of competition and price setting, we analyze the structure of bureaucracies and how it determines the bribe-setting behavior of frontline public officials. We then identify how differences in bribe-setting behavior impose different types of costs on users of public services.

To investigate how bribes are set we generate an original dataset on directly observed bribe payments to port bureaucracies for a random sample of 1,300 shipments going through two competing ports in Southern Africa. To the best of our knowledge, this is the first study to use primary data on bribe payments to document the magnitude, the determinants and the impact of corruption in an essential public bureaucracy. [3] Our empirical setup and the level of detail in our data enable us to observe how bribe levels vary across different types of bureaucracies, different types of bureaucrats within each bureaucracy, and different types of firm-level transactions. To assess the economic costs imposed by corruption on port users we focus on how it affects firms' shipping and sourcing strategies, both of which are highly dependent on the overall cost of using each port. Because we observe the entire chain between competing port bureaucracies, frontline bureaucrats setting bribes and users making

[3] Port bureaucracies provide fertile ground to analyze corrupt behavior since opportunities for rent-seeking abound. A port represents an administrative monopoly over an important public service, with broad discretionary powers and scant institutional accountability.

shipping and sourcing decisions, we are able to more accurately trace both the determinants and the systemic impact of corruption on the economy.

We present three main findings on the bureaucratic determinants of corruption and on the economic costs corruption imposes on users of public services. First, we find that public officials engage in two main types of corruption. "Collusive" corruption emerges when public officials and private agents collude to share rents generated by the illicit transaction. "Coercive" corruption takes place when a public bureaucrat coerces a private agent into paying an additional fee, above and beyond the official price, just to gain access to the public service or good. Bureaucrats will engage in "collusive" or "coercive" corruption depending on the opportunities provided by the bureaucratic structure under which they operate. In both cases, our findings suggest that when public officials set bribes they price discriminate primarily to minimize the informational costs of bargaining over bribes, and the probability of detection of the illicit transaction.

Second, we find that "collusive" and "coercive" types of corruption can impose costs on the economy, but through different mechanisms. Bribes appear to be higher and more frequent under "collusive" types of corruption, while "coercive" corruption appears to be more distortionary. In what we label the "diversion effect" of corruption, we find that firms travel on average an additional 322 kms - more than doubling their transport costs-, just to avoid "coercive" corruption at a port. The cost for a firm to re-route is eight times higher than the cost of the actual bribe requested, suggesting an extreme aversion to the uncertainty and ambiguity of bribe payments (Shleifer and Vishny, 1993). This uncertainty aversion is confirmed by survey data. Given that corruption at ports has a direct bearing on the relative costs of imports, firms also respond to different types of corruption by adjusting their decision to source inputs domestically or internationally. We find suggestive evidence that "collusive" forms of corruption can be cost-reducing, leading to an increase in firms' imports, whereas "coercive" corruption can be cost-increasing, reducing a firms' demand for imports. These findings suggest that firms organize production in ways that increase or decrease demand for the public service, in response to different types of corruption.

Third, while not as clearly identified, we also provide some suggestive evidence on how corruption can affect firms beyond the immediate cost of a bribe, by raising overall costs of transport. The "diversion effect" caused by "coercive" corruption increases congestion and transport costs in the region by generating imbalanced flows of cargo along the transport network. Even though the actual cost of physical transport is identical across the corridors under study, transport services on the transport corridor leading to the most corrupt port carry a 70% price premium, lending further evidence to the fact that"coercive" corruption can create both direct and indirect distortions in the market.

Our findings are consistent with an emerging literature that argues that bureaucrats price discriminate when setting bribes and that corruption can impose significant costs on the economy. Svensson (2002) and Fisman and Svensson (2002) find evidence that corrupt bureaucrats price discriminate in determining access to public services and that a 1 percentage point increase in bribery rates reduces firm growth by 3 percentage points. However, both studies rely primarily on self-reported measures of bribe payments to public officials by surveyed firms, which bear a high risk of perception and reporting bias (Olken, 2009). Bertrand et al. (2007) provides experimental evidence on how bureaucrats undercut existing regulations on obtaining a driving license in India, responding to the needs of private agents but at a high social cost. While this study suggests large social losses due to bribe payments, it lacks the data necessary to quantify the impact of bribes on economic activity.

The rest of the paper proceeds as follows. Section II describes the empirical setting and the nature of firms' shipping decisions. Section III discusses the conceptual framework, while section IV describes the data collection in more detail and presents key summary statistics. Section V identifies the determinants of corruption in the two ports, section VI measures the efficiency costs of corruption and section VII discusses robustness checks. Section VIII concludes.

II Empirical Setting

II.1 Transport and Port Bureaucracies in Southern Africa

In 2007, shipping a container from a firm located in the main city of the average country in Southern Africa was twice as expensive as shipping it from the US, Brazil or India (World Bank, 2007). Even in a middle income country like South Africa, expenditures on transport are equivalent to 15-20% of GDP (CSIR, 2005, 2007) and transport costs weigh heavily on the cost structure of firms, constraining decisions on the location of production, the sourcing of inputs and participation in international trade. But not only is exporting from Southern Africa more expensive, it is also more time-consuming. In 2007, it took an average of 35 days for a firm to get a standard 20ft container from its warehouse through the closest port and on a ship. This was twice as long as in Brazil and six times longer than in the US. Djankov, Freund and Phan (forthcoming) in turn find that each day cargo is delayed reduces a country's trade by 1% and distorts the ratio of trade in time-sensitive to time-insensitive goods by 6%. A growing literature also suggests that in Sub-Saharan Africa in general, transport costs currently impose a higher effective rate of protection than tariffs (Hummels, 2008).

In this study we focus on two competing transport corridors connecting South Africa's mining, agricultural and industrial heartland to the ports of Durban in South Africa and Maputo in Mozambique, as shown in Figures 1 and 2. Given its strategic location, the port of Maputo has historically been considered a critical part of South Africa's transport network and, together with Durban, serves as the primary transportation route to the sea for the booming South African provinces of Mpumalanga, Gauteng and Kwazulu-Natal.[4] The

[4] There is a third port in the region, the port of Richards Bay, which is located approximately halfway between Durban and Maputo along South Africa's eastern seaboard. This port was developed in the late 70s to serve a select group of private shareholders and is primarily used by large mining conglomerates to ship bulk cargo. Given the restricted nature of access to this port, we do not consider it to be a substitute for either Durban or Maputo for the type of firms covered in this study. In fact, the enterprise survey we conducted in South Africa covering a random sample of over 1,700 firms revealed that none of these firms used Richards Bay as an import or export port in 2007.

choice of which port to use is not trivial since cargo travels long distances - an average of 588 kms - between centers of production or consumption and ports, primarily by road given the high cost and low efficiency of railroad services in the region. Since 2004, the barriers for freight transit along the transnational corridor connecting South Africa to the port of Maputo have been significantly reduced.[5] Given this setup, a clearly defined group of South African firms faces the choice of using two different ports - Maputo or Durban - with similar overland transport costs, similar cargo-handling technologies and similar logistics services for standard cargo, but with different levels of expected corruption.

II.1.1 The Shipping Decision: the Role of the Clearing Agent and the Transit Bond

By law, no firm is allowed to interact directly with customs or port operators in Mozambique or in South Africa. Firms have instead to resort to clearing agents who specialize in clearing cargo through the port or border post.[6] Most firms will engage in ad hoc, shipment-based contracts with truckers and clearing agents to satisfy their transport and clearance needs.[7] In this paper we make several simplifying assumptions. For one, we assume that there is no strategic sorting between clearing agents and different port officials. In the case of imports, there is significant uncertainty as to when the vessels can dock at the port due to wind patterns and congestion levels, and for exports there is uncertainty as to when trucks can enter the port because of traffic and queuing. Given that port officials operate for 6 to 8 hour shifts and that no cargo can stay idle inside the port without documentation being submitted, we consider that clearing agents are randomly assigned to port officials.[8] We also abstract from several bargaining dynamics namely the possibility of collusion between

[5] For example, there are no visa requirements for truck drivers from either country to operate along the transnational Maputo corridor.

[6] The market for clearing agents is moderately competitive following the de-regulation of the trade in the 80s in South Africa and in the 90s in Mozambique.

[7] In the sample of firms we track in this paper, 80% of firms engaged in direct contracts with clearing agents, 65% of which were for a one-time shipment.

[8] For a random sample of 20 shipments, we asked clearing agents for the last time they had interacted with the port official dealing with the clearance of their shipment. 80% of the clearing agents responded that they had never interacted with that port official before.

different port officials within each port; agency problems between firms and clearing agents as well as intertemporal bargaining dynamics. We choose to abstract from these dynamics given that we do not find any evidence of collusion between port officials and we find that bribes vary significantly both across clearing agents, and across shipments handled by the same clearing agent. Moreover, the small sample of clearing agents participating in this study due to the secretive nature of the data collection effort rendered it impossible to test these hypotheses any further with the current data.

A critical feature of our empirical setup is that if a South African firm chooses to ship through the port of Maputo, it will only have to pay tariffs when the cargo enters South Africa, according to the South African tariff codebook. No tariff payments are made at the port of Maputo. However, while the shipment is in transit for approximately 120 kms through Mozambican territory, South African firms have to pay a refundable transit bond. The amount of this transit bond is in principle determined by the tariff amount the cargo would have to pay to Mozambican customs, were it to be diverted and stay in Mozambique. All the clearing agents who participated in this study confirmed that while transit bond procedures are in principle straightforward and easy to implement, customs in Maputo would often seek to re-classify shipments or change shipment values in order to negotiate a bribe against the threat of an arbitrary increase in the amount of the transit bond. We explore the consequences of this behavior in section VI.

The key nodes in the shipping process with more latitude for bribe asking are customs (at border posts and ports) and port operations (including port security, document clerks and stevedores, among others). Bribes are paid primarily by clearing agents, with all costs imputed to client firms.[9]

[9]Truckers may also pay bribes at roadposts along both corridors. We do not include these bribes in our study given that our trucking surveys indicated that the probability of paying a bribe in either corridor was identical, and that these bribes were on average 50% lower than the bribes that were paid at the port or border post by clearing agents.

II.2 The Ports of Maputo and Durban: Official Types, Bureaucratic Variation and Opportunities for Corrupt Behavior

Though each port official sells a differentiated product with monopoly power over a specific sequence in the clearing chain, we define two broad categories of officials that differ in their authority and in their discretion to stop cargo and create opportunities for bribe payments: customs officials and port operators. In principle, customs officials have greater discretionary power to extract bribes than regular port operators given their broader mandate and the fact that they can access full information on each shipment and each shipper at all times.[10] Regular port operators on the other hand have a narrower mandate to move or protect cargo on the docks, and they lack access to the cargo's documentation specifying the value of the cargo, the client firm and its origin/destination, among others.[11] To investigate if the structure of bureaucracies affects the level and type of corruption observed, we take a closer look at how each port bureaucracy is organized. The port bureaucracies of Maputo and Durban differ in two important organizational features that determine which of the two types of port officials described above have more opportunities for bribe extraction: the high extractive types -customs agents or the low extractive types -port operators. The two main differences relate to the level of direct, in-person interaction that exists between clearing agents and customs officials, and to the type of management overseeing port operations. In Durban, the level of direct interaction between clearing agents and customs agents is kept to a minimum since all clearance documentation is processed online. In contrast, this level of interaction is high in Maputo since all clearance documentation must be submitted in-person

[10] Customs officials possess discretionary power to single-handedly decide which cargo to stop and whether to reassess the classification of goods or import prices for tariff purposes. They can also threaten to conduct a physical inspection of the shipment, which can delay clearance for up to 4 days, or request additional documentation from the shipper.

[11] Bribes can be paid to different types of port officials: agents in charge of adjusting reefer temperatures for refrigerated cargo stationed at the port; port gate officials who determine the acceptance of late cargo arrivals; stevedores who auction off forklifts and equipment on the docks; document clerks who stamp import, export and transit documentation for submission to customs; port security who oversee high-value cargo vulnerable to theft; shipping planners who auction off priority slots in shipping vessels, and scanner agents who move cargo through non-intrusive scanning technology.

by the clearing agent.[12] The close interaction between clearing agents and customs officials creates more opportunities for corrupt behavior to emerge in Maputo.

In Maputo, port operators are privately managed but in Durban this is only the case for bulk cargo terminals. Container terminals are still under public control. Private management in Maputo and in the bulk terminals in Durban are associated with lower bribe payments, while publicly managed container operations in Durban are associated with high bribes. These organizational features determine that the high extractive types in customs have more opportunities to extract bribes in Maputo, while the low extractive types in port operations have more opportunities to extract bribes in Durban.

