Corruption and firm behavior: evidence from African ports

CORRUPTION AND FIRM BEHAVIOR:
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Abstract

This paper investigates how corruption affects firm behavior. Using an original and unusually rich dataset on bribe payments at ports matched to firm-level data, we observe how firms adapt to different types of corruption by adjusting their transport strategies. Our results suggest that firms respond to the price effects of corruption, organizing production in a way that increases or decreases demand for the public service.

Keywords: Corruption; Firm Behavior; Transport; Ports; Trade Costs

JEL Classification Numbers: D22, D73, L91, O12, R41.

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1 Introduction

The impact of corruption on economic activity has been extensively debated in the literature. One line of argument is that bribes can create direct incentives for bureaucrats to perform, or allow private agents to overcome cumbersome regulations. In both cases, corruption could lead to an improvement in the overall allocative efficiency of public resources (Leff 1964; Huntington 1968; Lui 1985). A second line of argument is that bribes are mostly set according to the strategic preferences of bureaucrats, distorting private agents' decisions and decreasing allocative efficiency (Krueger 1974; Klitgaard 1991; Shleifer and Vishny 1992; Shleifer and Vishny 1993; Rose-Ackerman 1999). The key empirical challenge behind this debate lies in understanding both how corruption affects the marginal price of public services and how economic actors respond to corruption-induced changes in marginal prices. Limited progress has been made on either front due to the absence of data on bribe payments that can be matched to users' demand for a public service. This paper attempts to fill this gap. We investigate the impact of corruption in ports on firm-level trade costs in the context of import shipping.[1] This is a particularly important setting given renewed interest in understanding the micro-level drivers of trade costs (Frankel and Romer 1999; Rodriguez and Rodrik 2001; Limao and Venables 2001; Obstfeld and Rogoff 2001; Anderson and Wincoop 2004).[2]

The impact of corruption on firm-level trade costs is theoretically ambiguous: corruption can increase costs if bribes increase the final price of clearing services, or corruption can decrease costs if bribes allow firms to avoid significant clearing fees such as tariff duties. To shed light on this question, we examine the impact of corruption on firm behavior that is directly affected by changes in marginal prices of border services: firms' choice of which port to use. To examine the impact of corruption on firms' choice of port, we surveyed a random sample of 120 South African firms of two types: firms that were equidistant to two alternative ports - Maputo and Durban - and firms

[1] We focus on imports since most countries have expedited port clearance for exports, with no tariff payments or mandatory screening procedures. This creates fewer opportunities for corruption deals to take place.

[2] In 2011, shipping a container from a firm in Sub-Saharan Africa was still almost twice as expensive as shipping it from India, and six times more time-consuming than shipping it from the US (Doing Business 2011). In 2011 it took an average of 31 days for a firm in Sub-Saharan Africa to get a standard 20ft container from its warehouse through the closest port and on a ship, with potential implications for the structure of trade in the region. Djankov, Freund and Phan (2010) 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%.

that were considerably closer to the port of Maputo, in Northeastern South Africa (see Figures 1 and 2). We then generated a unique dataset of directly observed bribe payments to port officials for a random sample of 1,300 imports going through both ports. Survey data revealed that a firm's choice of port is driven primarily by the combination of transport and corruption costs at each port. Transport costs are linear to the distance between each firm and the ports. Corruption costs on the other hand are determined by the type of product the firm imports. As we discuss in detail below, exposure to corruption in the port of Maputo is exogenously determined by a South African firm's distance from the port -which determines its transport costs- and by the choice of main input of production -which determines corruption costs-. This allows us to estimate how corruption affects South African firms' choice of which port to use, and in particular, how firms substitute higher transportation costs for higher corruption costs.

Our analysis yields three main findings. First, we observe that border officials engage in one of two different types of corruption for any given shipment: "Collusive" corruption occurs when public officials and private agents collude to share rents generated by the illicit transaction, thus reducing firm-level trade costs. We provide evidence on how collusive corruption in the form of tariff evasion allows private agents to capture sizable bribe rents, as the bribes paid often represent only 0.2% of the total tariff duty that is due. "Coercive" corruption takes place when a public bureaucrat coerces a private agent into paying an additional fee above the official price of the clearing service, which increases firm-level trade costs. Corruption is also high and pervasive with 53% of all shipments tracked in Maputo and 34% of all shipments tracked in Durban having to pay a bribe. Corruption is however not equalized across port - the mean bribe is almost 3 times higher in Maputo than in Durban.

Second, we find evidence that coercive corruption affects firms' choice of port. If a South African firm imports an input that is more vulnerable to cost-increasing coercive corruption in Maputo, it is more willing to travel on average an additional 319 kms - in some cases almost doubling its transport costs-, just to avoid the corrupt port. This effect is only observed for firms facing a higher probability of being coerced into a bribe due to the type of product they import. In the most extreme case in our sample, the cost for a firm to re-route could be three times higher than the

cost of the actual bribe requested at the closer port. This result is difficult to square with standard price theory. While we are unable to firmly establish the reason behind this behavior, survey data revealed that firms were willing to incur in higher transport costs to avoid the *uncertainty* associated with the level of coercive bribe payments at the most corrupt port. These results are robust to a variety of controls for potentially unobserved heterogeneity of product and firm type.

Third, given the detailed nature of our data, we provide descriptive evidence on how both coercive and collusive forms of corruption can affect economic activity beyond the immediate cost of the bribe to the user of the public service. The "diversion effect" caused by coercive corruption increased congestion and transport costs in the region by exacerbating imbalanced flows of cargo along the transport network. Even though the cost trucking companies incur in to ship through either corridor - leading to Maputo or to Durban- is identical and the transport market is fairly competitive, transport services on the transport corridor leading to the most corrupt port of Maputo carried a 70% price premium for users, lending further evidence to the fact that coercive corruption can introduce both direct and indirect distortions in the market. Collusive corruption in Mozambique is on the other hand associated with significant tariff revenue loss for the government, equivalent to a 5 percentage point reduction in the average nominal tariff rate.[3]

Overall, our findings suggest that reducing corruption might have heterogeneous effects on firm-level trade costs, depending on whether anti-corruption policies eliminate coercive or collusive forms of corruption. Moreover, while private agents seem to respond to collusive forms of corruption as predicted by standard price theory, coercive corruption appears to elicit a more differentiated response, depending on the degree of uncertainty associated with the bribe-setting process.

The validity of our empirical strategy relies on four key identifying assumptions. First, when analyzing South African firms' transport strategies we argue that the location and the type of input sourced by South African firms in our sample is exogenous to the level of bribes at the port of Maputo. To mitigate the problem of endogenous firm location and input choice in response to corrupt practices in Maputo, we restrict our analysis to firms established in a given sector before 2002, since the port only became a viable shipping option for our firms when it re-opened to

[3]This calculation is based on the tariff loss associated with the 650 shipments observed in our sample for the port of Maputo where this type of corruption takes place for Mozambican firms that are able to pay a bribe to avoid tariff duties.

international traffic in 2004, following decades of civil war in Mozambique.[4] Our results are robust to restricting the analysis even further to firms established as far back as 11 years earlier (1993), prior to the end of the Mozambican civil war. We also show that firms that are equidistant to the ports and those that are closer to either port do not differ in important characteristics such as volume of sales, number of employees, export capacity and size of inventories. Finally, we find no evidence that bribes are set according to the distance each firm has to travel to reach the port.

Second, we show that exposure to corruption at the port of Maputo is exogenously determined by whether South African firms import an input that happens to fall under a high or low tariff grouping according to the tariff code of Mozambique (the neighboring country in which the port is located). Falling under a high tariff grouping in Mozambique is uncorrelated with any relevant characteristics of South African cargo such as the average size of shipments, their value, or whether they were subjected to more intense inspections before being shipped from the respective country of origin (See Table 1, Online Appendix). Moreover, the tariff codes of South Africa and Mozambique were uncorrelated during the period under analysis with an insignificant correlation coefficient of 0.02. As a result, we argue that a firm's location and whether the input it imports is a high or low tariff product in Mozambique represent a plausibly exogenous source of variation in exposure to corruption at the port of Maputo.

Third, when measuring and comparing bribe schedules across ports, we assume that the overall type of cargo handled in Maputo does not significantly differ from the cargo handled in Durban along important dimensions that may be correlated with firms' transport strategies, or with the unobservable characteristics of each port. We provide evidence that the type of cargo handled in Durban and Maputo is indeed similar, based on important observable characteristics such as the average size of shipments or the average tariff grouping products fall under (see Table 11). A final concern is that a firm's choice of port is driven by other factors beyond what we account for in our analysis. While our design does not allow us to completely dismiss this possibility, we provide important evidence to the contrary. First, our firm survey revealed that the choice of transport corridor and port is driven primarily by trucking and corruption costs, both of which are directly measured in our data. Second, firms in our sample ranked the two ports similarly across a host of

[4] As discussed in section 1.1 of the online appendix, the re-opening of the port was driven by funding from the IFIs and the aim of achieving political stability in the region through economic integration, with limited initial engagement from the private sector.

important indicators.[5] Third, we observe that only a subset of firms that import goods at risk of paying a higher bribe in Maputo decide to re-route to Durban. This result holds when controlling for the value, size and perishability of the product, the urgency of the shipment as well as for the number of documents required to clear it (see sections 5 and 6 for a more detailed discussion of selection issues).

This study contributes to the literature examining the determinants and the economic costs of corruption. Svensson (2003) and Fisman and Svensson (2007) 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, though no direct mechanism for these effects is specified. In a contemporaneous study to our own, Dutt and Traca (2010) investigate the dual impact of corruption as a trade-reducing extortionary tool or as a trade-enhancing means to evade tariffs, but only at the aggregate, cross-country level. Moreover, both of these studies rely primarily on self-reported measures of bribe payments to public officials by surveyed firms or on perception-based indices of corruption, both of which bear a high risk of perception and reporting bias relative to data gathered through direct observation of bribery deals (Olken 2009). Bertrand et al. (2007) provides experimental evidence on how bureaucrats undercut existing regulations on obtaining a driver's license in India, in a form of collusive corruption that responds to the needs of private agents but at a potentially high social cost. Olken and Barron (2009) also traces the level of coercive bribes paid by truckers at road posts in Indonesia to the structure of localized markets for corruption. While both studies suggest large social losses due to bribe payments, they are not designed to directly identify how users may respond to each type of corruption.

We build on this literature to trace both the determinants and the systemic impact of corruption on the economy, by observing the entire chain between bureaucrats' bribe-taking and firms' import decisions. To the best of our knowledge, this is the first study to use primary data on bribe payments and firm behavior to document the magnitude, the determinants and the price effects of different types of corruption on the users of an essential public bureaucracy.

The rest of the paper proceeds as follows. Section 2 describes the empirical setting and section 3 discusses the data collection. Section 4 examines the characteristics of bribe payments at ports

[5]Surveys included questions about the speed, safety, capacity and reliability of port services in Maputo and Durban.

and section 5 analyzes the price effects of corruption and their impact on firms' transport decisions. Section 6 discusses endogeneity concerns and conducts further robustness checks. Section 7 concludes.