A second important difference between the two port bureaucracies is that the high extractive types at each port differ in their time horizons. As part of a comprehensive reform program, customs in Maputo adopted a policy of rotating agents across different ports and terminals.[13] While customs officials in Maputo can be in a post for as little as 6 weeks, port operators in Durban have extended time horizons given the stable support they receive from dock workers' unions.[14] We therefore expect that the high extractive types with the shortest time horizons extract the highest level of bribes (Campante, Chor and Do, 2009).

We argue that these differences in organizational structure between the two port bureaucracies were not determined by the level of corruption in the ports. In Mozambique, the privatization of port operations was a necessary condition for the government to receive funding from international financial institutions (IFIs) for the rehabilitation of the port.[15] In South Africa, dock workers' unions spearheaded a long and successful fight against the pri-

[12] The level of red tape is however similar in both countries. South Africa and Mozambique require the same number of documents to process the clearing of goods through their ports (Doing Business, 2007).

[13] This reform process was headed by the British Crown Agents between 1996-2006. As shown in section IV.5, bribes vary significantly by the type of product being shipped, and consequently by the type of terminal at the port. Customs agents can therefore be assigned to terminals with different levels of extractive potential at any given moment.

[14] Information obtained through interviews to the Customs Agency in Maputo and to the head of of SATAWU, the transport union in Durban.

[15] The derelict state of the port of Maputo in the late 1990s was the result of decades of civil conflict, economic isolation and under-investment in transport infrastructure. The capital requirements to rehabilitate and re-open the port to international traffic in the early 2000s could only be met by resorting to foreign financial assistance.

vatization of port operations, particularly in container terminals in charge of general cargo. The political strength of the organization is deeply rooted in an historical struggle against Apartheid, which culminated in its active participation in the tripartite political alliance that gave birth to the first post-apartheid government in South Africa.[16] Bulk terminals on the other hand are owned primarily by large mining conglomerates. A handful of powerful export mining conglomerates forged a stable political alliance across time with political power to gain control over their own transport chains.[17]

III Conceptual Framework

III.1 Competition Between Port Bureaucracies

Motivated by standard theories of industrial organization and price setting behavior, this section discusses how the organization of port bureaucracies affects the way bureaucrats set bribes, with important implications for the economic costs of corruption.

Since adjusting the price of the bribe is easier than restricting the quantity of the service provided, we assume Bertrand competition in bribes. We also assume that the cost of providing the service for a port bureaucrat is zero. If the market for the provision of port services is characterized by perfect competition, even with just two ports, the only Nash price equilibrium would be the one that equalizes the price of the bribe in each port to the marginal cost of providing the service for the bureaucrat. Bribes would be competed to zero and there would be no efficiency cost of corruption.

And yet, it is often the case that bureaucrats are still able to sustain positive profits while engaging in this type of bribe-setting competition. One possibility is that bureaucrats

[16] The South African Transport and Allied Workers Union (SATAWU) boasts 82,000 members and is affiliated with the Congress of South African Trade Unions (COSATU). COSATU is an active member in the tripartite political alliance with the ANC and the Communist party. In a clear display of its strength, in May of 2008, SATAWU members in Durban refused to unload a ship from China bearing a large amount of Chinese-manufactured weapons that were bound for Zimbabwe.

[17] In the 50s and 60s, the mass export of minerals funded South Africa's Import-Substitution Industrialization (ISI) model of development. In the 80s and 90s, as South Africa struggled under the weight of economic sanctions, the export of coal and iron ore became the primary sources of foreign exchange and the largest contributors to GDP. As a result of their economic importance, private groups have developed and managed all bulk terminals in South Africa's ports to this day.

are able to collude to jointly maximize bribe revenue across ports. In this case, bureaucrats would set bribe prices acting as a joint monopolist, internalizing cross elasticities of demand across ports and setting marginal revenue equal to marginal cost. If the game were repeated infinitely, the monopoly price would become a Nash equilibrium. Bureaucrats would decide on the following strategy: $b_t = b^m$ if both organizations collude and b^m is the monopoly bribe level, and $b_t = 0$ as long as the other organization deviates, with c being the marginal cost of providing the service. If π^m is the monopoly bribe profit when both bureaucracies set bribes at b^m, each will make a profit $\frac{\pi^m}{2}$. If a bureaucracy deviates from this arrangement on date t by setting a bribe that is slightly lower than b^m, it will make a profit in bribes that is close to π^m on date t but zero afterwards, since both bureaucracies will set bribes at $b_t = c$ after that. If on the other hand this strategy is sustained, then each bureaucracy will still make a profit: $\frac{\pi^m}{2}(1 + \delta + \delta^2 + ...) = \frac{\pi^m}{2(1-\delta)}$. Provided that the discount rate of bureaucrats is small enough so that $\delta \geq 0.5$, this will always be a stable equilibrium since $\frac{\pi^m}{2(1-\delta)} \geq \pi^m$. Sustaining this strategy in equilibrium would therefore require that coordination costs between bureaucrats across bureaucracies are low so that bribes can be set at b^m; the threat of punishment for deviating from the arrangement is credible so that b_t can be set at 0; bureaucrat's discount rates are low and equal across bureaucracies, and that the costs of deviating from the agreement are borne by the individual bureaucrats setting the bribes so that $\frac{\pi^m}{2(1-\delta)} \geq \pi^m$ (Stigler, 1964). Both in the case of perfect competition and perfect collusion, the efficiency costs of corruption are low, since bribes do not distort the allocation of resources. Whether the conditions for perfect competition or perfect collusion hold depends on the way bureaucracies are organized.

III.2 Bribe-setting Behavior by Frontline Bureaucrats

The structure of bureaucracies also determines the opportunities provided to bureaucrats to engage in different types of corruption. "Collusive" corruption emerges when public officials and private agents collude to share rents generated by the illicit transaction. A clear example of "collusive corruption" is when private agents collude with customs officials to evade tariffs. "Coercive" corruption takes place when a public bureaucrat coerces a private agent to pay a fee just to gain access to the public service. In this case, the private agent does not benefit from any rent from the illicit transaction as the bribe is extortionary by nature. This typology of corruption builds on the one suggested by Shleifer and Vishny(1993) of corruption *with* and *without* theft. In the case of corruption with theft, the final cost of obtaining the service for the user corresponds to the price of the bribe B. Corruption without theft raises the cost to $p+B$, corresponding to the official price of the service p plus the bribe B. Within this framework, "collusive" corruption emerges when $B < p$ or $B < \gamma$, with γ the rent that accrues to the private agent due to the illicit transaction. "Collusive" corruption can therefore be both with and without theft. Paying a bribe to evade tariffs and paying a bribe to speed clearance through the port both represent forms of "collusive" corruption, but while the former is a clear example of corruption with theft, the latter represents a case of corruption without theft. "Coercive" corruption on the other hand emerges when $B > p$ and $\gamma = 0$. If the demand for the public service is decreasing in cost B and increasing in rent γ, "collusive" corruption will always increase demand for the service, while "coercive" corruption will be cost-increasing, reducing demand for the service.

The efficiency costs of both "collusive" and "coercive" forms of corruption depend on how bureaucrats set bribes. These costs will be low if bureaucrats do not price discriminate, or if they price discriminate efficiently. In the case of no price discrimination, bribes are paid lump-sum over each shipment and corruption is equivalent to a non-distortionary tax on accessing port services. If bureaucrats price discriminate efficiently, bribes would also not distort firms' decisions. Examples of efficient price discrimination would be setting bribes according to the time preferences of users, according to their ability to pay or based on each firm's distance to each port. While still costly, corruption would represent just a transfer from private agents to bureaucrats that would not distort allocative efficiency (Leff, 1964, Huntington, 1968, Lui, 1994).

The bureaucrat's choice of how to price discriminate is analogous to the choice by a monopolist of the quality of the service to provide to customers. To understand the intuition, suppose that the inverse supply function of private agents paying bribes is $P(q, \sigma)$, which is increasing in σ since private agents can pay a higher bribe if bureaucrats price discriminate efficiently. For the bureaucrat, the cost of demanding a bribe $C(q, \sigma)$ also increases with the "quality" of discrimination σ since it requires obtaining more information from private agents on their willingness and ability to pay. Bureaucrats then choose the quantity of the bribes and the quality of price discrimination that can maximize their individual bribe revenue: $max_{q\sigma}\left[qP(q, \sigma) - C(q, \sigma)\right]$, where C is convex in σ. The first order condition of this maximization problem is $q\frac{\partial P}{\partial \sigma}(q, \sigma) = \frac{\partial C}{\partial \sigma}(q, \sigma)$. For the efficiency costs to be low, bureaucrats would have to instead maximize joint welfare with private agents, which would render the following first order condition: $\int_0^q \frac{\partial P}{x, \sigma} dx = \frac{\partial C}{\partial \sigma}(q, \sigma)$. Suppose private agents have a utility function $U = \theta\sigma - p$ and that θ is uniformly distributed in $[0, 1]$. The inverse supply function is $P(q, \sigma) = \sigma(1 - q)$. Given that the cross derivative $\frac{\partial^2 P}{\partial q \partial \sigma}$ is negative, which implies that $\int_0^q \frac{\partial P}{\partial \sigma}(x, \sigma) dx \geq q\frac{\partial P}{\partial \sigma}(q, \sigma)$, for any given quantity of bribes demanded, the "quality" of price discrimination by the bureaucrats holding monopoly power over the provision of a service will always be suboptimal.

This conceptual framework provides three types of predictions that we will explore in the empirical analysis that follows. The first prediction is that the efficiency costs of corruption will be low either in the case of perfect competition or perfect collusion between port bureaucracies, but high otherwise. The ability of bureaucrats to collude depends on their discount rates and on coordination costs across ports. The second prediction is that "collusive" corruption is overall "cost"-reducing, leading to an increase in the demand for the public service, while "coercive" corruption is cost-increasing, reducing demand for the public service. The third prediction is that by virtue of the monopoly that bureaucrats hold, they will seldom price discriminate efficiently, with important implications for the efficiency costs of corruption.

IV Data

We rely on three main sources of data in this study: (1) we measure transport costs on both the Maputo and Durban corridors with an original survey of trucking companies; (2) we measure the level and frequency of bribes payments at each port through by tracking cargo going through each port and (3) we identify firm's shipping strategies through an original enterprise survey. All data were collected for this project between October 2006 and July 2008 by the IFC and the World Bank.

IV.1 Transport Costs

To accurately measure overland transport costs in the region, we conducted a trucking survey covering a random sample of 220 trucking companies operating in both the Maputo and Durban corridors. We included both large and medium-sized licensed transport companies, but also smaller owner-drivers who were randomly sampled in the field in locations with high concentration of trucks, such as lorry parks and the entrance of ports. This survey elicited detailed information on vehicle operating costs including maintenance and fuel costs, average transit times on each corridor and transport rates charged to firms.[18] To guarantee that we obtained accurate survey data on transport rates charged to firms, we conducted an additional "mystery client" exercise by which we contacted 75 transport firms and requested specific rates for a standard shipment of goods to and from each port. We use these data to calculate transport costs to each port for all firms in our sample.[19]

To account for additional transport fees that firms need to pay to ship cargo, we collected information on port charges from the administration of each port, as well as on toll charges and border clearance fees from National Roads Agencies in both countries.

[18]This micro-data allows us to identify not only the transport rates private transport companies charge to firms, but also the actual transport costs these companies incur in.

[19]We concentrate on road transport costs since our enterprise survey revealed that less than 4% of the 1,700 randomly selected firms covered in both South Africa and Mozambique used railroad services in 2007.

IV.2 Bribe Payments

The second source of primary data is a tracking study designed and implemented by the IFC in the ports of Maputo and Durban, and in the border post between South Africa and Mozambique. The IFC hired well-established clearing agents to track all bribe payments to officials in a random sample of 1,300 shipments, between March 2007 and July 2008.[20] Clearing agents recorded detailed information on the date, time of arrival and clearance of each shipment; on expected storage costs at the port; on the size of the client firm and on a wide range of cargo characteristics such as its size, value and product type. They also noted the primary recipients of bribes, the bribe amounts requested and the apparent reason for a bribe request, ranging from the need to jump a long queue of trucks to get into the port, to evading tariffs or missing important clearance documentation.[21] For a random subset of shipments, the IFC hired local observers who accompanied clearing agents throughout the clearing process to verify the accuracy of the data. These observers began shadowing clearing agents several weeks before the tracking study took place in order to become familiarized with all clearing procedures. To avoid any suspicion, the observers were similar in age and appearance to any other clerk who normally assists clearing agents in their interactions with customs. We found no significant differences between the data reported with and without our observer present. Data from this tracking study enable us to measure expected bribes at each port for different types of shippers and different types of shipments.