2 Empirical Setting

2.1 Transport and Port Bureaucracies in Southern Africa

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 (see Figures 1 and 2). A firm's choice of which port to use is an important determinant of trade costs given that cargo travels long distances - an average of 588 kms - between centers of production or consumption and ports, at very high prices of overland transport.[6] Because of its location, the port of Maputo has historically played a major role in South Africa's transport network. The port was severely damaged during the 80s and 90s due to the Mozambican civil war, but reopened to international traffic in 2004 under private management. Together with Durban, the port of Maputo serves today as the primary transportation route to the sea for the South African provinces of Mpumalanga (Northeast) and Gauteng (Johannesburg and Pretoria).[7]

Since 2004, the barriers for freight transit along the transnational corridor connecting South Africa to the port of Maputo have been significantly reduced and a set of comparable South African trucking companies have begun to serve both ports.[8] 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 section 1 of the online Appendix for a more comprehensive description of the ports). As a result, we can observe the behavior of

[6] According to CSIR (2005, 2006), expenditures on transport and logistics in South Africa are equivalent to 15-20% of GDP, double the figure for comparable middle income countries like India or Brazil.

[7] 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 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 regional 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.

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

three types of firms: those that are equidistant to both ports, those that are significantly closer to the port of Maputo but could still choose to use the port of Durban, and Mozambican firms located in the direct catchment area of the port of Maputo that have no other shipping alternative. We rely on the first two types of firms to estimate the impact of corruption on choice of port, given that while these firms are similar on important observable characteristics -as evidenced by Table 2-, they can be exposed to different levels of expected corruption at each port depending on the type of input they import.

2.2 Border Officials and Clearing Agents

There are three types of agents involved in the clearance process: customs' officials, port/border operators and clearing agents. Customs' officials are in charge of validating clearance documentation and collecting all tariff payments due.[9] They have significant discretionary power to extract bribes relative to regular port operators given their broader bureaucratic mandate and the fact that they can access full information on each shipment, and each shipper, at all times. This provides customs' officials with a wide set of tools to extract different types of bribes from threatening to conduct a physical inspection of the shipment that can delay clearance for up to 4 days, citing irregularities -real or fictitious- with the documentation of the shipment or selling "tariff evasion" by misreporting physical quantities of imported products, misrepresenting prices, or misclassifying products from high to low tariff categories.

Regular port operators have a narrower mandate to move or protect cargo on the docks, and they sometimes lack access to the shipment's documentation specifying its value or the details of the client firm. As a result, relative to customs' officials, these agents can be classified as having low extractive capacity.[10]

The third type of player involved in the clearing process is the clearing agent. In this setting, by law, no firm is allowed to interact directly with customs or port operators. Firms have instead

[9] It is also possible that truckers have to pay bribes at roadposts along both transport corridors. We do not include these bribes in our study given that trucking surveys of a random sample of 220 trucking companies operating in both regions revealed that the probability of paying a bribe in either corridor was very similar, and that these bribes were on average 50% lower than the bribes that were paid at the port.

[10] These operators can be responsible for moving cargo from the docks to private depots; adjusting reefer temperatures for refrigerated cargo stationed at the port; determining whether to accept late cargo arrivals; assigning forklifts and equipment to shipments; overseeing high-value cargo on the docks; moving cargo through non-intrusive scanning technology.

to resort to private clearing agents who specialize in clearing cargo through the port or border post, mostly through *ad hoc*, shipment-based contracts.[11] Clearing agents submit all the required documentation, monitor the clearance process and make all necessary payments to customs' officials and port operators, including bribes. 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. In the sample we track in this paper, 80% of firms engaged in direct contracts with clearing agents, 65% of which were for a one-time shipment. Bribes are paid primarily by clearing agents, with all costs imputed to their client firms.

2.3 Bureaucratic Variation and Opportunities for Corruption

The port bureaucracies of Maputo and Durban differ in two important organizational features that can determine which type of port official has more opportunities to extract a bribe: the high-extractive types -customs agents- or the low-extractive types -port operators-. These differences result from the level of interaction that takes place between clearing agents and customs' officials, the type of management overseeing port operations, and the time horizons of each type of official. In Durban, direct interaction between clearing agents and customs' agents is kept to a minimum since all clearance documentation is processed online. In contrast, the level of interaction in Maputo is high since clearance documentation must be submitted in-person by the clearing agent.[12] The close interaction between clearing agents and customs' officials in Maputo may lead to more opportunities for corrupt behavior to emerge in customs relative to Durban.

Finally, officials with opportunities to extract bribes at each port differ in their time horizons. In 2006, the Mozambican customs' agency was merged into the country's tax authority. Since then, customs adopted a policy of frequently rotating agents across different terminals and ports.[13] While customs' officials in Maputo can be in a post for as little as 6 weeks, port operators in Durban

[11] While clearing agents are optional in the US and in other European countries, they have been made a mandatory fixture of the clearing process in several countries throughout the developing world such as Mali, Burkina Fasu, Honduras, and Venezuela, among others. For more detailed information on the role of clearing agents see http://docsonline.wto.org/.

[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] Bribes appear to vary significantly by the type of product being shipped, and consequently by the type of terminal at the port. Customs' agents can therefore at any given moment be assigned to terminals with different levels of extractive potential.

have extended time horizons given the stable support they receive from dock workers' unions.[14] As suggested in the literature, the high extractive types with the shortest time horizons - customs' officials in Maputo-, may therefore have a higher incentive and a higher ability to extract bribes relative to the low extractive types with long time horizons in Durban (Campante, Chor and Do, 2009).[15]

2.4 The Transit Bond

South African firms in our sample have the choice to ship through the ports of Maputo or Durban. A critical feature of the empirical setting is that in both cases, these firms pay import duties only when the cargo enters South Africa, in accordance with the South African tariff code. Even when cargo arrives in South Africa via the port of Maputo, no tariff payments are made in Mozambique. Instead, while the shipment is in transit for approximately 83 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 the cargo would have to pay in accordance to the Mozambican tariff code. This is a standard precautionary measure in case the cargo is diverted from its course and remains in Mozambique. Once the cargo enters South Africa, the clearing agent submits the required documentation to the Mozambican customs to request the refund of the bond.[16] Setting the level of the transit bond offers however an opportunity for customs' officials in Maputo to attempt to extract bribes from South African firms. Customs' officials can threaten to arbitrarily increase the size of the transit bond once the cargo reaches the port by challenging the reported

[14] Interviews with the Customs Agency in Maputo and SATAWU, the transport union in Durban.

[15] An important part of our setup is that these differences in bureaucratic structure are arguably exogenous to the level of corruption at each port. 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. The derelict state of the port of Maputo in the late 1990s resulted from 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 concessional lending. In South Africa, dock workers' unions spearheaded a long and successful fight against the privatization of port operations, particularly for container terminals. The political strength of the organization is deeply rooted in the historical role it played in the struggle against Apartheid, which culminated in the active participation of labor unions in the tripartite political alliance that gave birth to the first post-apartheid government of South Africa. The South African Transport and Allied Workers Union (SATAWU) enlists approximately 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, which is currently in power.

[16] The bond can be paid in cash or by cheque and the amount lodged is returned within an average of 10 working days following the acquittal of the shipment. The land border will send the documentation to the Mozambican customs at the port to provide evidence of acquittal. In our enterprise survey conducted in 2007, firms did not identify the refundable transit bond itself as a major impediment to shipping through the port of Maputo.

price of the good or the size of the shipment. The high variability of transit bonds introduces two types of additional constraints. First, it can create liquidity constraints for clearing agents in charge of making the transit bond payment. Second, it can exacerbate agency problems between the clearing agent and the client firm due to important asymmetries of information: last minute requests by clearing agents for additional funds to cover the cost of a bribe can raise suspicion, as South African firms are unable to completely verify the validity of these claims.

In practice, this translates into the possibility of customs' officials engaging in collusive arrangements with Maputo-based firms attempting to evade tariffs on imported goods but in coercive corruption with South African firms using Maputo as a transit corridor, if they have to pay bribes to avoid arbitrary increases in the amount of the transit bonds due.

The second important feature of our setting is the fact that firms opting for the Maputo corridor have to cross the border post between South Africa and Mozambique. The border post offers further opportunities for corruption as customs' officials can detect real or fictitious irregularities with the transit bond. In theory, this set of customs' officials have significantly lower extractive capacity than customs' officials at the port who will determine the level of the transit bond due in the first place. Moreover, there are constraints as to how long the cargo can be delayed at the border post given the lack of parking/storage facilities for trucks/cargo.

The third relevant feature of this empirical setting is that the tariff code in Mozambique is uncorrelated with important product-level characteristics of South African imports that could potentially also drive a firm's choice of port. Correlation coefficients between the tariff rates in Mozambique and the average size and value of the shipments are mostly small in magnitude and statistically insignificant (see table 1 in the Online Appendix). The correlation between tariff codes in both countries is also weak and insignificant (with a correlation coefficient of 0.02). In light of this evidence, we exploit the fact that whether an import by a South African firm falls under a high or low tariff grouping in neighboring Mozambique -thus increasing the likelihood that Mozambican customs' officials will attempt to extract a bribe-, creates an exogenous variation in South African firms' exposure to corruption at the port of Maputo.

This empirical setting suggests three main hypotheses to take to the data. First, the organization of each port bureaucracy creates opportunities for different types of border officials to engage in corruption: customs' officials in Maputo and port operators in Durban have more opportunities

to extract bribes. Moreover, bribes should be higher in Maputo given customs' officials' higher extractive capacity. Second, South African firms shipping cargo that happens to fall under a high tariff category according to the Mozambican tariff code should be more vulnerable to corruption at the port of Maputo and opt for Durban instead. Third, the border post may reinforce the impact of corruption on firms' choice of port, by allowing customs' officials to extract further bribes from high tariff shipments.

3 Data

We rely on three main sources of primary data: (1) we measure the level and frequency of bribes payments by tracking a random sample of shipments going through the ports of Durban and Maputo; (2) we identify firms' choice of port through an original enterprise survey and (3) we measure firm-level overland trucking costs on the transport corridors leading to the ports of Maputo and Durban through an original survey of trucking companies.

3.1 Bribe Payments

To measure bribe payments we implement a tracking study conducted at both ports, and in the border post between South Africa and Mozambique. Eight well-established clearing agents tracked all bribe payments made to port officials for a randomly selected sample of 1,300 shipments.[17] Clearing agents made available the listing of shipments received per week and were instructed to track every third shipment, recording detailed information on the date and time of arrival and clearance of the 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 reason for a bribe payment, ranging from the need to jump a long queue of trucks to get into the port, to evading tariffs or

[17]The study was restricted to eight clearing agents given the illicit nature of the bribe payments and the authors' 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. To ensure a representative sample of clearing agents, we began by assessing the "reputation" for corruption of each agent through a small survey of freight forwarders who worked closely with clearing agents at both ports in the two months preceding the actual tracking study. A list of formally registered clearing agents was then stratified by the perceived reputation of each agent, their size and their length of establishment. The final sample of participating agents was then randomly selected from within each stratum.

missing important clearance documentation.[18] Over 90% of these shipments were imports. Clearing agents reported bribes as being either cost-decreasing (collusive) or cost-increasing (coercive) for their clients. Collusive corruption occurred when public officials and private agents colluded to share rents generated by the illicit transaction. A clear example of collusive corruption was when private agents colluded with customs' officials to evade tariffs. Coercive corruption took place when a public official coerced a private agent to pay a fee just to gain access to the public service. In this case, the private agent did not capture any rent from the illicit transaction, as the bribe was extortionary in nature.[19]

Our focus was mostly on clearance taking place at the port since this is where importers are required to submit the documentation for the imported goods and make all payments for the transit bond. This is the critical step in which customs' officials are required to determine the level of risk associated with the the cargo and the level of the transit bond that is due. At the border post between Mozambique and South Africa, clearing agents are required to present the documentation prepared at the port and confirm that everything is in order with the transit bond in order to proceed with its acquittal. It is however possible that customs' officials stationed at the Mozambican side of the border post attempt to extract further bribes by claiming irregularities with the documentation. Their extractive capacity is however constrained by the previous assessment of customs' at the port and the potential for cargo build up overtaxing the infrastructure facilities at a relatively small and overcrowded border post. South African customs' officials stationed on the South African side of the border have less leverage (and no real stake on the transit bond) to alter the documentation they receive from their Mozambican counterparts. To observe corruption patterns at the border we track an additional set of 50 shipments going through the Mozambican border post. The data were captured by a randomly selected subset of 4 clearing agents out of a total of 10 established (formal) clearing agents working directly at the border post at the time of the data collection. The methodology of data collection was identical at the port and at the border post.

During this data collection exercise, emphasis was placed on capturing all formal and informal

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

[19] This typology of corruption differs from Shleifer and Vishny's (1993) distinction between corruption *with* and *without* theft. For our purposes, the main focus is on the effect of corruption on the user of the public service. Paying a bribe to evade tariffs and paying a bribe to speed clearance through the port represent forms of collusive corruption given that in both cases a rent is shared between the public official and the private agent. However, while the former is a clear example of corruption with theft, the latter represents a case of corruption without theft.

costs of moving goods through the ports and border post. The goal was to minimize the possibility of clearing agents strategically misreporting data on bribe payments. In this particular setting, however, there appeared to be limited stigma attached to the payment of bribes to port or border officials, since clearing agents reported that informal payments were perceived as a necessary payment made at the request of their client firms. Acting as mere intermediaries, clearing agents appeared to feel limited moral responsibility for their actions.

To cross-check the accuracy and reliability of the data collected, we conducted a randomized experiment that subjected clearing agents to randomly timed sequences of monitored and non-monitored data collection. Monitoring was conducted by locally-hired observers who shadowed clearing agents and reported on all legal and illegal payments made to port officials. The observers had experience in the shipping industry and were therefore familiar with all clearance procedures. To avoid any suspicion, the observers were also similar in age and appearance to any other clerk who normally assists clearing agents in their interactions with port officials. Clearing agents were then randomly assigned to monitored and unmonitored sequences of data collection for a total of 800 shipments. When shadowed, clearing agents revealed fewer instances of bribe payments (a 15% decline on average) and lower bribe amounts (a 0.4 standard deviations reduction). These results are robust to the inclusion of controls capturing the characteristics of the cargo, the client firm and clearing agent fixed effects. The general sense of the observers who participated in the experiment was that their presence had changed the nature of the interactions between the clearing agent and the public official, preventing certain illicit transactions from taking place. Interestingly, this effect was smaller in cases in which corruption may have been more "justified" such as when the bribe was being paid for tariff evasion. Since under these circumstances both parties were benefitting from the illicit transaction, public officials may have felt less embarrassment or shame when requesting a bribe in the presence of our observer. The results from this experiment are discussed in more detail in Sequeira (2013, 2014).

More generally, relying on reported evidence from subjects is common practice in studies of sensitive behavior. An extensive literature in psychology documents how self-administered questionnaires increase the willingness of respondents to report sensitive behavior in a variety of settings (Bradburn and Sudman 1979; Waterton and Duffy 1984; Groves 1989; Weinrott and Saylor 1991; Turner et al 1995; Barnett 1998). Furthermore, given that clearing agents were informed from the outset

that they could be monitored at some point, it is unlikely that they would try to strategically misreport information on bribe payments while they were not being monitored. In light of these experimental results and the conventional approach in the literature, we restrict our analysis to the data reported directly by the clearing agent, which enables us to measure expected bribes at each port for different types of imports.

3.2 Firm-level Transport Costs

To measure the transport cost incurred in by each firm in our sample when importing through the ports of Maputo and Durban we conducted a trucking survey, which covered a random sample of 220 trucking companies. Our sample includes both large and medium-sized licensed transport companies, but also smaller owner-drivers who were randomly sampled 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 the transport prices charged to client firms.[20] To ensure that we obtained accurate information on transport rates charged to firms, we conducted an additional "mystery client" exercise that involved contacting approximately 100 transport firms and requesting rates for a standard shipment of goods to each port.

To account for all 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 Road Agencies in both countries. We use these data to calculate precise transport costs between each firm in our sample and the two ports.[21]

3.3 Firm-level Transport Strategies

To identify firms' choice of port we conducted an enterprise survey that covered a random sample of 240 firms located in the overlapping hinterland of the ports of Durban and Maputo in 2007[22]

[20] This dataset allows us to identify not only the rates transport companies charge to firms, but also the actual costs they incur in.

[21] We concentrate on road transport costs since our enterprise survey revealed that less than 4% of the randomly selected firms surveyed in both South Africa and Mozambique used railroad or air transport services.

[22] This represented a subsample of the regional enterprise survey we conducted in 2007, which covered a total of 1,700 enterprises.

The survey elicited information on firms' perceptions of the quality of each port, their transport strategies, but also on the characteristics of their average shipments such as frequency, size and potential urgency, which was proxied by firm-level inventories. The sample was stratified by firm size and industry, covering both transport intensive and non-transport intensive firms. These data allow us to identify firms' choice of port conditional on their location, the potential urgency of their imports, the trucking costs they would incur in and the characteristics of their cargo.

3.4 Secondary Data Sources

To examine the determinants of bribe payments, we begin by matching each product in our tracking sample to its respective tariff grouping according to the South African and Mozambican tariff codes. In our setting, product tariff levels may affect the probability of an import 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 (Fisman and Wei 2004). 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 identify the mechanism through which tariffs affect bribe levels we rely on Rauch's (1999) typology 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. Previous studies have suggested that the difficulty of assessing the correct import price of a good increases the probability of corrupt behavior given that shippers have strong incentives to underreport the value of goods, while customs agents have an incentive to overvalue them.[23] To account for this possibility, we categorize all products in our tracking sample as being differentiated, part of an organized exchange or having a reference price. We then investigate whether differentiated products are associated with higher bribe levels due to the increased difficulty in assessing import prices.

[23] Javorcik and Narciso (2008) suggest that trade in differentiated products is correlated with higher tariff evasion due to the misrepresentation of import prices while Fisman and Wei (2004) find evidence of pervasive misclassification of tariff categories.

4 Bribe Payments at Ports

In Table 3 we present descriptive statistics of bribe payments at each port. The data reveal that bribes are high, frequent and not equalized across ports. The probability of paying a bribe is significantly higher in Maputo - nearly 53% compared to 36% in Durban -, and the amount of bribes paid is also 3 times higher.[24] In Maputo, the mean bribe paid 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 - on any route connecting Southern Africa to the Far East. However, when bribes are paid for tariff evasion, the bribe should instead be interpreted as buying a much greater reduction in tariff duties. The ratio of the bribe amount paid to the total tariff duty due is small (0.2%) and fairly stable across different tariff levels (see Figure 4). In Durban, the incidence of bribe payments is lower, but the mean bribe is still equivalent to a 32% increase in total port costs for a standard 20 ft container. This corresponds to a 4% increase in total shipping costs on routes connecting South Africa to the Far East.

Bribes are also high and significant when measured as a percentage of each bureaucrat's salary. The mean bribe in Maputo is equivalent to approximately 24% of the monthly salary of a customs' official, while in Durban, the mean bribe is equivalent to 4% of the monthly salary of a regular port operator (CPI adjusted at 2005 USD). 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% due to corruption. If we assume that because of higher volumes a 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]

[24] See Figure 3 for the distribution of bribes per container and per ton 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 and across time. We also collect information on any in-kind gifts to port officials in return for faster handling of cargo on the docks, 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] In these calculations we are assuming that officials retain the entire amount of the bribe instead of sharing it with other officials. While we are unable to directly assess the validity of this assumption, clearing agents participating in

Recipients of bribes and the reasons for bribe payments also vary significantly across ports. In Maputo, the primary recipients of bribe payments are customs' officials (80%) and the primary reason for bribe payments is tariff evasion (41%). In Durban, the primary recipients of bribes are clerks in the document department (38.5%) and security agents (24.34%) overseeing idle cargo on the docks, to prevent cargo from being arbitrarily moved from the general docks to expensive depots while waiting for clearance. This pattern of corruption is consistent with the hypotheses stated in section 2.

4.1 Estimating the Determinants of Bribe Payments

To examine the determinants of bribe payments, we begin by estimating the probability of a shipment paying a bribe given the characteristics of the cargo, the timing of the arrival of the shipment at each port and the characteristics of the client firm. In our main specification, the dependent variable is denoted by $Bribe_{ij}$, equalling 0 if no bribe is paid and 1 if a bribe is paid for the j^{th} shipment at port i. The vector of independent variables is

$$Bribe_{ij} = \beta_{1i} Tariff_{ij} + \beta_{2i}\, LargeFirm_{ij} + \beta_{3i}\, LStorage_{ij} + \beta_{4i} X_{ij} + \epsilon_{ij} \tag{1}$$

where $Tariff_{ij}$ represents the tariff level a given shipment falls under; $LargeFirm_{ij}$ is a dummy variable indicating that the shipment belongs to a large firm (defined as having more than 100 employees) and $LStorage_{ij}$ represents the natural log of the storage costs the shipment has to pay when held back at the port for more than 3 days. This equation is estimated separately for each port, with $i = 1$ representing imports going through Maputo, and $i = 2$ imports going through Durban. X_{ij} represents a vector of shipment and firm-level controls, which vary across specifications but include, among others, the frequency of each firm's shipments; a binary indicator of the perishability of the cargo; a variable denoting the deviation between the actual temperature the day the shipment arrives at the port and the average monthly temperature at the port (which could potentially affect perishable cargo); the natural log of the value of the shipment; the size of the shipment measured in tons; the terminal that processed the cargo; whether the cargo was pre-inspected at origin; whether the shipment included agricultural or consumer goods; whether

the tracking study perceived the bribe to be captured by a single official.

the shipment was containerized or bulk; and a dummy variable indicating if the product lacks a set international price according to Rauch's typology. Rauch's classification is at the 4-digit SITC level, which we match based on the concordance in Feenstra (1996). Standard errors are clustered at the level of the product's 4 digit harmonization code to allow for within product type correlation across time, while accounting for this coarser industry classification.