[20] The sample size was restricted to eight clearing agents given the illicit nature of the bribe payments and the IFC's concern with ensuring discretion in the data collection to maximize its accuracy. However, each clearing agent worked with an average of 20 to 25 clients. The "reputation" of each agent was assessed through a small survey of freight forwarders operating with clearing agents at both ports in the two months preceding the actual tracking study. A list of formally registered clearing agents was first stratified by the "reputation" of each agent and by their length of establishment. A random sample of agents was then selected from within each stratum.

[21] Clearing agents also noted whether the container had smuggled goods. Given the small number of shipments that fell under this category, we removed them from the analysis.

IV.3 Firms' Shipping Decisions

To identify firms' choice of port we conducted an enterprise survey in 2007, covering 250 firms located in the overlapping hinterland of the ports of Durban and Maputo and over 1,400 firms in other regions of South Africa and Mozambique. The survey elicits information on firms' perceptions of the quality of each port, their shipping strategies, and on the characteristics of their average shipments such as frequency, size and degree of urgency proxied by firm-level inventories. The sample was stratified by firm size and industry, covering a range of both transport intensive and non-transport intensive firms. We use these data to identify firms' choice of transport corridor and port given their location, the urgency of their shipments and the characteristics of their cargo.

An important feature of this empirical setup is that neither port dominates the other in terms of overall speed and quality of cargo handling (see Table 1 for a summary of the main characteristics of each port, and Appendix I for a more comprehensive description of each ports).

IV.4 Secondary Data Sources

We collected secondary data on variables that could be associated with higher bribe payments at each port. To begin with, perishable products carry a higher probability of spoilage in warm temperatures. This suggests that the weather could be an important determinant of variation in shippers' time preferences, and implicitly, in the level of bribes paid to speed clearance through the port. To test this hypothesis, we collected daily temperature data from the National Weather Institutes.

In this setting, tariff levels may also affect the probability of paying a bribe through two different channels. First, shippers and bureaucrats at each port may disagree on the amount of tariffs due, with either side attempting to misclassify goods or misrepresent import prices. A second way in which tariff levels may affect bribe payments is through the transit bonds placed on transit cargo traveling between the port of Maputo and South Africa. To test this hypothesis on the importance of tariffs and the transit bond, we collected tariff data from customs in South Africa and Mozambique for all products in our tracking sample.[22]

To further test the mechanism through which tariffs can affect bribe levels and distinguish between the misclassification of goods and the misrepresentation of import prices, we turned to Rauch's (1999) typology on the valuation of internationally traded commodities. Rauch distinguishes between goods with a reference price quoted in organized markets such as sugar or wheat; goods with a reference price quoted only in trade publications such as certain metals and minerals, and differentiated goods for which "average" prices are more difficult to assess, such as clothing or vehicles. It is possible that the difficulty of assessing the correct import price of a good increases the probability of corrupt behavior given that shippers have a strong incentive to underreport the value of goods, while customs agents have an incentive to overvalue them. Following this typology, we categorize all products shipped by firms in our sample as being differentiated, part of an organized exchange or having a reference price. We then test whether differentiated products are associated with higher bribe levels due to the increased difficulty in assessing reported import prices.[23]

IV.5 Descriptive Statistics of Bribes and Shipments

In table 2 we present basic descriptive statistics of bribe payments at each port. We find that bribes are high, frequent and different across ports. Not only is the probability of paying a bribe much higher in Maputo - nearly 53% compared to 36% in Durban -, but the amount of bribes paid in Maputo is also almost 3 times higher than in Durban.[24] In

[22]The Mozambican tariff structure can be summarized as follows: (0%) for medicines and raw materials originating from SADC countries; between 2.5-5% for non-SADC raw materials, equipment goods and oil products; 7.5% for sugar, rice and certain intermediate goods and 20-25% for consumer goods. There is a VAT tax of 17% as well as excise taxes but for the purpose of this study, we focus only on taxes that can affect transit cargo. South Africa's tariff schedule is more complex but similar in coverage, with high tariffs applied to agricultural goods, textiles, vehicles and other manufactured goods.

[23]Javorcik and Narciso (2008) suggest that trade in products without set international prices is correlated with higher tariff evasion due to the misrepresentation of import prices.

[24]See Figure 3 for the distribution of bribes across each port. We find no evidence that clearing agents pay flat rates to customs officials since the probability of paying a bribe and the level of bribes paid vary significantly across all clearing agents in our sample, and for each clearing agent, across shipments. We also collect information on any in-kind gifts to port officials in return for faster handling of cargo on the docks

Maputo, the average bribe represents a 129% increase in total port costs for a standard 20 ft container, and is equivalent to a 14% increase in total shipping costs - including overland transport, port clearance costs and sea shipping - for the container to be shipped between South Africa's economic hub and a destination in Eastern Africa or in the Far East. In Durban, the incidence of bribe payments is lower, but still high at 36% out of a random sample of 650 cargo movements. The average bribe corresponds to a 32% increase in total port costs for a standard 20 ft container and are equivalent to a 4% increase in total shipping costs on the same routes to Eastern Africa or the Far East.

Bribes are also high and significant when measured as a percentage of the bureaucrat's salary. The median bribe in Maputo is equivalent to approximately 24% of the monthly salary of a customs official, while in Durban, the median bribe is equivalent to 4% of the monthly salary of a regular port operator (CPI adjusted). A back of the envelope calculation suggests that if we assume that any given customs official in Maputo extracts a bribe out of 53% of the approximately 50 shipments he clears a month, his monthly salary can grow by more than 600% just due to corruption. If we assume that due to higher volumes the regular port operator in Durban processes double the number of shipments per month than a customs official in Maputo, this would still correspond to a salary increase of 144% per month due to corruption. The salary of a customs official in Maputo is one of the highest in public administration in the country and is equivalent to that of a port operator in South Africa, when adjusted for each country's CPI index.[25]

Tables 2 and 3 show descriptive statistics of the random sample of cargo tracked at each port. First, we find no evidence that distance affects bribes. Firms located more than 500 km away pay as much as firms located in the vicinity of the port, which does not support the

or clearance from customs. In both countries, we only observed 4 instances out of 1,300 shipments in which a gift was exchanged in the form of a couple of bottles of whiskey. These gifts were primarily made to stevedores in Durban to guarantee the availability of handling equipment for certain shipments.

[25]These findings are not consistent with a well-developed literature (Becker and Stigler, 1974; Besley and McLaren, 1990) that emphasizes the role of wage incentives in reducing corruption when in the presence of a non-zero probability of detection. As discussed in section VI, our results suggest instead the importance of the *opportunity* for bribe extraction as an important motivation for bribery to take place.

hypothesis that bureaucrats price discriminate efficiently based on the distance each firm has to travel to the port.[26] An additional concern is that in a dynamic model of corridor choice, assortative matching could take place between firms' cargo or shipment characteristics and unobservable characteristics of each port. If bribe payments are also correlated with these unobservables, we would mistakenly identify corruption as the driver of port choice. In Table 3 we present the distribution of important shipment characteristics at each port. Given the difference in average value of the shipments going through each port, we conduct further tests against sorting in section V.2.1. Finally, given that Durban is marginally closer to the Western shipping routes leading to South and North America, we also check if Durban tends to attract more cargo heading or originating in the West. One hypothesis is that Western shippers are less prone to corrupt behavior than shippers from China and the Middle East. Instead, we find that in our random sample of shipments from each port, the proportion of cargo originating or going to the West is higher in Maputo, the most corrupt port, than in Durban.

The recipients of bribes and the reasons for bribe payments in our sample vary significantly across ports as indicated in Table 4. In Maputo, the primary recipients of bribe payments are customs officials (80%). In Durban, the primary recipients of bribes are clerks at the document department (38.5%) and security agents (24.34%) overseeing idle cargo on the docks. Table 5 shows the reported reasons for bribe payments. In Maputo, bribes are paid primarily to customs to evade tariffs (40.86%) or to solve problems with documentation for clearance (17.03%). In Durban, bribes are paid to port security (38.5%) to oversee idle cargo on the docks and to document clerks (24.34%) to prevent cargo from being arbitrarily moved from the general docks to expensive depots while waiting for clearance from customs.

[26] To confirm these results, we presented four clearing agents in both ports with two hypothetical bribery scenarios, where the only distinguishing factor was that the cargo originated either in the port city or farther inland. None of the clearing agents identified distance as a determinant of the probability of paying a bribe or of the bribe amount to be paid.

V The Determinants of Bribe Payments

V.1 Competition between Port Bureaucracies

As shown in Table 4, our data do not support the hypothesis that bribes are competed to zero across ports or that there is any type of collusion between port bureaucracies and frontline bureaucrats when setting bribes. This non-cooperative outcome in bribe setting across bureaucracies is likely to result from high coordination and communication costs between different levels of bureaucrats in different countries; from the fact that price-cutting and any deviation from "joint monopolist" prices is not easily observed and that the threat of punishment for this deviation is not credible given that due to capacity constraints, neither port is capable of reducing bribes to zero and serve the entire market. More importantly, the public officials involved in corruption at each port differ in their discount rates. Customs officials in Maputo have high discount rates while port operators in Durban have low discount rates. This implies that deviations from the "joint monopolist" bribe level would not be internalized in the same way by the different bureaucrats.

Bribe levels at each port appear to be determined primarily by the extractive capacity of the different bureaucrats who are able to engage in corruption at each port. Each of these groups of bureaucrats act as independent monopolists when setting bribes, maximizing their own individual bribe revenue as opposed to that of the bureaucracy they belong to. This uncoordinate bribe setting increases the efficiency costs of corruption, as discussed in section VI.

V.2 Bureaucrats' Choice of Price Discriminating Strategy

To investigate how bureaucrats set bribes at each port, we begin by estimating the following equation on the probability of a shipment paying a bribe:

$$Pr(B_{ij}|HT_{ij}, B_{ij}, DP_{ij}, X_{ij}) = \alpha_{1i} + \beta_{1i}HT_{ij} + \beta_{2iij} + \beta_{3i}\,DP_j + \beta_{4i}\,X_j + u_{ij} \tag{1}$$

where B_{ij} equals 0 if no bribe was paid and 1 if a bribe was paid for the j^{th} shipment. This equation is estimated separately for each port, with $i = 1$ representing shipments going through Maputo, and $i = 2$ shipments going through Durban. We test for the differential effect of the tariff level on the probability of paying a bribe by introducing a dummy variable HT_{ij} that equals 1 to indicate a product subject to a 20-25% tariff rate, and 0 for products subject to 0-7.5% rates, at port i.[27] B_{ij} is a dummy variable indicating whether the shipment is containerized or bulk, and DP_j indicates whether the shipment corresponds to a differentiated product as categorized by Rauch (1999). The coefficient on DP_{ij} tests the hypothesis that the absence of a fixed price in international markets provides customs' officials and shippers with more room to claim or detect the misrepresentation of import prices. X_{ij} represents a vector of shipment-level controls, which vary across specifications but always include a dummy variable indicating large firms; the frequency of shipments by each firm; a variable calculating the deviation of temperature the day the shipment arrives at the port from the average monthly temperature; whether the shipment represents an export or an import; the natural log of the value of the shipment; its size measured in tons and a dummy for perishable cargo.[28]Ideally, we would incorporate in our regression analysis a variable measuring the distance each shipment traveled to reach the port. Due to logistical constraints, we only captured this indicator for a randomly selected subset of 60 shipments. As shown in section IV.5, we find no evidence in this sub-sample that distance affects bribes.

We do not observe shipments in which a clearing agent was asked for a bribe and the bribe was avoided altogether. Any negotiation that ensues is presumably to attempt to reduce the level of bribe paid. As such, we can also estimate the determinants of the amount of bribes paid at each port, independent of the probability of paying a bribe:

$$LBA_{ij} = \alpha_{2i} + \beta_{5i}\, HT_{ij} + \beta_{6iij} + \beta_{7i}\, DP_{ij} + \beta_{8i}\, X_{ij} + v_{ij} \tag{2}$$

[27]Since there was a change in tariff levels in Mozambique during the data collection, we include a dummy variable for the year the shipment took place, pre or post tariff change, and we include an interaction between the year the shipment took place and the high tariff dummy. In this equation we only capture the level effect of being a high tariff good in both years on the probability of paying a bribe.

[28]We consider a large firm to have more than 100 employees.

where LBA represents the natural log of the bribe amount paid, and all other variables are identical to the variables included in the previous equation.[29] We also exploit a natural experiment to more clearly identify the impact of tariff levels on bribes. In January 2008, the phasing in of an additional chapter of a trade agreement for the Southern African Development Community (SADC) reduced tariff levels by 20 percentage points for select categories of goods in Mozambique. This change affected cargo going through Maputo that stayed in Mozambique, but also cargo in transit to South Africa, due to its effect on the size of the transit bond. If the tariff group to which the South African product belongs to is correlated with bribes as suggested in our summary statistics, we expect this reduction in tariffs to affect the probability of paying a bribe at the port of Maputo for cargo that transitioned from a high to a low tariff group. To test for this effect, we adopt a difference-in-differences approach by including a time-shock dummy $YEAR08$ interacted with a dummy variable that we label $TRED$, which is equal to 1 if the good experienced a tariff reduction in 2008 and 0 if the good remained in the high tariff group. This change affected 53% of the shipments in our sample.

The difference-in-differences (DD) estimator calculates the difference in the probability of paying a bribe and on the amount of bribe paid, between goods that experienced a tariff reduction and those that did not, before and after the reduction took place in Mozambique. The DD is estimated by the following equations:

$$Pr(B_j|X_j, HT_j, TRED_j) = \alpha_3 + \sigma\, TRED_j + \rho\, TRED_j * YEAR08 + \omega\, YEAR08 + \psi\, X_j + \epsilon_j \quad (3)$$

$$LBA_j = \alpha_4 + \delta\, TRED_j + \gamma\, TRED * YEAR08_j + \phi\, YEAR08 + \lambda\, X_j + v_j \quad (4)$$

where $TRED_j$ represents the dummy variable indicating the change in tariffs in $YEAR\,08$. ρ and γ are the coefficients of interest, reporting the difference in the probability of paying a bribe and in the amount of bribe paid between goods that experienced a reduction in tariffs and those that did not, before and after the tariff reduction took place.

[29] To mitigate our concern about dealing with censured data since we only observe cases in which bribes were paid, we test different specifications using the full sample, the sample omitting the observations with zero payments and a tobit model. As shown in Table 7, the results are robust to all the different specifications.

V.2.1 Discussion of Results

In Table 7, we present the estimation results for equations (1) and (2) for the ports of Maputo and Durban, respectively. Column (1) presents the estimates for a linear probability model on the probability of paying a bribe in Maputo, column (2) presents the same estimation for Durban; columns (3) and (4) present the OLS estimates of the determinants of the amount of bribe paid in Maputo and Durban and columns (5) and (6) present the results for a tobit model.[30] We find that in Maputo high-tariff goods are 13% more likely and bulk cargo is 13% less likely to pay a bribe. We find no statistically significant effect of either differentiated products or perishable goods in warmer weather being more vulnerable to higher bribes. These results are consistent with our initial findings that bribes in Maputo are paid primarily to customs and suggests that customs officials in Maputo engage both in "collusive" corruption when dealing with domestic cargo, and in "coercive" corruption when dealing with South African cargo in transit through the port. While domestic cargo can pay a bribe to evade tariffs, transit cargo has to pay a bribe to avoid an arbitrary increase in the transit bond due.

In Table 8 we present the results for the triple difference estimator under a linear probability model and standard OLS, estimating the effect of the reduction in tariffs in Mozambique on the probability of paying a bribe and on the amount of bribe paid.[31] Though the results are not statistically significant, the coefficients have the expected sign, suggesting a 5% decline in the probability of paying a bribe and a 24% reduction in the amount of bribe paid for goods that experienced a reduction in tariff levels.

In Durban, port operators in publicly managed terminals target containerized cargo and cargo that would have to pay high storage costs if moved from the general dock to the depots.

[30]The sample is reduced once we introduce the full set of controls. This is primarily due to the fact that some variables were reported in different units (eg: the size of the shipment in tons versus number of containers) and to the difficulty in matching certain products to Rauch's classification. We have every reason to believe that observations are randomly dropped in columns (2) and (4). We do not include storage costs in the estimation of bribes in Maputo given that Maputo offers 21 days of free storage to shippers, which represented a non-binding constraint for all shipments in our sample.

[31]This tariff change only took place in Mozambique.

A one standard deviation in the cost of storage in Durban, which corresponds to adding 5 USD to the total storage bill per container, increases the probability of paying a bribe by 42% and the amount of bribe paid by almost 70%. Storage costs are product specific and while most cargo would have up to 3 free days to remain in the general docks, port operators will often claim that due to congestion in the port cargo has to be moved to more expensive depots. Bulk cargo, which is managed primarily by private operators, has a 53% lower probability of paying a bribe. The tariff grouping the product belongs to has no impact on the probability of paying a bribe in Durban. These results suggest that bribe payments in Durban are concentrated in port operations, and that port operators are engaged primarily in a "coercive" form of corruption. In the following section we discuss the implications of each type of corruption on the economy.

We conduct an additional exercise to test if the differences in corruption between Maputo and Durban are driven primarily by the characteristics of each port and their level of corruption, as opposed to the distribution of shipments each port handles. To this end we pool our data for both ports and estimate equations (1) and (2), adding a dummy variable for whether the shipment went through Maputo or not. We then decompose the differences in fitted values of both the probability of paying a bribe and of the amount of bribe paid between ports into a "port effect" and the effect of other significant explanatory variables. As shown in Table 9, we find that the main driver of our results is the Maputo intercept, lending further support to our institutional argument that it is the port, and not the distribution of shipments that drives differences in bribe patterns.

Our results show that bribes are determined primarily by product characteristics and that they differ across ports, depending on the opportunities for bribery presented to different types of port officials. We also find that bureaucrats to do not price discriminate "efficiently" by maximizing joint welfare with the shipper. In Maputo, bribes are paid primarily to customs by shipments of high tariff goods, in a "collusive" form of corruption. The extractive power of customs officials is high given that they have access to full information on the shipment at all times and that they have a broader toolkit on which to draw from to extract a bribe. Associating the bribe to the tariff level of the good combines the desirable features of reducing both the informational costs of bargaining and the risk associated with the illicit transaction. From the perspective of the customs official, whether the good falls into a high tariff category or not encapsulates all necessary information on the willingness-to-pay of a bribing shipper. Customs officials assume that all firms would be better off by evading a tariff, or by reducing the level of the transit bond, so the higher the tariff, the higher the bribe a firm would be willing to pay. All other shipment characteristics carry only coarse information on the firm's willingness-to-pay a bribe, requiring that the customs' official engage in a costly and time-consuming exercise to retrieve information on each firm's time sensitivity, or its ability to pay. For example, the size of the shipment is an imperfect indicator of willingness to pay a bribe: large shipments may signal a firm carrying higher than average inventories with a lower willingness to pay to expedite clearance, or a large firm with a higher ability to pay for speed of clearance. A lengthy process of discovering both commitment to an illicit transaction and the reservation costs of a shipper increases the risk and the cost of the bargaining game for both parties.

A transaction based on tariff evasion also lowers the risk of detection of the illicit transaction through a second channel: since both parties are implicated in the illicit deal, self-damage due to an *ex post* defection from it is well-defined and understood (Schelling, 1956). This results in a more credible commitment to the bargaining deal and a stronger deterrent for either party to defect from it. Tariff evasion is also less visible and easier to conceal from other customs officials and clearing agents when compared to an observable action such as jumping a queue or avoiding a physical inspection.

In Durban, bribes are paid to document clerks, cargo handlers and port security, all of which have low extractive power due to limited access to information on the shipment, and limited authority to stop and delay cargo. Bribes are set according to the storage costs the cargo would have to pay if it were moved from the general docks into private depots. Associating the bribe to potential storage costs also combines the desirable features of reducing the informational cost of bargaining and the risk associated with the illicit transaction. Storage costs are easy to calculate based on the volume of the shipment and on the type of product to be stored. Port operators assume that this is a cost firms will always want to avoid. The timing of when the cargo has to move to the depot also depends on the congestion levels at the port, a variable that is not directly observable to the clearing agent, allowing a port operator to exploit an important informational asymmetry to extract a higher bribe with low probability of detection. These payments fall under the category of "coercive" corruption since they represent a cost, above and beyond what shippers would normally have to pay in the absence of corruption. In most instances, we observed that the payment of a bribe took place before the cargo had remained in the general docks for the full three days it is entitled to.

VI The Efficiency Costs of Corruption

In this section we examine the implications of different bribe setting behaviors for the efficiency costs of corruption. We measure the efficiency costs of corruption primarily by observing how "collusive" or "coercive" types of corruption distort a firm's choice of port and its sourcing decisions.

VI.1 Shipping Decisions: Estimation Strategy

To identify the impact of corruption on business, we observe how South African firms choose which port to use.[32] Our assumption is that in the absence of corruption, firms minimize overall transport costs, which are a linear function of geographic distance. With corruption, firms minimize both geographic distance and expected bribes when deciding which port to use.

We test whether corruption affects firms' choice of port given their location, the level

[32] We restrict our analysis of port choice to South African firms that have a real choice between both ports. Given the layout of the road network, it is unviable for any Mozambican firm to use the port of Durban as its main port of entry or exit. See figures I and II for more evidence.

of urgency of their shipments and the characteristics of the cargo that make them more or less vulnerable to paying a bribe in Maputo or in Durban. We then specify a binomial probability model to estimate the probability of each firm choosing Maputo or Durban, given its location, transportation costs and the type of cargo it ships:[33]

$$Pr(P_f|X_{4f}) = \alpha_4 + \sigma_2\, HTD_f + \theta\, HTM_f + \phi\, LRTC_f + \lambda\, LF_f + \gamma_2\, LDI_f + \beta_{12}\, X_{4f} + z_f \quad (5)$$

in which $P_f = 0$ if firm f selects Durban and $P_{2f} = 1$ if it selects Maputo; X_{4f} consists of a vector containing firm-level controls that differ across specifications but always include the frequency of shipments; dummy variables indicating whether the firm ships perishable cargo; if the firm is an importer or an exporter; the industry the firm belongs to and whether the firm ships a differentiated product. HTM_f and HTD_f are dummy variables indicating if the cargo falls into a high tariff category in Mozambique and South Africa, respectively. A critical aspect of this setup is that these firms will always have to pay South African tariffs once the cargo enters South Africa, irrespective of whether the point of entry of the shipments is the port of Maputo or the port of Durban. The Mozambican tariff code will only affect South African firms by determining the level of the transit bond they have to pay while their cargo is traveling approximately 120 km in Mozambique before entering South African territory. $LRTC_f$ represents the natural log of the ratio of total transport costs to Maputo over transport costs to Durban for each firm in the sample. These transport costs include all overland transport costs, border fees and port charges; LF_f represents a dummy variable indicating a large firm and LDI_f corresponds to a dummy variable indicating whether a firm has a below average inventory level given its size and industry grouping, as a proxy for the urgency of its shipments. We also include several interaction terms to account for the differential effect of inventories and distance for exporters and importers. This tests, among other hypotheses, whether importers who are closer to Maputo importing high tariff goods have a lower probability of choosing Maputo than an importer of low tariff goods due to

[33]Transportation costs include the cost of road transport, all port charges, tolls and border fees.

corruption; or if importers have a lower probability of paying a bribe than exporters. Import cargo arriving through Maputo into South Africa has to pay the transit bond at the port of Maputo, while export cargo pays the transit bond at the border post between South Africa and Mozambique. Implicitly, we therefore also test whether bribes for transit bonds are higher at the port or at the border post.

VI.1.1 Discussion of Results

Table 10 presents the results of a linear probability model fitted to equation (5). Column (1) shows the results for the base model, without any additional interactions. In column (2) we augment the model to investigate whether there is a differential effect of distance when a firm is transporting urgent cargo by including interactions between distance and perishable cargo, and distance and firms carrying low levels of inventories. In column (3) we test if distance is more or less important for exporters and importers with low and high inventories, by including triple and double interactions between exporters, distance and inventories.

We find that if a South African firm ships goods that are subject to a high tariff classification in Mozambique, the probability of choosing Maputo declines by approximately 22-23%. The only channel through which Mozambican tariffs can affect the choice of port by South African firms is through its effect on the transit bond. In the absence of corruption in customs in Maputo, the transit bond would be pre-determined by the Mozambican tariff code and swiftly paid and refunded the same day, once the cargo travels the 120 kms separating the port from the South African border. South African firms reported however that there is significant uncertainty as to the level of transit bonds that need to be paid since this value is not revealed by Mozambican customs until the cargo reaches the port or the border post. Given that corrupt officials at the port of Maputo and at the border post target high tariff goods to attempt to extract a bribe, regardless of whether cargo is in transit or not, South African firms shipping goods that happen to fall under a high tariff classification in Mozambique will avoid the “coercive” corruption they face in Mozambique and use Durban instead. Despite the fact that local and transit cargo have very different elasticities of demand for port services in Maputo, there are two possible reasons for why customs officials in Mozambique do not discriminate between transit and local cargo when setting bribes. First, customs officials in Mozambique have very short time horizons and consequently high discount rates given that they may not stay in their posts for longer than 6 weeks. The cost of requesting high bribes from firms with a high elasticity of demand is felt primarily in the future so officials do not fully internalize it today. Furthermore, transit cargo only represents about 15% of the total number of shipments moving through Maputo at the moment. Second, it is possible that adopting more sophisticated bribe-setting strategies that discriminate between transit and local cargo increase the probability of detection of the illegal transaction due to the perceived unfairness of charging different bribes to South African and Mozambican shippers. This hypothesis was suggested by the clearing agents participating in our study.