To investigate the determinants of the amount of bribe paid, a count model is more appropriate given the truncated nature of the dependent variable. We present results for a negative binomial since a Poisson model can be rejected at high levels of confidence due to overdispersion of the bribe amount outcome variable. In these specifications, the dependent variable is the natural log of the bribe amount paid, and the independent variables are identical to the main specification used to explore the determinants of the probability of a bribe payment.[26] Disturbances in this specification are also allowed to be correlated across products belonging to the same 4-digit harmonization code grouping.

4.2 The Determinants of Bribe Payments: Discussion

Tables 5 through 8 report the determinants of bribe payments at the ports of Maputo and Durban. In Table 5, columns (1) through (4) present the estimates for a linear probability model estimating the probability of paying a bribe in Maputo and columns (5) and (6) represent estimates of the probability of a shipment paying a bribe for a pooled sample of shipments going through both ports. In the latter specification, the coefficient of interest is the Maputo Port intercept and its interaction with a High Tariff indicator in columns (5) and (6) respectively. In Table 6, columns (1) through (3) present ordinary least square estimates of the amount of bribe paid, conditional on paying a bribe. Columns (4) through (8) present results from a negative binomial model. In columns (7) and (8) the specification is changed to provide estimates of the amount of bribe paid for a pooled sample of shipments going through both the port of Maputo and the port of Durban. In this specification, the coefficient of interest is the Maputo Port intercept and its interaction with a High Tariff indicator. Given the occasional difficulty in matching product descriptions to tariff groupings, in columns (4), (5) and (6) of Table 5 and columns (6), (7) and (8) of Table 6 we replace

[26] The dependent variable is log of the bribe amount paid plus 1.

the continuous variable denoting the tariff level the shipment falls under with a dummy variable indicating whether the tariff is high (above 20%) or low (between 0-10%). Storage costs are not included in the specifications reported in Tables 5 and 6 given that at the time of this study, the Maputo port offered 21 days of free storage to shippers relative to the 3 days offered in Durban. Given that the average clearance time was 8 days in Maputo, the cost of storage was effectively zero.[27]

We find that in Maputo moving from a low tariff rate of 2.5% to a high tariff rate of 20% increases the probability of a bribe payment occurring by 18%. A 1% increase in the tariff rate is also associated with an expected log count increase of 0.34 in the amount of bribe paid.[28] Larger firms are also associated with an increase in the probability of paying a bribe and with an increase in the amount of bribe paid, though the results are not always stable across specifications. We find no statistically significant effects on the probability of paying a bribe for differentiated products, for perishable products in high temperatures, for shipments inspected at origin, or for agricultural and consumer goods.

While we are not able to directly observe through which method customs' officials are able to sell tariff evasion, both primary and secondary data suggest that they may be underreporting quantities. First, we observe that being a differentiated product has no statistically significant impact on the probability of paying a bribe. Second, we calculate the trade gap -the difference between reported imports and reported exports- for trade flows occurring between South Africa and Mozambique in 2006 through 2010, as reported by UN Comtrade. This is a standard measure of tariff evasion used in the literature, given the assumption of differential reporting incentives across trading partners: exporters have less incentive to misreport values or quantities traded relative to importers. We find that the trade gap measured in terms of reported quantities is significantly larger in magnitude than the trade gap measured in values (see Figures 1 and 2 of the Online Appendix).

Taken together, both the descriptive statistics and the regression results confirm our hypotheses:

[27]The sample is reduced once we introduce the full set of controls, starting in column 3 of all tables. This is primarily due to variables such as the size of the shipment being reported in different units (eg: tons, units or number of containers) and to the absence of information on certain variables such as whether the shipment was subjected to pre-shipment inspections. Observations that are dropped are however not statistically different from those that remain in the sample in terms of general product and shipment-level characteristics.

[28]The results are robust to different functional forms including a probit or a logit model, as well as in the case of Tables 6 and 8 a standard ordinary least squares (OLS) regression in which the dependent variable consists of non-zero bribe payments (results not shown but available upon request).

bribes in Maputo are paid primarily to customs' officials who are in charge of receiving all tariff payments. It also 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 appears to be paying a bribe to evade tariffs, transit cargo is paying a bribe just to avoid an arbitrary increase in the transit bond of products that fall under a high tariff category, since no tariff evasion is possible for these imports in Maputo. Given that customs' officials' in Maputo are the high extractive types, we confirm that bribes are higher and more frequent in Maputo.

"Selling" tariff evasion is likely to be the highest yielding bribe extraction method available to customs' officials, since it can both reduce the informational costs of bribe-setting and the risk associated with the illicit transaction. From the perspective of the customs' official, whether the good falls under a high tariff category or not carries important information on a shipper's willingness-to-pay a bribe. A standard assumption is that all firms would be better off by evading a tariff so bribes should be an increasing function of tariff rates. All other bribe extraction tools can potentially yield lower bribe revenue, as they rely on observing shipment characteristics that carry only coarse information on a firm's willingness-to-pay. This basic information asymmetry can then force customs' officials to engage in a costly and time-consuming exercise of eliciting information on the time sensitivity of the firm's shipment, or on the firm's ability to pay a bribe. For example, the size of the shipment is an imperfect indicator of willingness-to-pay: large shipments may signal a firm carrying higher than average inventories with a lower willingness-to-pay a bribe to expedite clearance, or a large firm with a higher ability to pay for a faster service. A lengthy process of discovering both commitment to an illicit transaction and the reservation costs of a shipper increases both the risk and the cost of setting bribes. A corruption deal based on tariff evasion has the additional benefit of lowering the risk of detection of the illicit transaction through a second channel: given that both parties are implicated in the deal, neither side will have an incentive to deviate from it, resulting in a more credible commitment (Schelling 1956).

In Tables 7 and 8 we present the estimation results for shipments going through the port of Durban. The results suggest that the main determinant of the probability of a bribe payment at the port of Durban is the storage cost that the shipment incurs in if clearance is delayed. Doubling a shipment's expected storage costs from the mean increases the probability of a bribe payment by

30% and the amount of bribe paid by over 400%. The relationship between bribes and storage costs appears however to be strongly non-linear: as storage costs increase, the probability of paying a bribe and the amount of bribe paid decrease sharply. Storage costs are product specific and while most cargo would have up to 3 free days to remain in the general docks, port officials will often claim that due to congestion in the port (which is non-verifiable information for the clearing agent or the client firm), cargo has to be moved to more expensive depots. Similar to tariff evasion in Maputo, associating the bribe with potential storage costs in Durban also appears to combine the dominant features of reducing the informational cost of bribe-setting 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. Similarly, port operators are likely to consider that this is a cost firms will likely 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 observed by the client firm or the clearing agent. This allows 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 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 stay for free.[29]

Finally, we do not find any evidence that high-tariff or differentiated products have a higher probability of paying a bribe in Durban, consistent with our hypothesis that customs' officials have lower extractive capacity in Durban since there is no direct face-to-face interaction with clearing agents

[29]We make several further simplifying assumptions when interpreting our results. 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 due to wind patterns and congestion levels at the port, and for exports there is uncertainty as to when trucks can offload their cargo given road traffic and queuing at the entrance to the ports. Since port officials operate 6 to 8 hour shifts and no cargo can stay idle inside the port without the respective documentation being submitted, we consider that clearing agents are randomly assigned to different port officials. In fact, for a random sample of 94 shipments in the port of Maputo, we asked clearing agents to identify the last time they had interacted with the port official dealing with their shipment. Less than 20% of this sample reported interacting frequently with the same port official. We also do not consider the possibility of collusion between different port officials within each port as well as intertemporal bargaining dynamics. We choose to abstract from these dimensions given that we found no qualitative evidence of collusion between port officials. Bribes also vary significantly both across clearing agents, across shipments handled by the same clearing agent and across time. 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 explore any of these issues further in the current setting, with the existing data. These simplifying abstractions do not however affect our main results on the efficiency costs of corruption: our study was primarily designed to capture the total costs of corruption that are passed on to firms.

and all documentation is submitted online prior to the arrival of the shipments.

5 The Price Effects of Corruption

In this section we examine how firms respond to different types of corruption. According to standard price theory, demand for the public service should respond to changes in prices induced by corruption in predictable ways - collusive corruption would increase demand for the service, while coercive corruption would decrease it.

5.1 Estimating the Impact of Coercive Corruption on Choice of Port

To identify the impact of coercive corruption on firm behavior, we examine how South African firms choose between the ports of Durban and Maputo, based on their location and on the product that they are importing. 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 transport costs and expected bribes when deciding which port to use.[30]
To examine how corruption affects a firm's choice of port given its location, the level of urgency of its shipments and the characteristics of the cargo that render it more or less vulnerable to paying a coercive bribe in Maputo or in Durban, we estimate the following model:

$$\begin{aligned}\text{Maputo}_k = \alpha + \sigma\, Tariff\, Moz_k + \theta\, Tariff\, South\, Africa_k + \phi\, Transport_k + \\ + \lambda\, Large\, Firm_k + \gamma\, Low\, Inventories_k + \rho\, X_k + z_k \qquad (2)\end{aligned}$$

Our dependent variable is denoted by $Maputo_k$, which equals 1 if firm k chooses to ship through the port of Maputo and 0 otherwise. $Tariff\, Moz_k$ represents the tariff level category that the main input shipped by the firm would fall under according to the Mozambican tariff code if it uses the Maputo port, which determines the amount of the transit bond the firm will have to place. $Tariff\, South\, Africa_k$ represents the level of tariff due once the cargo enters South Africa, irrespective of whether the point of entry is the port of Maputo or the port of Durban. $Transport_k$

[30] Table 1 shows that cargo dwelling time is comparable across ports so we do not include clearance time in our analysis.

denotes the natural log of the ratio of total transport costs to Maputo over transport costs to Durban for each firm in the sample (transportation costs include the cost of road transport, all port charges, tolls and border fees); $Large\,Firm_k$ is a dummy variable indicating a large firm (defined as having more than 100 employees) and $Low\,Inventories_k$ corresponds to a dummy variable indicating whether the client firm has a below average inventory level given its size and industry grouping, as a proxy for the urgency of its shipments. X_k consists of a vector containing firm-level controls that differ across specifications including the frequency of a firm's 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; the average value of the product shipped; the value of the product interacted with the distance the shipment has to travel to the port of Maputo and whether the product represents a differentiated good according to Rauch's (1999) classification. Standard errors are allowed to be correlated at the level of the 4-digit harmonization code of the product being shipped.