We also find that firms that import are less likely to use the port of Maputo than the firms that export, suggesting that bribes on transit bonds are higher at the port than at the border post. This was confirmed by direct bribe data obtained at the border post.

These results suggest that even when accounting for distance, perishability and the urgency of the shipment, the expected bribe is a strong predictor of the choice of port. As an example, 46% of South African firms in our sample located in regions in which overland costs to the port of Maputo are 57% lower, are still going the long way around to Durban in order to avoid higher bribe payments. Of these, 75% are shipping perishable cargo and 74% are shipping urgent cargo.[34] To illustrate the impact of corruption, take a firm located in the town of Nelspruit, the capital of the booming Mpumalanga province in northeastern South Africa. This firm is 171 kms from the port of Maputo and 992 kms from the port of Durban. If it ships a high tariff good, this firm is 22% more likely to incur in a 210% increase

[34]A firm's choice of port was captured in 2007, prior to the tariff regime change in 2008 so we are unable to observe whether the choice of port has changed in line with changes in the probability of paying bribes for high tariff goods. This will be captured in a second round of the enterprise survey, scheduled for 2010

in overall costs to ship through Durban than through Maputo.[35] For firms that re-route to the least corrupt port, this cost adds up to an 8% overall increase in yearly transport costs relative to a firm that ships cargo that is less vulnerable to corruption.[36] The "diversion costs" of corruption for each individual firm are eight times higher than the actual bribes collected by the customs' official in Maputo for the average high tariff shipment. This also suggests a very aversion to the ambiguity and uncertainty on behalf of firms as to the level of bribes they would have to pay.[37] This aversion was confirmed by survey data.

Figures 4 and 5 show non-parametric regressions of the probability of a South African firm choosing Maputo as a shipping port on the relative transport costs to Durban. In the absence of corruption, we would expect the indifferent firm to be located at the point that equates transport costs to either port, which in figure 4 corresponds to zero (relative transport costs are in log form). If corruption distorts firms' choice of corridor, we expect the indifferent firm, i.e. the inflection point, to be located closer to the most corrupt port. After this point, firms start switching to the alternative port to avoid corruption. In figure 4 we observe that the firm which is most likely to ship through Maputo is located at approximately $L = \frac{1}{3}$, which is considerably closer to Maputo than the point of transport cost equivalence at $L = \frac{1}{2}$. These results further contradict the hypothesis of non-distortionary price discrimination, whereby the indifferent firm would still be located at the point that equates transport and port costs to alternative ports, even in the presence of corruption. In figure 5, it is clear that at the point of transport cost equivalence around 1, goods that are less vulnerable to corruption have a higher probability of choosing Maputo. In this figure, low and high bribe goods are those that fall under a low and high tariff category in Mozambique respectively.

[35] This accounts for road tolls, trucking charges, port costs and expected bribes in Durban. Average costs of shipping a standard 27 ton container through Maputo are $1035 USD$ whereas for the same container to be shipped through Durban the shipper expects to pay $2187 USD$

[36] This calculation is based on the average number of shipments a firm in this region ships a year, the average size of the shipments and self-reported data on the total transportation costs of the firm for 2007, which were obtained through our enterprise survey

[37] As observed in figure 1, the variance of bribes in Maputo is much higher than in Durban

The distortions created by this "diversion" effect are magnified when we move to a general equilibrium framework. Every time a firm re-routes away from the most corrupt port, it imposes a negative externality on other firms. We label this negative externality the "congestion effect" of corruption. The re-routing of firms adds to congestion in the least corrupt port and contributes to fewer and more imbalanced cargo flows to the more corrupt one, resulting in higher overall transport costs. In our trucking survey, we observe that though the actual costs of operating in either corridor are almost identical for all trucking companies, the absence of a regular flow of backloads along the Maputo corridor leads to a 70% increase in transport rates charged to firms on that route.[38] Given that imports are more vulnerable to paying higher bribes than exports on this corridor, there is more outbound than inbound cargo. As a result, a regular transport service to Durban is priced at 0.07 c/ per ton-km compared to 0.12 c/ per ton-km to Maputo. Though this difference cannot be solely attributed to the "congestion and diversion" effects of corruption, the pattern of bribe payments in Maputo and its effect on South African firms' demand for the port and corridor is likely to play an important role in this result.[39] In the absence of any corruption, if transport rates were equalized across corridors, the overall transport costs for the average firm located closer to Maputo would decrease three-fold. This is a clear example of how "coercive" corruption can be highly distortionary.

VI.2 Sourcing Decisions: Estimation Strategy

We analyze how the level and type of corruption at each port affects the relative cost of importing inputs versus sourcing them domestically for both South African and Mozambican firms. We assume that all else equal, if corruption increases the cost of using a port, firms

[38] This difference in prices charged to firms also persists even though the quality of the roads is comparable. The Maputo-bound toll highway was built in 2002 and is privately managed. The Durban bound road is part of the South African highway system.

[39] The effects that we find on the impact of corruption on firms' choice of port are likely to be magnified across the region given that the South African and Mozambican transport networks also serve six land-locked and neighboring countries in Southern Africa - Malawi, Lesotho, Swaziland, Botswana, Zambia and Zimbabwe.

should have an incentive to decrease demand for imported inputs, while the opposite would happen if corruption decreases port costs. Corruption therefore directly affects sourcing decisions by changing relative prices of domestic and imported inputs.

Decisions on the sourcing of inputs matter not only because they affect the productivity of the firm itself, but also because they have significant spillover effects in the economy as a whole, by affecting the nature and the extent of backward and forward linkages between firms.

To analyze the impact of different types of bribes on a firm's sourcing decision, we estimate the following reduced-form equation for firms that face "collusive" corruption in Maputo, and firms that face "coercive" corruption in Durban:[40]

$$DS_{fi} = \alpha + \tau \, BRIBES_{fi} + \theta \, X_{fi} + \nu_{fi} \tag{6}$$

where DS_{fi} represents the proportion of inputs each firm f in country i sources from domestic markets. $BRIBES_{fi}$ is calculated for each firm based on the estimates obtained in section V.1, the type of product each firm is shipping and the frequency of its shipments. X_{fi} represents a vector of firm and product-level characteristics and nu_{fi} represents a stochastic error term. Vector X_{fi} includes variables that control for firm size; distance from the nearest port; the industry grouping the firm belongs to; the tariff level of the input; whether the input is transported in bulk and whether it is perishable.

An important concern with this specification is that causality can be reversed, running from sourcing decisions to bribes. The proportion of inputs a firm decides to import affects the number of interactions it has with the port, which could ultimately affect the level of bribes paid. While we are unable to completely eliminate this possibility, the results in section V.2 provide little evidence to support it. We found that the level of bribes at each port was product-specific and did not depend on the frequency of each firm's shipments.

[40] Note that all South African firms in our sample face "coercive" corruption both in Durban and in Maputo due to the nature of bribe payments for transit bonds. Mozambican firms on the other hand face "collusive" corruption in Maputo that allows them to evade tariffs

Table 11 presents the results for an OLS estimation of equation 6 for South Africa and Mozambique. We find that corruption has the opposite effect on firms' sourcing decisions depending on whether they face "coercive" corruption, as in the case of South African firms, or "collusive" corruption, as in the case of Mozambican firms. A one standard deviation increase in expected bribes is associated with a 3% (0.089 standard deviation) increase in the proportion of inputs sourced domestically for firms facing "coercive" corruption and a 7% (0.173 standard deviation) decline in the proportion of inputs sourced domestically for firms facing "collusive" corruption.

"Collusive" corruption reduces the relative cost of imported inputs while "coercive" corruption increases it. As such, firms in Mozambique that can pay bribes to evade tariffs are less likely to source their inputs domestically, whereas in South Africa, where bribes are paid coercively, providing no rent to the shipper, firms are more likely to source domestically.

VII Robustness Checks

When we analyze a firm's choice of port, we face a clear endogeneity challenge: the pattern of bribe payments at each port may have influenced a firm's geographic location or its type of business. To address this issue, we restrict our sample to firms that were already established when the Maputo port re-opened in 2004. We find no significant differences in the main coefficients of interest.

We also explore the existence of a "border effect" and how it could dissuade firms from shipping through a port located in a different country. We begin by investigating the quality of shipping services on each corridor and the additional costs imposed by the border post on South African firms that choose to ship through Maputo. Since 2004, several South African freight forwarding companies have established offices both in Maputo and at the border post to facilitate the clearance of transit cargo to and from South Africa. In our survey of 220 trucking companies in the region, all companies operating internationally between Maputo and South Africa were under South African management. This mitigates our concern about differences in the quality of trucking companies serving the ports of Maputo and Durban. We also track the average time it takes for a container leaving Johannesburg to reach a vessel in both Maputo and Durban. While containers are often delayed at the border post when heading to Maputo port, this time difference is more than offset by the higher congestion and delays at the port of Durban. Second, we tracked a random sample of 50 shipments through the South African - Mozambican border post, using the same methodology for data collection used at the ports. We hired local observers with previous experience in the shipping business who shadowed clearing agents for three months. We then estimate equations 2 and 4, applied to the random sample of shipments from the border post. Tables 12 and 13 present the results, with bootstrapped standard errors clustered at the level of the product's harmonization code. Consistent with our findings at the port, high tariff products are associated with a 97% increase in the amount of bribe paid at the border post. In the difference-in-difference framework we validate these results by showing that goods that moved from being high tariff to low tariff due to the phasing in of the trade agreement in Mozambique in early 2008, are associated with a 76% decline in the amount of bribe paid. These findings suggest that the border post reinforces the disincentive to choose the port of Maputo, primarily through the same channel of corruption.

VIII Conclusion

In this paper we take an unusually close look into the blackbox of corruption to document the magnitude, the determinants and the efficiency costs of bribe payments at ports. Motivated by standard industrial organization theories of competition and price setting, we conduct an empirical analysis of how bureaucrats set bribes, and how different bribe-setting behaviors can determine the costs corruption imposes on firms. Our empirical setup and the level of detail in our data allow us to observe the entire chain of bribery, including the bureaucracies that compete in the provision of services, the frontline bureaucrats who set bribes under the constraints imposed by the bureaucracies, and the private agents who make decisions based on the bribe schedules they face.

We find that the industrial organization of port bureaucracies determines whether and how bureaucrats extract bribes. Important features of bureaucratic organization such as the level of coordination costs between bureaucracies, which types of bureaucrats have opportunities to extract bribes and their discount rates, can determine whether bureaucracies engage in perfect competition, perfect collusion or uncoordinated bribe-setting, with important implications for the efficiency costs of corruption. We also find that bureaucrats seldom choose to price discriminate efficiently by maximizing joint welfare with the shipper, focusing instead on minimizing the informational costs of bribe-setting and the probability of detection of the illicit transaction. They engage in different types of corruption, "coercive" or "collusive", presenting firms with different sets of constraints or opportunities. "Collusive" corruption is cost-reducing, increasing a firm's demand for the public service, while "coercive" corruption is cost-increasing, reducing a firm's demand for the public service. Overall, our results suggest that "coercive" corruption is likely to be more distortionary than "collusive" corruption, but "collusive" corruption is likely to be more persistent.

Finally, we also look beyond the direct impact on firms to try to estimate the impact of corruption on government revenue due to "collusive" types of corruption like tariff evasion. We restrict the analysis to Mozambican firms that pay bribes primarily to evade tariffs at the port of Maputo. The impact of corruption on tariff revenue is equivalent to a 5% point reduction in the average tariff rate. The median bribe paid corresponds to only 6% of the tariff liability evaded, suggesting a small transfer between shippers and bureaucrats relative to the size of the rent associated with evading tariffs through a bribe payment. This result adds to the growing evidence on what has been termed the "Tullock Paradox": that bribes are small relative to the size of the corresponding rent.