5.2 Corruption and Choice of Port: Discussion

Table 9 reports the estimation results from equation 2. Column (1) represents the base specification, while in column (2) we augment the model to investigate whether there is a differential effect of distance on the choice of port when a firm is transporting valuable cargo. To account for any possible mismatch between products and tariff groupings, in column (3) we capture the tariff category the product falls under through a dummy variable equalling 1 if the product falls under a tariff category above 20% and 0 if the tariff is between 0-10%. To mitigate concerns with the endogenous location of firms relative to the port of Maputo, in column (4) we restrict our sample to firms established 11 years before the port of Maputo reopened to international traffic (one year prior to the end of the civil war). To account for the smaller sample size we implement a bootstrap regression model, with 1000 replications. This approach does not require any distributional assumptions about the error term. In column (5) we present the results for a probit model, with the reported coefficients representing marginal effects. We find that the tariff level a product falls under in Mozambique is negatively associated with the probability of a South African firm choosing the port of Maputo. The coefficient implies that moving from importing a product with a 2.5% tariff rate

to importing a product with a 20% tariff rate in Mozambique, the probability of choosing the port of Maputo declines by approximately 13% (column 2). These results are robust to the inclusion of all controls (including higher level polynomials for shipment value and distance) and interactions between distance, importer status and product value. In column (4) we observe that the bootstrap standard errors of the high tariff coefficient are not significantly larger than the asymptotic standard errors of columns (1) through (3). The marginal effects reported in column (5) are also consistent with the standard ordinary least squares results.[31]

The only channel through which the Mozambican tariff schedule can affect South African firms' choice of port is through its effect on the transit bond. In the absence of corruption in customs in Maputo, the tariff code of neighboring Mozambique should in theory not play a role in determining South African firms' choice of port. Paying a high or low transit bond (depending on how the product is classified by the Mozambican customs' officials) does not create any further delays or require any additional documentation for the cargo to move through the port of Maputo. The clearing agents who participated in this study confirmed that while transit bond procedures are in principle straightforward and easy to implement, when handling high-tariff cargo, 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 due. According to South African firms, the exact amount of the bond they would have to pay was not revealed by Mozambican customs' agents until the cargo reached the port or the border post. Given that corrupt officials at the port of Maputo are targeting high tariff goods to attempt to extract a bribe, South African firms shipping goods that happen to fall under a high tariff classification in Mozambique choose to avoid the coercive corruption they face in Mozambique and ship through the port of Durban instead.

While we are unable to firmly establish the underlying mechanisms, we provide two potential reasons for why customs' officials in Mozambique do not discriminate between transit and local cargo when setting bribes, despite differences in the elasticity of demand for each type of service. 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. As a result, officials do not fully

[31] Results remain fairly unchanged when we replace the high tariff dummies with the respective continuous variables across the different specifications.

internalize the cost of demanding high bribes from firms with a high elasticity of demand. On the other hand, adopting more sophisticated bribe-setting strategies that discriminate between transit and local cargo could potentially increase the probability of detection of the illegal transaction, as the different shipments may be handled by the same clearing agents. While this hypothesis was suggested by the clearing agents participating in our study, we are unable to test it further with our data.

These results suggest that even when accounting for distance, perishability and the urgency or value of the shipment, the expected bribe is a strong predictor of a firm's choice of port. For 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 if they went through Maputo. Of these, 75% are shipping perishable cargo and 74% are shipping urgent cargo. To illustrate the impact of coercive corruption, take a firm located in the town of Nelspruit, the capital of the province of Mpumalanga in northeastern South Africa. This firm is 171 kms from the port of Maputo and 992 kms from the port of Durban. If the firm happens to import a high tariff good, this firm is 13-21% more likely to double its overall costs to ship through Durban instead of Maputo.[32] For firms that re-route to the least corrupt port, this cost can add up to an 8% overall increase in yearly transport costs relative to a firm that ships cargo that is less vulnerable to corruption.[33]

The "diversion costs" of corruption for each individual firm are on average three to four times higher than the actual bribe collected by the customs' official in Maputo.[34] This puzzling result suggests that firms are averse to the uncertainty associated with coercive bribe payments in Maputo. Consistent with this observation, conditional on being a targeted firm, the coefficient of variation of the distribution of bribes per ton is higher at the more corrupt port of Maputo (3.63) relative to the port of Durban (1.5) (See figure 3). The high variance of bribes in Maputo is the key driver of this result: assuming that firm managers have standard CARA utility functions, even very low

[32]This accounts for road tolls, trucking charges, port costs and expected bribes in Durban.

[33]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 the average prices paid for trucking services along each corridor, all of which were elicited through our firm and trucking surveys.

[34]A firm located in the city of Nelspruit, would incur in an additional cost of approximately 1,000 USD to transport a 27 ton, 20 foot container to the port of Durban relative to transporting the same container via the port of Maputo, even when accounting for trucking costs and all border fees. The increase in transport costs is therefore three to four times higher than the average bribe the firm might have to pay

values of risk aversion (below 1) would already predict that firms would switch to Durban over Maputo at the point in the transport network in which total costs -transport plus average bribe- would be equalized.

This uncertainty aversion was further confirmed by survey data and a likely explanation is that in an environment of higher and more unpredictable bribes, the asymmetry of information that exists between firms, clearing agents and port officials with respect to bribe payments becomes more salient, making firms more reluctant, and less able, to guarantee the necessary liquidity for clearing agents to make all required payments. These results are consistent with an extensive literature suggesting the crippling effect of unpredictable corruption on business activity (Shleifer and Vishny 1993; Bardhan 1997; Campos, Lien and Pradhan 1999; Dierdimer and Pritchett 2010).

Our main result on the impact of corruption on a firm's choice of port is robust to different functional forms. Figure 5 shows a non-parametric regression 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 of transport cost equivalence between the two ports (1). Instead, what we observe is that at that point, South African firms importing goods that are more vulnerable to corruption at the port of Maputo will avoid it, relative to firms importing goods that are less vulnerable to corruption. In this figure, low and high bribe goods are those that fall under a low and high tariff category in Mozambique, respectively. This pattern of port choice driven by high and low tariff products is incompatible with an alternative explanation suggesting that firms are avoiding the port of Maputo altogether due to any quality or capacity concerns.

The distortion created by this "diversion" effect can be further magnified if we move to a general equilibrium framework. Every time a firm re-routes its imports away from the most corrupt port it imposes a negative externality on other firms, adding to congestion in the least corrupt port and contributing to fewer and more imbalanced cargo flows to the more corrupt one. Given that imports are more likely to be stopped by customs' to extract a bribe, there is more outbound than inbound cargo on the Maputo corridor. These imbalanced flows of cargo drive higher overall transport costs on the Maputo corridor. Our trucking survey confirmed that even 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. 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.[35] Although 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 are likely to play a role.[36] As a clear example of how the distortions in demand for the public service introduced by coercive corruption represent an important cost for firms, in the absence of any corruption, the overall transport costs (road plus port) for the average South African firm located closer to Maputo would be halved. Note also that our analysis in he previous section (5.1) already accounts for these higher trucking prices for cargo shipped through Maputo. To the extent that these higher prices may be partially driven by corruption, our estimates of the diversion effect should be interpreted as the lower bound of the impact of corruption on trade costs.

6 Robustness Checks

A potential concern with our analysis of the impact of corruption on choice of port is that differences in corruption levels across the ports of Maputo and Durban could be driven by the distribution of shipments they handle and not by any port-level characteristic. The problem arises if in a dynamic model of transport corridor choice, assortative matching takes place between firms' cargo or shipment characteristics and the unobservable characteristics of each port. If bribe payments are also correlated with these unobservables, we would mistakenly identify certain cargo characteristics as the drivers of corruption patterns. In Table 10 we present the distribution of relevant shipment characteristics going through each port, including the p-values from a two sample t-test and a two sample chi-square test for important variables such as the shipment value and size, as well as the percentage of consumer and high tariff goods. With the exception of the value per tonnage and whether goods are differentiated or not, variable means are close and none of the p-values suggest significant differences at conventional levels. Given the statistically significant difference

[35]The distances and the quality of of the roads are comparable in both corridors. The Maputo-bound toll highway was built in 2002 and is privately managed by a South African and Mozambican consortium. The Durban bound road is part of the South African highway system.

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

in three characteristics - value, differentiated and consumer goods- for shipments going through Durban and Maputo, we conduct further tests of the sorting hypothesis. In Tables 5 and 6 we also present estimates of the probability of paying a bribe and the amount of bribe paid for a pooled regression that controls for these characteristics, in which the intercept corresponding to the Maputo Port is always positive and statistically significant. We also confirm that being a high tariff good differentially affects cargo going through the port of Maputo, lending further support to our institutional argument that it is the port that drives differences in bribe patterns, instead of the distribution of shipments.[37]

When we analyze a firm's choice of port, we face a clear endogeneity concern: the pattern of bribe payments at each port may have influenced a firm's geographic location or its type of business, and consequently, the type of input it imports. To address this selection issue, we restrict our sample to firms that were already established up to 11 years before the Maputo port became a viable option for international transit in 2004, when Mozambique was still in the midst of a civil war. The coefficients of interest are unchanged when we use the restricted versus the full sample (Table 9, columns 4 and 5). Furthermore, Table 2 also shows p-values for a two sample t-test with unequal variances and a chi-square test for important observable characteristics of firms located close to ports and those located inland. In all cases, we fail to reject at conventional levels that these two types of firms are similar both with regards to firm-level characteristics (size, export behavior, number of employees in 2003 and 2007, sales levels and days of inventory) and to the type of inputs they source (average tariff level in Mozambique, tonnage of average shipment, perishability, among others).

A related selection concern emerges if the differences in corruption we observe across ports is driven by the composition of shipments sampled from Durban and Maputo. This is an important concern, particularly in light of the results discussed in section 4, whereby corruption at the Port of Maputo appears to be an important determinant of the type of products South African firms ship through the different ports. However, South African cargo represents approximately only 10% of the total cargo handled at the port of Maputo, suggesting that it is unlikely that the composition of South

[37]Ideally, we would include in our specification a variable measuring the distance each shipment traveled to reach the port. Due to constraints related to the disclosure of the identity of the firm, we only captured this indicator for a randomly selected subset of 60 shipments. As shown in Table 3, we find no evidence in this sub-sample that distance is correlated with bribes.

African imports are significantly shaping the random sample of trade flows captured by our tracking study in Maputo.

6.1 The Impact of the Border Post

We also explore the existence of additional constraints to shipping imposed by the border post between Mozambique and South Africa, and how these could dissuade South African firms from shipping through a port located in a different country, independent of corruption patterns. To test this hypothesis, we investigate 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 the port of 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 the port of Maputo, this is more than offset by the higher congestion and delays they experience 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 that we used at the ports. Our sample was considerably smaller reflecting the relatively smaller volume of trade flows going through the border. Our sample corresponded mostly to import cargo, either in transit from the port of Maputo to South Africa or South African cargo having Mozambique as its final destination. Given the small size of our sample, we are unable to disaggregate these two types of trade flows in our analysis. Our assumption is that these two types of cargos are similarly vulnerable to bribe extraction, as was the case at the port. The main difference however is that for cargo in transit, customs' officials at the border post have in theory considerably less latitude to extract bribes than customs' officials at the port given that the initial decision on the level of the transit bond and the level of risk associated with the cargo is made at the port. Border

officials are, however, still in a position to raise questions about the validity of the transit bond or to threaten with a lengthy physical inspection of the cargo, which can slightly delay the release of the cargo and consequently the refund of the bond to the firm. Note that these bribes are paid on the Mozambican side of the border for cargo in transit from the port of Maputo into South Africa. South African customs' will have received each shipment's documentation online and are not responsible for the transit bond.

Consistent with our findings at the port, increasing the tariff level of a shipment by 1% increases the amount of bribe paid by approximately 3% (Table 13).[38] As expected, bribes at the border post are smaller in magnitude but highly variable (approximately 14 USD for the average shipment with a standard deviation of 22 USD). This corresponds to about 5% of the average bribe amount recorded at the port. These results suggest that corruption patterns are similar between the port and the border post, and that the border effect appears to reinforce the high corruption costs associated with shipping higher tariff goods through the Maputo corridor.

7 Conclusion

In this paper we take an unusually close look at how different types of corruption affect firm behavior. Our empirical setup and the level of detail in our data allow us to observe the entire chain of bribery: frontline bureaucrats setting bribes within the constraints imposed by the bureaucracies under which they operate, and firms deciding how to respond to different bribe schedules.

First, we find that bureaucrats engage in different types of corruption, coercive or collusive, presenting firms with different sets of constraints and opportunities. Second, we find that demand for the public service can be directly affected by cost-reducing collusive corruption or cost-increasing coercive corruption. Our results suggest however that firms' responses to changes in corruption prices can differ from changes in other factor prices, particularly when there is uncertainty associated with the price of bribes. In the most extreme case in our sample, the cost for a firm to go the long way around to avoid uncertain coercive corruption could be up to three times higher than the cost of the actual bribe demanded at the most corrupt port. Survey data revealed that firms were willing to incur in higher transport costs to avoid the uncertainty surrounding coercive bribe

[38] Standard errors for this smaller sample are bootstrapped with 1,000 replications.

payments at the most corrupt port.

Third, we provide suggestive evidence on how the cost of corruption to the economy can go beyond the transfer of money between a private agent and a public official. A striking example is the fact that coercive corruption increased transport costs in the region by contributing to imbalanced cargo flows. Collusive corruption on the other hand can significantly reduce government revenue. In our setting, the impact of this type of corruption on tariff revenue was equivalent to a 5 percentage point reduction in the average nominal tariff rate. Interestingly, the average bribe paid corresponds to only 0.2% 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 the "Tullock Paradox": that bribes are small relative to the size of the corresponding rent they can buy.

There are several important implications of this analysis for the study of corruption and for the design of anti-corruption policies. First, we argue that incentives for corrupt behavior are partly 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 port 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 to emerge. Second, our findings suggest that different public officials employ similar rules of thumb to discriminate between high and low-bribe shipments. Understanding the motivation behind the choice of price discriminating strategies 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 delivery of the public service. Moreover, understanding the difference between collusive and coercive forms of corruption, and consequently how rents associated with bribery deals are distributed between public officials and private agents is important insofar as it can ultimately determine the degree of support anti-corruption policies will elicit from both private sector agents and the public officials charged with enforcing them. Lastly, our findings suggest that corruption can affect the economy in many direct and indirect ways that cannot be accounted for exclusively by standard price theory. Depending on the the type of corruption bureaucrats engage in, bribes can increase or decrease demand for the public service, with important implications for economic activity but also generate deadweight

loss and reduce government revenue.

The goal of this paper is to begin to document the static inefficiency of corruption in transport networks and its potential costs. How corruption can in the long-run affect the number of firms participating in international trade, the volume of trade they engage in and their growth trajectories, remains an exciting area for future research.

8 References

Amjadi, Azita. and Alexander J. Yeats. 1995. "Have Transport Costs Contributed to the Relative Decline of Sub-Saharan African Exports: Some Preliminary Empirical Evidence", *World Bank Policy Research Working Paper N 1559*

Barnett, Julie. 1998. "Sensitive questions and response effects: an evaluation", *Journal of Managerial Psychology*, Vol. 13, Issue: 1/2, pp.63 - 76

Bertrand, Marianne, Simeon Djankov, Rema Hanna and Sendhil Mullainathan. 2007. "Obtaining a Driver's License in India: An experimental Approach to Studying Corruption", *Quarterly Journal of Economics*, vol. 122:4, pp 1639-1676

Bradburn, Norman M and Sudman, Seymour. 1979. *Improving interview methods and questionnaire design.* San Francisco: Jossey-Bass Publishers

Campante, Filipe, Davin Chor, and Quoc-Anh Do. 2009. "Instability and the Incentives for Corruption", *Economics and Politics*, vol. 21 (1), pp. 42-92

Campos, J. Eduardo, D. Lien and S. Pradhan. 1999. "The Impact of Corruption on Investment: Predictability Matters", *World Development*, 27 (6): 1059-67

Clark, Ximena, David Dollar, and Alejandro Micco. 2004." *Port Efficiency, Maritime Transport Costs and Bilateral Trade*", NBER Working Paper No. W10353

CSIR. 2005, 2006. *"Study of Logistics and Transport Costs in South Africa"*

Crump, Richard K, V. Joseph Hotz, Guido Imbens and Oscar Mitnik. 2009. "Dealing with Limited Overlap in the Estimation of Average Treatment Effects" *Biometrica*

Djankov, Simeon, Caroline Freund, and Cong S. Pham. 2008. "Trading on Time", *The Review of Economics and Statistics*

Dutt, Pashun and Daniel Traca. 2010. "Corruption and Bilateral Trade Flows: Extortion or Evasion" *Review of Economics and Statistics*, November 2010, Vol. 92, No.4

Feenstra, Robert. 1996. *U.S. Imports, 1972-1994: Data and Concordances*,NBER Working Paper 5515

Fisman, Raymond and Jakob Svensson. 2007. "Are corruption and taxation really harmful to growth? Firm-level evidence", *Journal of Development Economics*, vol. 83 (1), pp. 63-75

Groves, Robert. 1989. *Survey Errors and Survey Costs*, New York: John Wiley and Sons, 1989

Hummels, David. 2008. "Transportation Costs and International Trade over time" *Journal of Economic Perspectives*, American Economic Association, vol. 21(3), pp. 131-154

Huntington, Samuel P. 1968. *Modernization and Corruption: Political Order In Changing Societies*, New Haven: Yale University Press, pp. 59-71

Javorcik, Beata S. and Gaia Narciso. 2007. "Differentiated products and evasion of import tariffs," *Policy Research Working Paper Series 4123*

Krueger, Anne O. 1974. "The Political Economy of the Rent-seeking Society" *American Economic Review*, Vol. 64, No.3, pp. 291-303

Lee, Raymond. 1993. *Doing Research on Sensitive Topics*, London: Sage

Leff, Nathaniel H. 1964. "Economic Development Through Bureaucratic Corruption" *American Behavioral Scientist*, VIII(3), pp. 8 -14

Lui, Francis. 1985. "An Equilibrium Queuing Model of Bribery", *Journal of Political Economy*, 93, pp. 760-781

Maachi, Patricia and Sandra Sequeira. 2009."L'Infrastructure de Transport "Immaterielle" des Ports de Maputo et Durban". *Afrique Contemporaine*, no 230, pp. 69-82

Limao, N. and A. Venables.2001. "Infrastructure, Geographical Disadvantage, Transport Costs and Trade,", *World Bank Economic Review* 15, p.451-479

Niehaus, Paul and Sandip Sukhtankar. (forthcoming) "Corruption Dynamics: The Golden Goose Effect", *American Economic Journal: Economic Policy*

Olken, Benjamin. 2007. "Monitoring Corruption: Evidence from a Field Experiment in Indonesia", *Journal of Political Economy* 115, no.2; pp. 200-249

Olken, Benjamin and Patrick Barron. 2009."The Simple Economics of Extortion: Evidence from Trucking in Aceh", *Journal of Political Economy*, vol. 117(3), pp 417-452

Olken, Benjamin A. 2009."Corruption perceptions vs. corruption reality," *Journal of Public Economics*, Elsevier, vol. 93(7-8), pp. 950-964

Rauch, James. 1999. "Networks versus Markets in International Trade" *Journal of International Economics* vol.48, pp. 7-35

Rose-Ackerman, Susan. 1978.*Corruption: A Study in Political Economy*, New York: Academic Press

Schelling, Thomas. 1956. "An Essay on Bargaining" *The American Economic Review*, vol. 46, No. 3, pp. 281-306

Sequeira, Sandra. 2011. "Tariffs and Corruption: Evidence from a Trade Liberalization Program", London School of Economics, mimeo

Sequeira, Sandra. 2012. "Advances in Measuring Corruption", eds Danila Serra and Leonard Wantchekon, *New Advances in Experimental Research on Corruption*, Emerald Publishing

Shleifer, Andrei and Robert W. Vishny. 1992. "Pervasive Shortages under Socialism", *RAND Journal of Economics*, XXIII, pp. 237-246

Shleifer, Andrei and Robert W. Vishny. 1993. "Corruption" *Quarterly Journal of Economics* vol. 108, no. 3, pp. 599-617

Stigler, George. 1974. "A Theory of Oligopoly", *Journal of Political Economy*, LXXII, pp. 44-61

Svensson, Jakob and Ray Fisman. 2003. "Who must pay bribes and how much? Evidence from a cross section of Firms" *Quarterly Journal of Economics* vol. 118 (1), pp. 207-230

Svensson, Jakob. 2005. "Eight Questions about Corruption" *Journal of Economic Perspectives*, 19:3, pp. 19-42

Turner, CG, L. Ku, S. M. Rogers, L. D. Lindberg, J.H.Pleck, F.L.Sonenstein. 1995. "Adolescent Sexual Behaviour, Drug Use and Violence:Increased Reporting with Computer Survey Technology', Science, vol. 280, pp.867-873

Waterton, Jennifer and John Duffy. 1984."A Comparison of Computer Interviewing Techniques and Traditional Methods in the Collection of Self-Report Alcohol Consumption Data in a Field Survey", *International Statistical Review*, Vol. 52, No. 2 (Aug., 1984), pp. 173-182

Weinrott Mark and Maureen Saylor. 1991. "Self-report of crimes committed by sex offenders", *Journal of Interpersonal Violence*; 6: pp. 286-300

Yang, Dean. 2008. "Integrity for Hire: An Analysis of a Widespread Customs Reform" *Journal of Law and Economics*, Vol. 51, No. 1, pp. 25-57