There are several important implications of this analysis for the study of corruption and for the design of anti-corruption policies. First, we find that incentives for corrupt behavior are shaped by the organizational structure of different bureaucracies, in which the structural *opportunity* to extract a bribe plays an important role in the motivation for corrupt behavior. Policies that reduce in-person contact between clearing agents and officials, or that reduce the number of steps in the clearing process such as the introduction of online submission of documentation or pre-clearance programs, may also reduce opportunities for corruption. Second, we find that port officials employ similar rules of thumb to discriminate between high and low-bribe shipments. Understanding the motivation behind the choice of price discriminating strategy and the type of corruption bureaucrats are engaging in may assist in concentrating monitoring efforts in certain categories of products and in certain phases of the clearance chain. Third, our findings suggest that corruption can affect the economy in many direct and indirect ways. Depending on the the type of corruption bureaucrats engage in, bribes can generate deadweight loss and reduce tariff revenue for the government but also increase or decrease the demand for the public service, with important implications for economic activity.

This paper is primarily concerned with the static inefficiencies of corruption and its costs. How distortionary corruption can in the long-run affect the number of firms engaged in international trade, and the volume of trade they engage in, remains an exciting area for future research.

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X Appendix I: The Ports of Durban and Maputo

We collect both administrative and survey data to support our assumption of the overall comparability between services provided by the ports of Durban and Maputo. To begin with, though Durban achieves significant economies of scale in operations as the largest container port in Sub-Saharan Africa, most port services are still publicly owned, with frequent labor strikes and long turnaround vessel times. The port of Maputo was privatized in 2004, which brought significant investments in its physical infrastructure. Though Maputo is a smaller port and is still expanding its capacity to handle all types of cargo, berth occupancy rates are much lower at 30%, compared to 100% in Durban.[41]

As an important indicator of service quality, crane moves per hour on the docks are similar in both ports (15 TEU/hour), reflecting the higher productivity of the Mozambican private stevedores against the higher capital intensity of operations in Durban. Finally, though storage capacity is larger in Durban, space is at a premium due to the large volume of cargo flows going through the port. Durban offers 3 days of free storage to shippers while Maputo is able to offer 21 days, after which storage costs in Maputo are still half of what is charged in Durban. The overall quality of road freight services to both ports are similar given that transport and logistics services to Maputo are primarily provided by the same South African freight forwarding companies that serve Durban. The port of Maputo is also managed by a consortium of British and South African capital, including as shareholders some of South Africa's main transport companies. Most documentation can therefore be processed in English, greatly reducing the logistical cost for a South African firm to ship through Maputo.

Beyond these administrative indicators of the quality of each port, we also obtain users' perspectives on Maputo and Durban as viable shipping alternatives. In our firm survey conducted in 2007, a sub-sample of 250 South African firms located in the hinterland of

[41] A lower berth occupancy rate means that a freight forwarder is able to bring a ship in and out of Maputo faster than if it queues in Durban.

both ports ranked Maputo and Durban at respectively 3.4 and 3.7 out of a total score of 5 in terms of overall quality of port services.[42]

Despite the comparability of Maputo versus Durban, it is still possible that firms' choice of shipping corridor is based instead on the relative cost of ocean shipping from each port. Recent work by Hummels (2008) suggests that shipping lines price discriminate across routes, depending on the prices of the products transported and the number of competitors faced on any given route. Durban is a larger port, attracting a wider variety of cargo and a higher number of shipping lines.[43] There is however a frequent feeder service between Maputo and Durban, which increases the flexibility of firms to ship through either port. In Table 2 we also find that even though Durban is 24 hours closer to the Western transport routes, a higher proportion of cargo shipped through Maputo is either originating or is destined to the West, when compared to the sample we obtained from Durban. Though we are unable to rule out the importance of having fewer container lines calling at Maputo, the results from our survey suggest that this is not a binding constraint, and that Maputo is regarded as competitive for shipments originating in and destined to different parts of the world.

In addition to the actual cost of shipping and handling, a firm's shipping choice may also be influenced by the time it takes to clear cargo at each port. In this paper, though we account for port costs, we abstract from transit times given that they do not vary significantly across ports. The median of the distribution of the average number of days reported by firms

[42]This corresponds to an unweighted average of the score assigned to each port in a scale of 1 (Very Poor) to 5 (Very Good), along the following dimensions: a) Facilities for large and abnormal cargo and flexibility in meeting special handling requirements, b) Frequency of cargo loss and damage, c) Convenient pick up and delivery times, d) Availability of information concerning shipments and port facilities, e) Speed of on the dock handling of containers, f) Availability of intermodal arrangements (rail, road and port) and g) Port Cost.

[43]In fact, there is a significant difference in the number of shipping lines calling at each port, particularly for container cargo. Non-containerized cargo is carried primarily by tankers, which operate under a taxi model across ports, whenever there is demand for the service. Containerized cargo on the other hand is transported by conference lines with scheduled service at specific ports. Durban is the main container port in the region and as such attracts the largest shipping lines on a regular basis. The port of Durban averages 2 container vessels a day, which is what Maputo receives in a week. Despite these differences, almost no firms covered in our enterprise survey highlighted this fact as a binding constraint. In mid 2006, one of the largest freight forwarding companies in South Africa acquired a 28% stake at the port of Maputo. This company owns several container liners that have started to call more frequently at the port of Maputo.

to clear customs was similar for both ports (4 days) and the median of the distribution of the longest number of days reported to clear customs was only slightly higher in Durban (8 days) than in Maputo (7 days).

Finally, an important assumption in our analysis is that firms are capable of switching between corridors at low cost. In our enterprise survey, we find that from the 1,000 firms surveyed in all of South Africa, nearly 65% outsourced transport services to freight forwarders and clearing agents, primarily through spot contracts with high turnover rates. Furthermore, less than 4% of these firms have ever made a long-term investment in either port. When asked about an alternative transport route, more than 50% of firms using either corridor identify Maputo or Durban as a real alternative and when asked to rank both ports on several quality indicators, Maputo and Durban are ranked very similarly. Finally, an informal survey conducted among a select group of freight forwarders further suggested that the choice of corridor is primarily guided by cost considerations as well as by the request of the client firm. These findings allay our concern that firms could be locked into using a particular route, a particular clearing agent or a particular port.

XI Figures

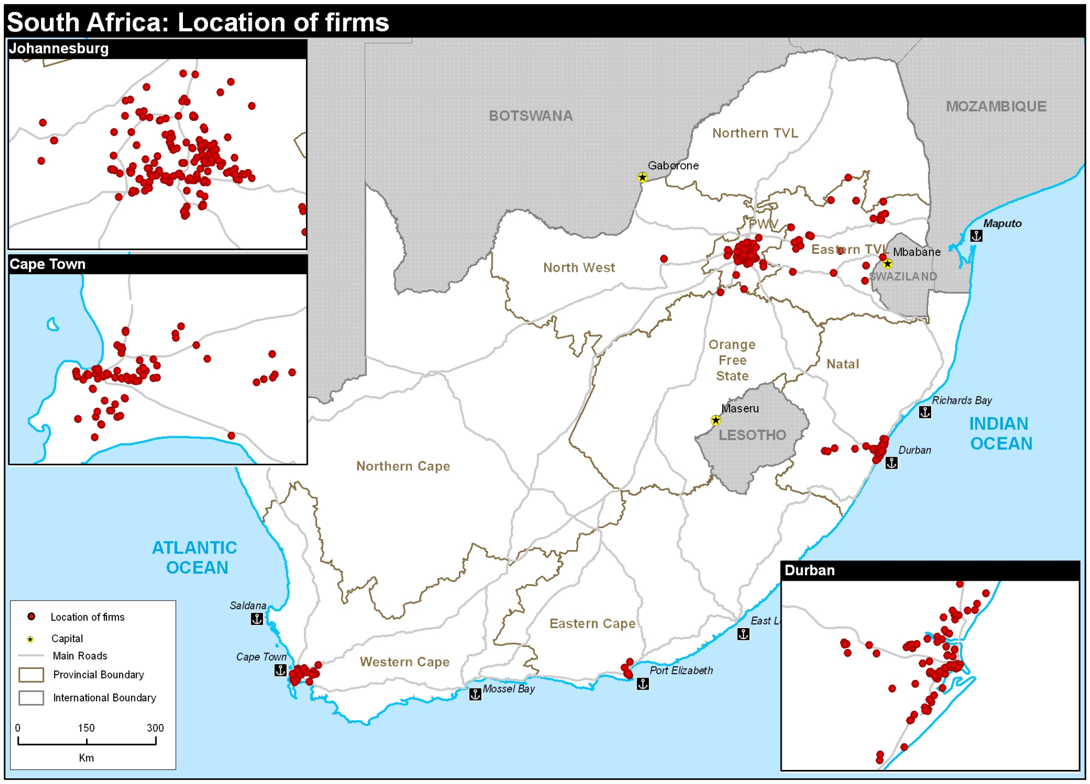

Figure 1: Map of Southern Africa identifying the Ports of Maputo and Durban. The dots correspond to the firms that were covered in our firm survey

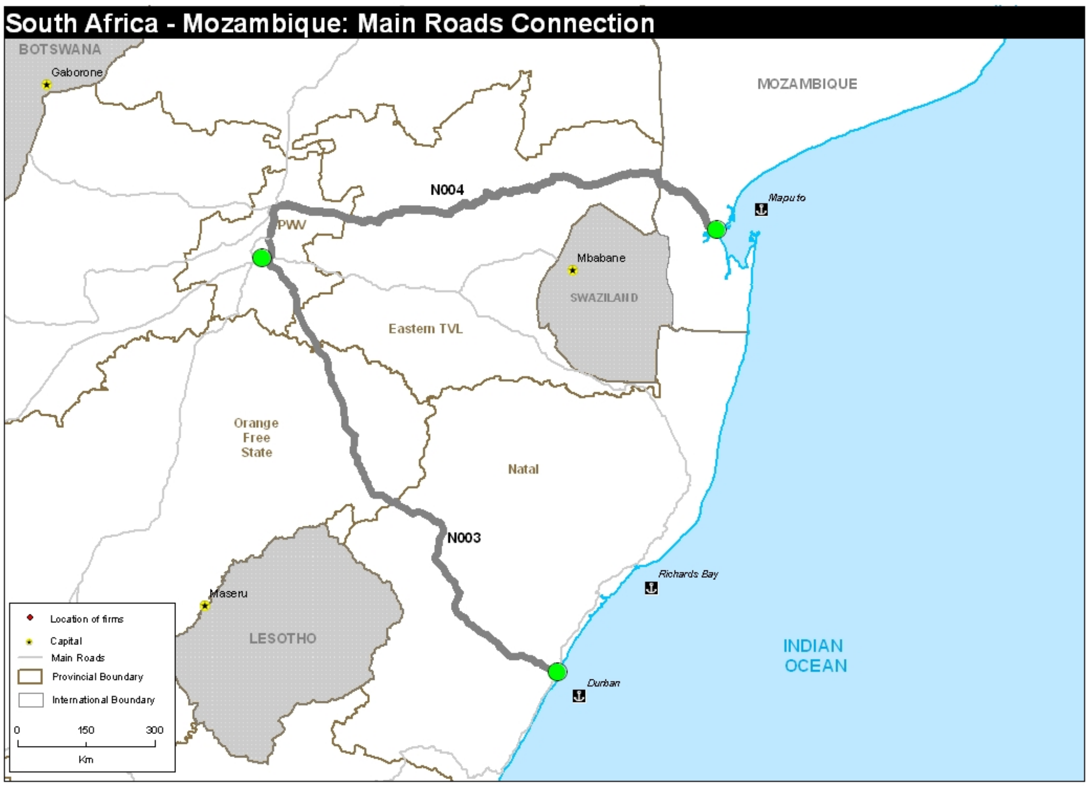

Figure 2: Road Network connecting the hub of economic activity in South Africa to the Ports of Maputo and Durban. The thick lines correspond to the main highways. There is no direct road that can competitively connect Maputo directly to Durban.

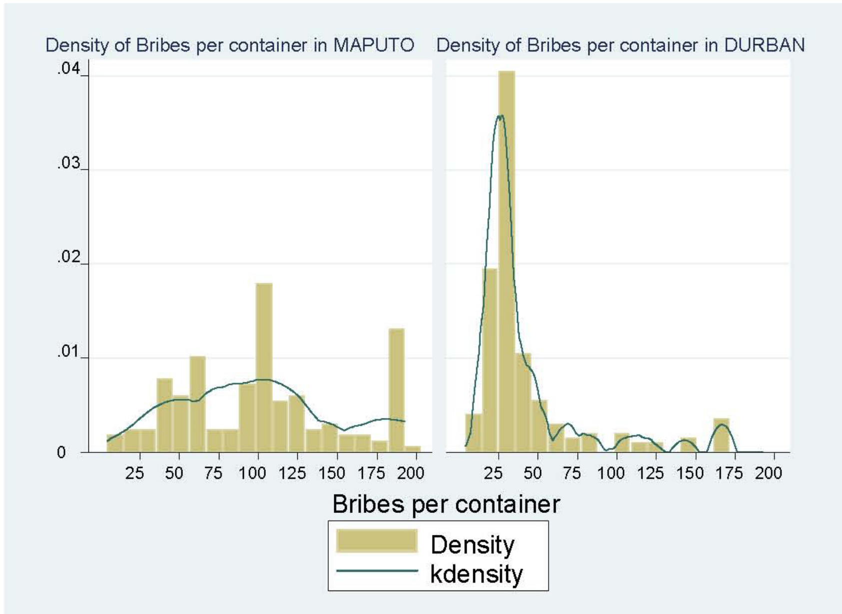

Figure 3: Distribution of Bribes per Container at the Ports of Durban and Maputo

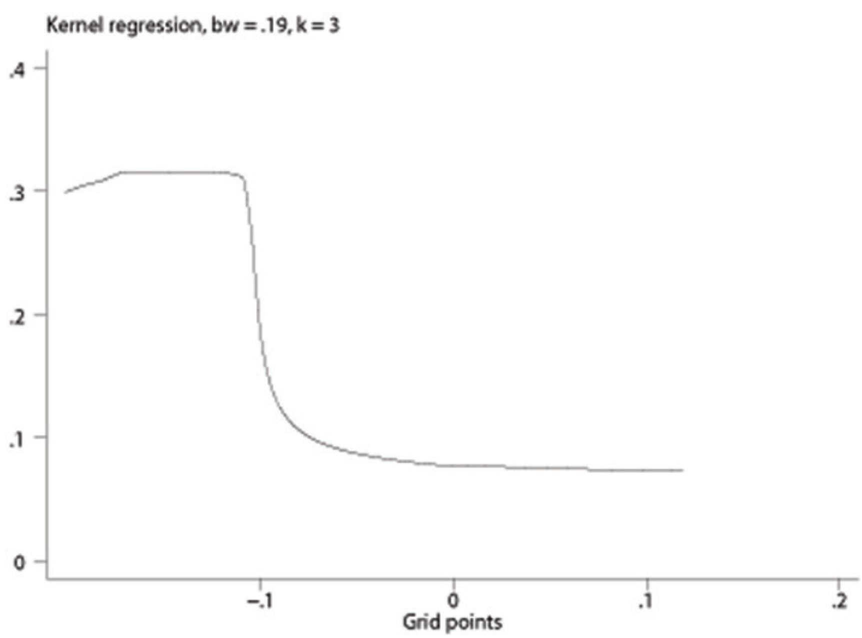

Figure 4: Non-Parametric Kernel Regression of the Probability of Choosing Maputo (y-axis) on the Log of Relative Transport Cost to Durban (x-axis). At the point at which transport costs to Maputo and to Durban are equalized at 0, the probability of choosing Maputo is under 10%.

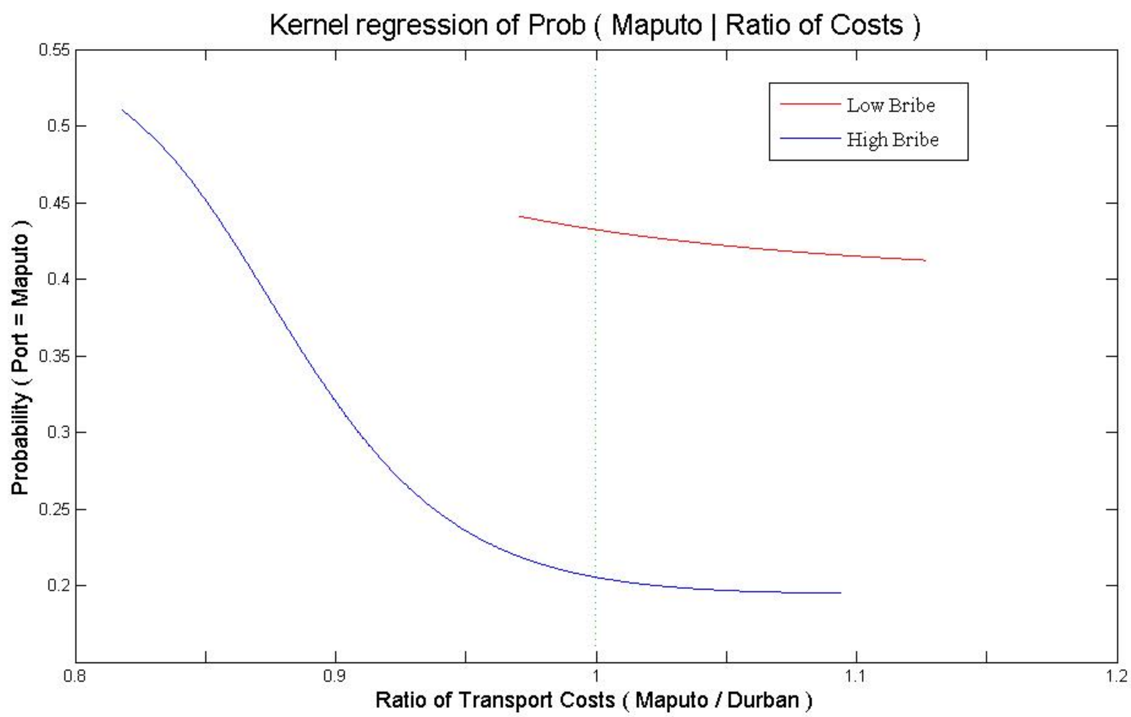

Figure 5: Non-parametric Kernel Regression of the Probability of Choosing Maputo (y-axis) on the Log of Relative Transport Cost to Durban (x-axis). Low Bribe corresponds to firms shipping goods that fall under a Low Tariff category in Mozambique and High Bribe corresponds to firms shipping goods that fall under a high tariff category. The point of transport cost equivalence between both ports is 1.

XII Tables

Table 1: **Comparing the Ports of Durban and Maputo**

PORT CHARACTERISTICS	MAPUTO	DURBAN
Average Quay Length (m)	238.4	225.9
Average Alongside Depth (m)	10.8	10.54
Maximum Alongside Depth (m)	11.5	12.8
Minimum Alongside Depth (m)	9.5	6.1
Berth Occupancy Rates (%)	30	100
Crane Movements per hour (TEU)	15	15
Days of free storage	21	3
Average number of days to clear customs *(median of the distribution)*	4	4
Longest number of days to clear customs *(median of the distribution)*	7	8
Average distance to Johannesburg (km)	586	578
Technology in Customs	In-person submission	Online Submission
Port Performance Ranking (out of 5)	3.4	3.7
Security	ISPS certified	ISPS certified
Document submission	In-person	Online
Management of Terminals	Private	Public

[a] Sources: Port of Maputo (MPDC), South Africa Freight Database, Enterprise Survey 2007 (IFC).

[b] NOTES: The port performance ranking was obtained through the IFC's survey of 250 firms in South Africa and corresponds to an unweighted average of the score assigned to each port in a scale of 1 (Very Poor) to 5 (Very Good), along the following dimensions: a) Facilities for large and abnormal cargo and flexibility in meeting special handling requirements, b) Frequency of cargo loss and damage, c) Convenient pick up and delivery times, d) Availability of information concerning shipments and port facilities, e) Speed of on the dock handling of containers, f) Availability of intermodal arrangements (rail, road and port) and g) Port Cost. ISPS code stands for the International Ship and Port Facility Security Code. It corresponds to a comprehensive set of measures to enhance the security of ships and port facilities developed in response to the perceived threats in the wake of the 9/11 attacks in the United States. All countries that are members of the SOLAS convention are required to be ISPS certified. SOLAS is the most important of all international treaties concerning the safety of merchant ships. TEU (Twenty-foot Equivalent Unit) is a unit of cargo capacity often used to describe the capacity of container ships and container terminals, based on the volume of a 20ft container.

Table 2: **Summary Statistics of Bribes and Cargo at Each Port**

VARIABLE	Maputo	Durban
Probability of Paying a Bribe	52.75%	36.09%
Mean Bribe Amount (USD)	275.3	95
Mean Bribe as a % of port costs	129%	32%
Mean Bribe as a % of overland costs	25%	9%
Mean Bribe as a % of ocean shipping to East Africa	37%	13%
Mean Bribe as a % of ocean shipping to Far East	46%	37%
Mean Bribe as a % of total shipping costs (overland, port and ocean shipping)	14%	4%
Median Bribe (USD) if firm > than 500 km from port	192	35
Median Bribe (USD) if firm < than 5 km from port	190	32
Monthly salary increase of port official	600%	144%
Real monthly wage of port official in USD (CPI adjusted)	692	699
Distribution of Cargo across Ports		
Percent of High Tariff Goods	53.33	52.54
Percent of High Tariff Goods in 2007	61.2	64.12
Percent of High Tariff Goods in 2008	44.41	37
Percent of Perishable Cargo	20.19	32.4
Percent of Cargo with Origin/Destination in the West	35.38	13.16

Sources: Tracking Study at Maputo and Durban ports.

Table 3: **Shipment Summary Characteristics at Each Port**

VARIABLE	Mean		(Std. Dev.)		Median		P-value
	Maputo	Durban	Maputo	Durban	Maputo	Durban	
Tons	123.9	129.3	(977.8)	(216.7)	8	26.5	0.93
Value of Shipment in (USD)	85,336.6	263,539	(51,5035)	(265,847)	17,000	188,888	0

Sources: Tracking Study at Maputo and Durban ports. P-value tests with unequal variances.

Table 4: **TOTAL BRIBE PAYMENTS: Who receives bribes?**

RECIPIENTS of BRIBES	MAP (%)	DURB (%)	Amounts MAP Mean	Amounts DURB Mean
Customs	**80.07**	10.18	344	35.45
			(529.9)	(24.39)
Stevedores	15.81		42.3	
			(4.44)	
Port Police	1.03		300	
			(.)	
Gate Officials		7.96		102.8
				(110.76)
Port Security		24.34		54.98
				(69.79)
Document Department		**38.5**		60.2
				(70.67)
Shipping Planners		10.18		294.2
				(254.96)
Depot Workers		6.19		138.10
				(142.79)
Weighbridge Officials		1.33		480.11
				(393.86)
Temperature Reefer Agents		0.44		66
				(.)
Scanner Agents	3.09	13.16	167.69	
			(152.76)	

Sources: Tracking Study.

NOTES: Standard errors in parenthesis. The Document Department releases a document for each container to allow cargo handling and customs clearance among others. All values calculated as a percentage of total bribe payments in our sample.

Table 5: **TOTAL BRIBE PAYMENTS: Why are bribes paid?**

REASONS FOR BRIBES	MAP (%)	DURB (%)	Amounts MAP Mean	Amounts DURB Mean
Jump queue of trucks at Port Gate	18.10	**33.33**	172.77	69.87
			(138)	(81.72)
Problems with Documentation	17.03	11.95	250.96	43.72
			(128.94)	(33.25)
Jump Tariffs	**40.86**	0.88	300	32.14
			(493.85)	(5.05)
Late arrival	2.37	14.60	230.26	230.67
			(.)	(238.97))
Avoid overnight stay		1.33		94.55
				(127.76)
Avoid Storage Costs		**29.65**		62.28
				(78.2)
Avoid Late Container Return Fee		2.65		151.54
				(200.864)
Urgent Consignment		3.10		39.3
				(48.99)
Change Reefer Temperature		0.44		66.66
				(.)
Congestion at the Port	20.39	0.88		42.3
				(4.43)
Avoid the Scanner	6.47	0.88	417.2	678.5
			(515.9)	(2.72)
Other Reasons	0.65		258.97	
			(217.61)	

Sources: Tracking Study. Standard errors in parenthesis. All values calculated as a percentage of total bribe payments in our sample.