World Bank. 2011. *Doing Business Report*

9 Figures

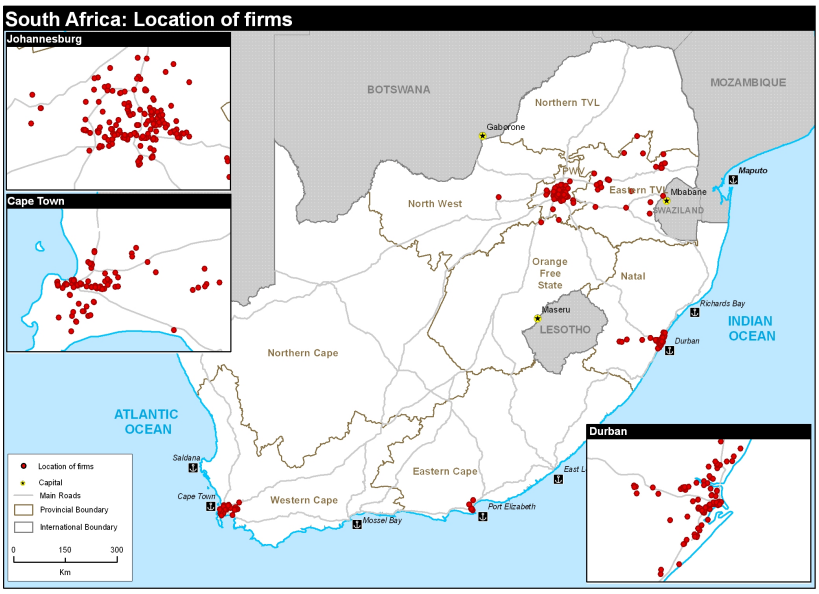

Figure 1: Map of Southern Africa and the ports of Maputo and Durban. The dots correspond to the firms covered in our regional enterprise survey conducted in 2007

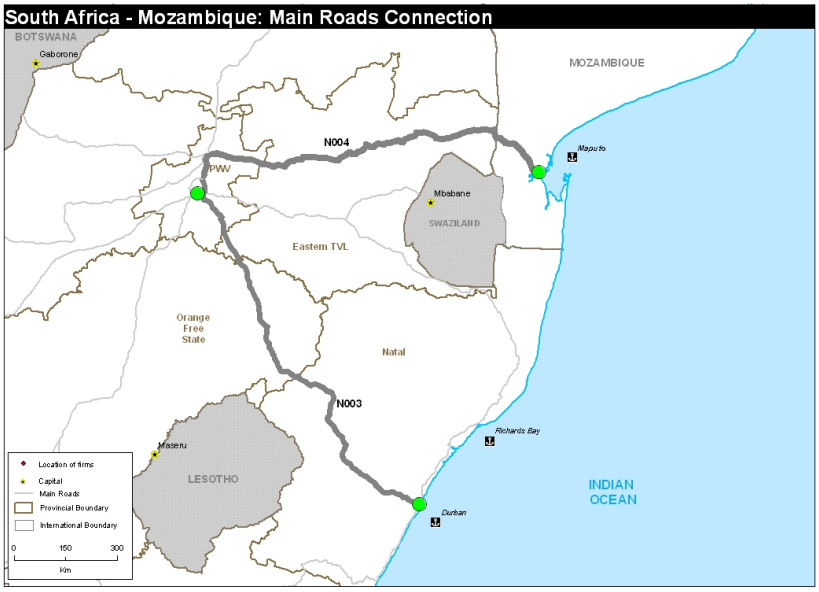

Figure 2: Road network connecting the hub of economic activity in South Africa to the ports of Maputo and Durban. The thick lines correspond to the main highways. There is no road that can competitively connect Maputo directly to Durban.

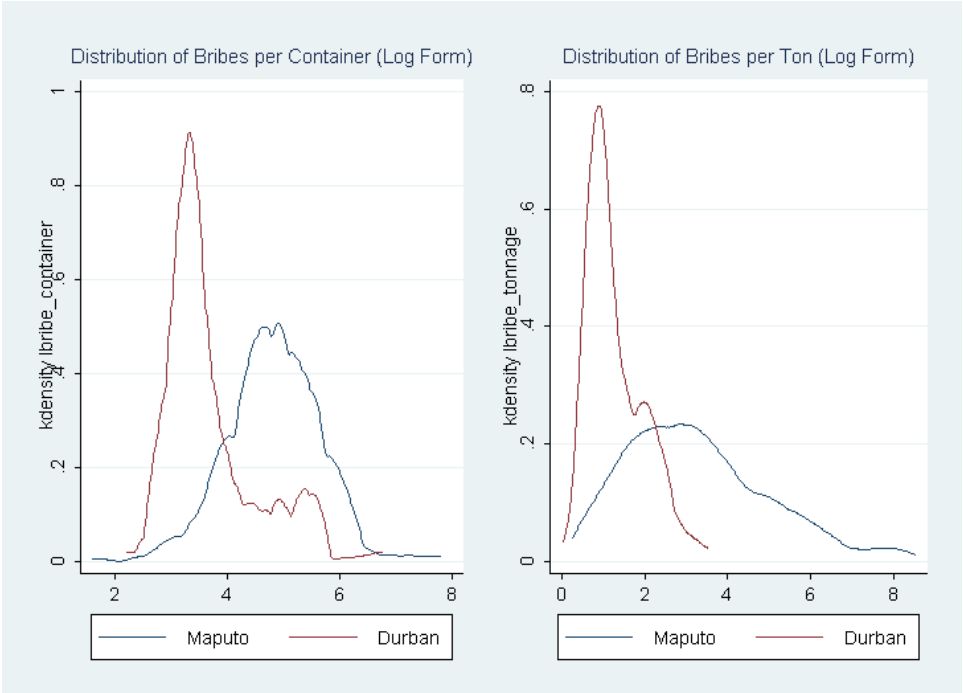

Figure 3: Distribution of bribes across the ports of Durban and Maputo.

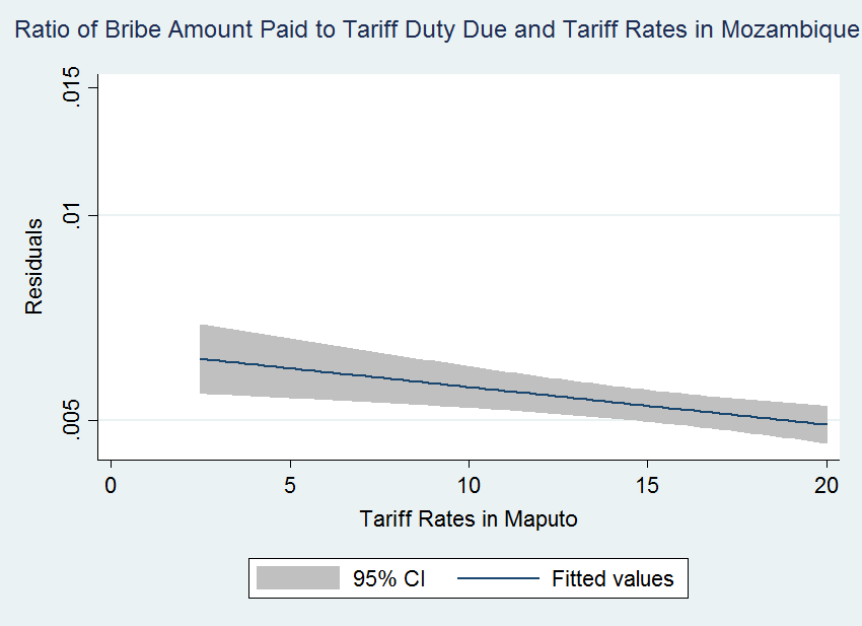

Figure 4: Relationship between the ratio of bribe amounts paid to total tariff due, and tariff rates. Y-axis: Residuals from regressing the ratio of bribe amount paid to the total tariff duty due, controlling for observable cargo-level characteristics (listed in equation 1), X-axis: Natural log of tariff rates. Bribe rents as a percentage of total tariff duties due experience only a slight decline as tariff rates increase.

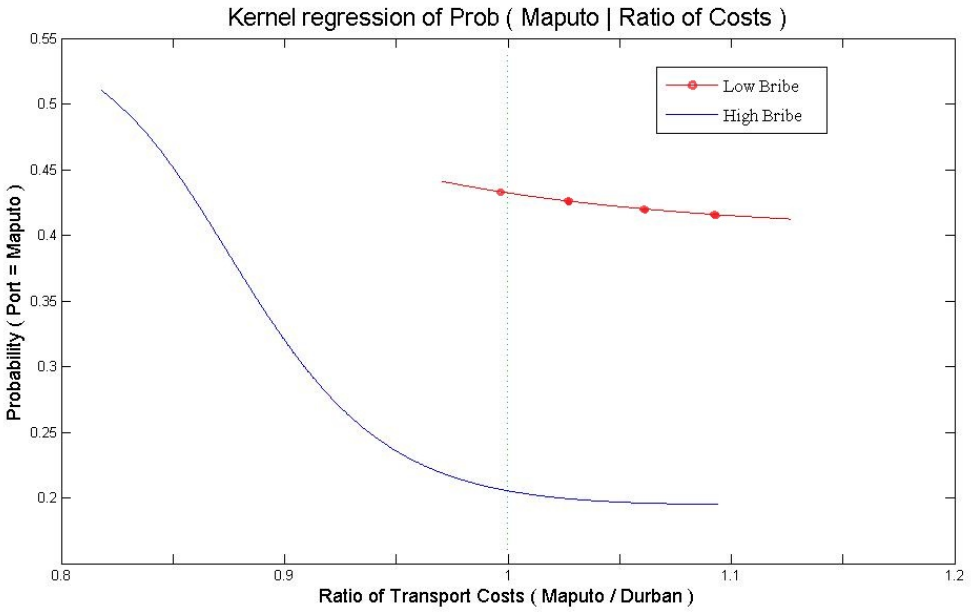

Figure 5: Non-parametric kernel regression of the probability of a South African firm choosing Maputo (y-axis) on the log of the ratio of total transport costs for an average 20 foot container traveling to Maputo over the total costs for the same container to travel to Durban (x-axis). Total transport costs include trucking costs, border fees and port fees for each corridor. The point of transport cost equivalence between both ports is 1. 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.

10 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
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

[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 240 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. 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 used to describe the capacity of container ships and container terminals, which is indexed to the volume of a 20 ft container.

Table 2: **Firm Characteristics by Distance to the Ports**

	Ports Mean	**SD**	**Inland Mean**	**SD**	**P-value Inland=Port**
Value of Inputs	23,176	2,165	19,323	1,449	0.13
Tariff Level of Inputs in RSA	9	1.32	9	1.1	0.17
Sales in 2007	3,287,684	652,504	11,700,000	2,323,278	0.13
Number of Employees in 2007	68	11.6	84	12.86	0.57
Number of Employees in 2003	54	10.67	73	12.99	0.56
Size of Inventory	28	2.5	23	1.7	0.18
Avg Days of Inventory	16	3.3	20	4.4	0.49
Avg Days to Clear Customs	6.3	3.2	6.7	0.77	0.84
Tonnage of Average Shipment	54	31.9	41	12.8	0.67
Log Storage Costs	5.3	0.06	5.3	0.04	0.83

	Ports Percentage	**Inland Percentage**	**P-Value Inland=Port**
Large Firm	24	25	0.81
Firm Exports	26	25	0.72
Non-containerized Cargo	49	42	0.18
Perishable Cargo	5	3	0.21
High Tariff Cargo in Mozambique	37	26	0.18
Differentiated Goods	16	20	0.42

[a] Source: Tracking Study at Maputo and Durban ports. Upper Panel: P-value for t-test of equality of means between firms located inland and those close to ports, with unequal variances. Lower Panel: P-value for Chi-Square test.