Table 6: **Variable Descriptions**

Variables	**Description**
HIGH TARIFF MAPUTO	Coded 1 if product falls into high tariff category according to the Mozambican Tariff Code. High tariffs are considered to be subject to 20-25% rates Source: Mozambican Customs
HIGH TARIFF DURBAN	Coded 1 if product falls into high tariff category according to the South African Tariff Code. High tariffs are considered to be subjected to 20-25% rates Source: South African customs
YEAR 2008	Coded 1 if shipment took place after the tariff reduction and 0 otherwise Source: Tracking study
LARGE FIRM	Coded 1 if firm has more than 100 employees and 0 otherwise Source: Enterprise Survey, IFC 2007 and tracking study
LOG VALUE SHIPMENT	Natural log of value of shipment in USD. Source: Tracking Study
LOG TONS	Natural log of tonnage of shipment. Source: Tracking Study
PERISHABLE	Coded 1 if products belongs to any of the following categories: prepared food, beverages, wheat, vegetables, tobacco, medicine meat, fish, dairy, nuts and 0 otherwise Source: Enterprise Survey IFC 2007 and tracking study
DIFFERENTIATED PRODUCT	Coded 1 if product does not have a set price in international markets as defined by Rauch (1999) and 0 otherwise Source: Enterprise Survey, IFC 2007 and tracking study
BULK	Coded 1 if cargo is non-containerized and 0 if it is containerized Source: Tracking Study
LOG STORAGE COSTS	Natural log of expected storage costs, as calculated by the clearing agent prior to the arrival of the cargo on the docks Storage costs are based on the type of product shipped
EXPORTER	Coded 1 if firm exports and 0 otherwise. Source: Enterprise Survey, IFC 2007
IMPORTER	Coded 1 if firm imports and 0 otherwise. Source: Enterprise Survey, IFC 2007
DAYS BETWEEN SHIPMENTS	Average number of days between each firm's shipments Source: Enterprise Survey, IFC 2007
LOG DAYS OF INVENTORY	Log number of days of inventory of the main input by the time the next shipment arrives. Source: Enterprise Survey, IFC 2007
LOG REL. DISTANCE TO DURBAN	$\frac{DM*RM+PM}{(DD*RD+PD)}$
TRED	Equals 1 if good experienced a tariff reduction, 0 if it remained in a high tariff category. Source: Tracking study
DD	Distance to Durban
RD	Transport Rate to Durban
PD	Port and toll costs to Durban
DM	Distance to Maputo
RM	Rate to Maputo
PM	Port, toll and border fees to Maputo

Table 7: **Determinants of Bribe Payments in Maputo and Durban**

	MAPUTO	**DURBAN**	**MAPUTO**	**DURBAN**	**MAPUTO**	**DURBAN**
Dependent Variables	Prob Bribe	Prob Bribe	Bribe Amount	Bribe Amount	Bribe Amounts	Bribes Amounts
	LPM	LPM	OLS	OLS	TOBIT	TOBIT
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
HIGH TARIFF	0.130**	-0.120	0.578	-0.544*	2.94***	
	(0.0600)	(0.0821)	(0.431)	(0.312)	(0.6)	
LOG TONS	0.0132	0.00961	0.114	0.0792		
	(0.0181)	(0.0607)	(0.103)	(0.267)		
BULK	-0.135**	-0.532***	-0.838***	-3.027***	-2.11***	-10.95***
	(0.0614)	(0.116)	(0.320)	(0.838)	(0.91)	(0.292)
DIFFERENTIATED PRODUCT	0.0740	-0.0446	0.0256	-0.296		
	(0.0889)	(0.0857)	(0.454)	(0.332)		
LOG STORAGE COSTS		0.114***		0.592***		0.91***
		(0.0382)		(0.208)		(0.292)
Temperature controls	Yes	Yes	Yes	Yes	Yes	Yes
Value of shipment	Yes	Yes	Yes	Yes	Yes	Yes
Observations	149	319	112	120	155	405
Adjusted R-squared	0.458	0.307	0.188	0.535		
Pseudo R-squared					0.184	0.205
Log Likelihood					-303.24	-569.9

[a] Robust standard errors in parentheses clustered at the product level. *** p<0.01, ** p<0.05, * p<0

[b] High tariff equals 1 if high tariff product and 0 otherwise. Tariffs calculated according to the Mozambican and South African tariff codes. All regressions include controls for the deviation of temperature the day the cargo arrives at the port from the monthly temperature average and an interaction with a perishable dummy; the log of the value of the shipment, whether the shipment is an import or an export; a year dummy for when the shipment was captured; a year dummy interacted with the high tariff dummy to account for the change in tariffs that occurred in Mozambqiue in 2008; whether the shipper is large or small and whether the cargo is perishable.

Differentiated Product Dummy equals 1 if product does not have a referenced price in international markets, as categorized by Rauch (1999), and 0 otherwise. Columns (1) and (2), represent a linear probability model, columns (3) and (4) ordinary least squares, and columns (5) and (6) a tobit model.

Table 8: **Did a Change in Tariffs Lead to a Change in Bribes? Difference-in-Differences**

VARIABLES	LPM
Dependent Variable	**Prob Bribe**
TRED	-0.026
	(0.017)
TRED * YEAR 08	**-0.056**
	(0.088)
YEAR 08	-0.64***
	(0.066)
Log Value of Shipment	Yes
Log Tons	Yes
Temperature	Yes
Perishable	Yes
Differentiated Product	Yes
Bulk	Yes
Observations	284
R-squared	0.57

[a] Robust standard errors in parentheses, clustered at the product level. *** p<0.01, ** p<0.05, * p<0.

[b] Linear probability model fitted to the sub-sample of cargo shipped through the Maputo Port. TRED Dummy equals 1 if the product experienced a tariff reduction between 2007 and 2008 and 0 if it remained as a high tariff product. High tariff equals 1 if tariff rate is above 20% and 0 if the tariff rate is between 0-7.5%. Tariffs calculated according to the Mozambican tariff code. All regressions include controls for the value and size of the shipment, the deviation of temperature the day the cargo arrives at the port from the monthly temperature average and an interaction with a perishable dummy, as well as whether the cargo is bulk or not. Differentiated Product Dummy equals 1 if product does not have a referenced price in international markets, as categorized by Rauch (1999) and 0 otherwise. Large firm dummy equals 1 if firms has more than 100 employees.

Table 9: **Decomposing Differences in the Probability of Paying a Bribe and on Bribe Amounts by Port**

	Prob of Paying a Bribe	Maputo Intercept	High Tariff	Log Tons	Bulk	Storage Costs
$\frac{\overline{X}_{Mp}}{\overline{X}_{Db}}$	1.46		1.009	0.96	0.446	0.531
Contribution to fitted values	1.63	0.40	-0.04	0.0002	-0.37	-0.02
$\frac{\hat{B}_{Mp}}{\hat{B}_{Db}}$	(100%)	**(24.37%)**	(-2.71%)	(0.013%)	**(-22.46%)**	(-1.103%)

	Bribe Amount	Maputo Intercept	High Tariff	Log Tons	Bulk	Storage Costs
$\frac{\overline{B}_{Mp}}{\overline{B}_{Db}}$	2.90		1.009	0.96	0.446	0.531
Contribution to fitted values	1.05	1.89	-0.24	-0.002	-0.860	-0.078
$Ln\,\hat{\beta}_{Mp} - Ln\,\hat{\beta}_{Db}$	(100%)	**(180%)**	**(-22.74%)**	(-0.21%)	**(-81.8%)**	(-7.37%)

Table 10: **Corruption affects Firms' Shipping Decisions**

	Model 1	**Model 2**	**Model 3**
VARIABLES	(1)	(2)	(3)
Dependent Variable		Probability of Choosing Maputo Port	
HIGH TARIFF MAPUTO	-0.23**	-0.22*	-0.23*
	(0.11)	(0.11)	(0.12)
HIGH TARIFF DURBAN	-0.076	-0.096	-0.071
	(0.092)	(0.096)	(0.098)
LOG REL. TRANSP. COST TO DB	-1.1	-1.03	0.91
	(0.77)	(1.48)	(5.88)
LARGE FIRM DUMMY	-0.074	-0.090	-0.066
	(0.085)	(0.088)	(0.093)
PERISHABLE	0.14	-8.72*	0.15
	(0.29)	(4.98)	(0.30)
DAYS BETWEEN SHIPMENTS	-0.00071**	-0.00076***	-0.00073*
	(0.00027)	(0.00026)	(0.00037)
EXPORTER	0.11	0.087	0.14
	(0.15)	(0.15)	(0.25)
IMPORTER	-0.27**	-0.25**	-0.33
	(0.12)	(0.12)	(0.21)
LOW INVENTORY DUMMY	-0.15	-0.16	-0.15
	(0.11)	(0.15)	(0.19)
DIFFERENTIATED PRODUCT	0.040	0.011	0.028
	(0.096)	(0.093)	(0.10)
Dist*Perishable	No	Yes	Yes
Dist*Inventory	No	Yes	Yes
Dist*Exporter	No	No	Yes
Dist*Importer	No	No	Yes
Dist*Imp*Inventory	No	No	Yes
Imp*Inventory	No	No	Yes
Observations	89	89	89
R-squared	0.194	0.216	0.210

[a] Robust standard errors in parentheses, clustered by city *** p<0.01, ** p<0.05, * p<0.1

[b] High-Tariff Dummies calculated according to the Mozambican and South African Tariff Codes and equal 1 if the firm ships high tariff products. Log Relative Transport Costs to Durban is calculated as $\frac{(Distance\ Maputo * Rate\ Maputo + Port\ toll\ and\ border\ fees\ to\ Maputo)}{(Distance\ Durban * Rate\ Durban + Port\ and\ toll\ costs\ to\ Durban)}$.

Differentiated product dummy equals 1 if the product does not have a referenced price in international markets, as categorized by Rauch (1999). Large firm dummy equals 1 if the firm has more than 100 employees. Column (1) corresponds to the base model.

Column (2) includes interactions between distance and perishable cargo, and distance and firms carrying low inventories.

Column (3) includes triple and double interactions between exporters, distance and inventories.

These results are also robust to the inclusion of industry dummies. We consider different measures of firm's urgency of shipments: the log of each firm's average inventory levels; a measure of how each firm's inventory level deviates from the average inventory levels in the respective industry category; and a dummy variable indicating if the firm's inventory levels are below the average inventory levels for a firm of similar size and industry category. The results are not sensitive to any of these specifications.

Table 11: **Corruption Affects Firms' Sourcing Decisions**

VARIABLES	**Coercive Corruption**	**Collusive Corruption**
DV: Percentage of Inputs that Firm Sources Domestically		
Bribes	0.064***	-0.36***
	(0.019)	(0.12)
Perishable Inputs	Yes	Yes
High Tariff Inputs	Yes	Yes
Distance to Port	Yes	No
Industry	Yes	Yes
Large Firm	Yes	Yes
Bulk Inputs	Yes	Yes
Perishable Inputs	Yes	Yes
Observations	112	153
F-test	3.34	5.43
Adjusted R-squared	0.065	0.076

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10.

Coercive Corruption includes only South African firms shipping through Durban. Distance to port variable included

for South African companies but not for Mozambican companies, since the entire Mozambican sample was located in the city of Maputo, next to the port.

Table 12: **Is there a BORDER EFFECT?**

VARIABLES	OLS	OLS
DV: Log Bribe Amount		
HIGH TARIFF	**0.722**	**0.970***
	(0.466)	**(0.576)**
HIGH TARIFF* YEAR 08	**-0.954***	**-1.128**
	(0.509)	**(0.701)**
YEAR 08	0.309	0.360
	(0.435)	(0.545)
PERISHABLE	0.0279	0.198
	(0.361)	(0.623)
LOG VALUE SHIPMENT		0.0182
		(0.179)
DIFFERENTIATED PRODUCT		0.392
		(0.407)
Constant	5.153***	4.596**
	(0.374)	(1.823)
Observations	40	38
R-squared	0.086	0.125

[a] Bootstrapped standard errors in parentheses, clustered at the product level. *** p<0.01, ** p<0.05, * p<0.10. High-Tariff Dummies calculated according to the Mozambican and South African Tariff Codes, equals 1 for shipments of high tariff products.

Table 13: **Is there a BORDER EFFECT? Difference-in-Differences**

VARIABLES	OLS	OLS
DV: Log Bribe Amount		
TRED	0.638*	0.352
	(0.365)	(0.435)
TRED * YEAR 08	**-0.942*** **	**-0.760** **
	(0.294)	**(0.387)**
YEAR 08	0.309	0.36
	(0.435)	(0.545)
PERISHABLE		0.496
		(0.483)
LOG VALUE OF SHIPMENT		-0.213
		(0.212)
DIFFERENTIATED PRODUCT		-0.225
		(0.484)
Constant	5.244***	7.435***
	(0.227)	(2.328)
Observations	31	31
R-squared	0.171	0.242

[a] Bootstrapped standard errors in parentheses clustered at the product level *** p<0.01, ** p<0.05, * p<0.10.

[b] TREAD Dummy equals 1 if the product experienced a tariff reduction between 2007 and 2008 and 0 if it remained as a high tariff product. High tariff equals 1 if tariff rate is above 20% and 0 if the tariff rate is between 0-7.5%. Tariffs calculated according to the Mozambican tariff code.