Table 3: **Summary Statistics of Bribes 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/from East Africa	37%	13%
Mean Bribe as a % of ocean shipping to/from the 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

[a] Source: Tracking Study at Maputo and Durban ports. *Based on a sub-sample of 60 firms.

Table 4: **Variable Description**

VARIABLE	DESCRIPTION
Tariff Level Maputo	Tariff level the shipment falls under according to the Mozambican tariff code *Source:* Mozambican Customs
Tariff Level Durban	Tariff level the shipment falls under according to the South African tariff code Source: South African Customs
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 Tonnage	Natural log of shipment tonnage. Source: Tracking Study
Perishable Product	Coded 1 if products belong 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
Log Storage Costs	Natural log of expected storage costs, as estimated by the clearing agent prior to the arrival of the cargo on the docks. *Source:* Enterprise Survey; Rauch (1999)
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
Frequency of Shipments	Average number of days between each firm's shipments *Source:* Enterprise Survey, IFC 2007
Low Inventory Dummy	Equals 1 if firm has average days of inventory below the mean for its size and industry group *Source:* Enterprise Survey, IFC 2007
Log Relative Transport Cost to Durban	$\frac{DM*RM+PM}{(DD*RD+PD)}$ *Source:* Enterprise Surveys, Trucking Surveys, IFC and World Bank, 2007
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 5: **Determinants of Bribe Payments at the Port of Maputo**

	LPM	**LPM**	**LPM**	**LPM**	**LPM**	**LPM**
Dependent					Pooled	Pooled
Variable: *Bribe Paid*	(1)	(2)	(3)	(4)	(5)	(6)
Log Tariff Level	0.167***	0.143***	0.194***			
	(0.016)	(0.022)	(0.038)			
High Tariff Dummy				0.280**	0.099**	0.04
				(0.14)	(0.05)	(0.05)
Large Firm		0.012	0.16**	0.22**	0.1**	0.1**
		(0.046)	(0.077)	(0.089)	(0.04)	(0.04)
Differentiated Product		0.152**	0.173	0.146	-0.01	-0.003
		(0.075)	(0.11)	(0.14)	(0.05)	(0.05)
Maputo Port					0.19***	0.12**
					(0.05)	(0.06)
Maputo Port * High Tariff Dummy						0.2**
						(0.09)
Controls						
Value of Shipment	No	Yes	No	No	No	No
Value per Tonnage	No	No	Yes	Yes	Yes	Yes
Pre-inspected Shipment	No	Yes	Yes	Yes	Yes	Yes
Consumer Product	No	Yes	Yes	Yes	Yes	Yes
Agricultural Product	No	Yes	Yes	Yes	Yes	Yes
Terminal	No	Yes	Yes	Yes	No	No
Shipment Date	No	Yes	Yes	Yes	No	No
Temperature Controls	No	Yes	Yes	Yes	No	No
Temperature Controls*Perishable	No	Yes	Yes	Yes	No	No
Observations	741	403	96	96	655	655
F-test	103	12.82	9.18	5.4	9.16	10.35
Adjusted R2	0.22	0.26	0.37	0.194	0.12	0.12

[a] Source: Tracking Study at Maputo and Durban ports. Note: Dependent Variable corresponds to a dummy variable that equals 1 if a bribe was paid and 0 otherwise. LPM stands for Linear Probability Model. Results are robust to different specifications such as logit and probit models. Log Tariff Levels corresponds to the natural log of the tariff level the product falls under; High Tariff Dummy equals 1 if tariff level is greater than 20%, and 0 if tariff level is between 0-10%, Differentiated Product corresponds to 1 if the product does not have a set price in international markets according to Rauch's (1999) categorization (conservative) and 0 otherwise; Large Firm equals 1 if the shipper is a large firm (defined as having more than 100 employees). Columns (5) and (6) represent estimates from a pooled sample of shipments going through both ports (these results are robust to the inclusion of the full set of controls, though it will significantly reduce the sample size). Pre-inspected Shipment equals 1 if shipment was subjected to a pre-shipment inspection, temperature controls include both deviations from monthly temperatures and precipitation levels on the day of arrival of the shipment. Standard Errors clustered at the 4 digit harmonization code level and in parentheses. All regressions include clearing agents controls. Significant at *** 1%, **5%, and *10%.

Table 6: **Determinants of Bribe Payments at the Port of Maputo**

Dependent Variable:	**OLS**	**OLS**	**OLS**	**Neg. Binomial**	**Neg. Binomial**	**Neg. Binomial**	**Neg. Binomial** Pooled	**Neg. Binomial** Pooled
Log Bribe Amount	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Tariff Level	0.91***	0.89***	0.91***	0.33***	0.34***			
	(0.09)	(0.1)	(0.15)	(0.04)	(0.07)			
High Tariff Dummy						0.41***	0.17	0.03
						(0.19)	(0.10)	(0.13)
Large Firm Dummy		0.28	0.83	0.13	0.4***	0.36***	0.18	0.19*
		(0.19)	(0.33)	(0.09)	(0.15)	(0.14)	(0.11)	(0.11)
Differentiated Product		0.53	0.27	0.17	-0.008	0.04	-0.06	-0.12
		(0.33)	(0.53)	(0.10)	(0.2)	(0.2)	(0.12)	(0.12)
Maputo Port							0.7***	0.57***
							(0.13)	(0.16)
Maputo Port*High Tariff Dummy								0.42**
								(0.2)
Controls								
Value Shipment	No	Yes	No	Yes	No	No	No	No
Value per Tonnage	No	No	Yes	No	Yes	Yes	Yes	Yes
Pre-inspected Shipment	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Consumer Product	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Agricultural Product	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Terminal	No	Yes	Yes	Yes	Yes	Yes	No	No
Shipment Date	No	Yes	Yes	Yes	Yes	Yes	No	No
Temperature Controls	No	Yes	Yes	Yes	Yes	Yes	No	No
Temp. Controls*Perishable	No	Yes	Yes	Yes	Yes	Yes	No	No
Observations	644	585	187	585	187	187	641	641
F-Test	85.17	14.65	8.95					
Adjusted R2	0.23	0.27	0.27					
Log Pseudo Likelihood				-1249.46	-402.07	-411.6	-1150.57	-1149.53
Wald Statistic				108.33	46.97	27.85	54.03	74.15

[a] Source: Tracking Study at Maputo and Durban ports. Note: Dependent variable corresponds to the natural log of bribe amounts (+1) for columns (1) through (8). OLS corresponds to standard ordinary least squares regression in columns (1) through (3) and columns (4) through (8) correspond to a negative binomial model. Columns (7) and (8) represent regressions with the pooled tracking data of shipments going through both the Port of Maputo and the Port of Duban. Log Tariff Levels corresponds to the natural log of the tariff level the product falls under; High Tariff Dummy equals 1 if tariff level is greater than 20%, and 0 if tariff level is between 0-10%, Differentiated Product corresponds to 1 if the product does not have a set price in international markets according to Rauch's (1999) categorization (conservative) and 0 otherwise; Large Firm equals 1 if the shipper is a large firm (defined as having more than 100 employees). Maputo Port is a binary variable equalling 1 if the shipment is going through the Maputo Port and 0 if the shipment is going through Durban Port. Standard Errors clustered at the 4 digit harmonization code level and in parentheses. All regressions include clearing agent controls. Significant at *** 1%, **5%, and *10%.

Table 7: **Determinants of Bribe Payments at the Port of Durban**

	LPM	**LPM**	**LPM**	**LPM**
Dependent Variable: *Bribe Paid*	(1)	(2)	(3)	(4)
Log Tariff Level	0.140**	0.0695	0.0529	
	(0.0666)	(0.0920)	(0.0813)	
High Tariff Dummy				-0.0348
				(0.0761)
Log Storage Costs		0.37**	1.33***	1.34***
		(0.17)	(0.31)	(0.33)
Log Storage Costs Squared		-0.029**	-0.11***	-0.11***
		(0.013)	(0.03)	(0.031)
Log Storage Costs *Large Firm		-0.041	-0.22*	-0.23*
		(0.0346)	(0.132)	(0.13)
Large Firm		0.3	1.1*	1.11*
		(0.22)	(0.62)	(0.62)
Differentiated Product		0.021	0.056	0.045
		(0.062)	(0.091)	(0.092)
Controls				
Value Shipment	No	Yes	No	No
Value per Tonnage	No	No	Yes	Yes
Pre inspected Shipment	No	Yes	Yes	Yes
Consumer Product	No	Yes	Yes	Yes
Agricultural Product	No	Yes	Yes	Yes
Terminal	No	Yes	Yes	Yes
Shipment Date	No	No	Yes	Yes
Temperature Controls	No	No	Yes	Yes
Temperature Controls*Perishable	No	No	Yes	Yes
Observations	498	371	197	195
F-test	4.44	21.71	1.98	2.11
Adjusted R-squared	0.004	0.15	0.002	0.002

[a] Source: Tracking Study at Maputo and Durban ports. Note: Dependent Variable corresponds to a dummy variable that equals 1 if a bribe was paid and 0 otherwise. LPM stands for Linear Probability Model. Results are robust to different specifications such as logit and probit models. Log Tariff Levels corresponds to the natural log of the tariff level the product falls under; High Tariff Dummy equals 1 if tariff level is greater than 20%, and 0 if tariff level is between 0-10%; Differentiated Product corresponds to 1 if the product does not have a set price in international markets according to Rauch's (1999) categorization (conservative) and 0 otherwise; Large Firm equals 1 if the shipper is a large firm (defined as having more than 100 employees) and Log Storage Costs corresponds to the natural log of the storage cost the shipment would have to pay if it were stored at the port. Standard Errors clustered at the 4 digit harmonization code level and in parentheses. All regressions include clearing agent controls. Significant at *** 1%, **5%, and *10%.

Table 8: **Determinants of Bribe Payments at the Port of Durban**

Dependent Variable: ***Log Bribe Amount***	**OLS**	**OLS**	**OLS**	**Neg. Binomial**	**Neg. Binomial**	**Neg. Binomial**
	(1)	(2)	(3)	(4)	(5)	(6)
Log Tariff Level	0.39***	0.43*	0.43*	0.23	0.22	
	(0.032)	(0.23)	(0.25)	(0.35)	(0.35)	
High Tariff Dummy						-0.11
						(0.22)
Log Storage Costs		1.899***	-1.04	2.9***	2.56***	4.89**
		(0.388)	(1.274)	(0.849)	(0.857)	(2.318)
Log Storage Costs Squared		-0.14***	0.16	-0.25***	-0.22***	-0.43*
		(0.037)	(0.13)	(0.07)	(0.07)	(0.24)
Log Storage Costs *Large Firm		-0.31*	-0.15	-0.36*	-0.36*	-0.53
		(0.17)	(0.15)	(0.2)	(0.20)	(0.37)
Large Firms		1.43	0.72	1.98*	2.003*	2.63
		(0.88)	(0.67)	(1.06)	(1.07)	(1.75)
Differentiated Product		0.041	0.018	0.11	0.095	0.089
		(0.18)	(0.15)	(0.25)	(0.25)	(0.27)
Controls						
Value Shipment	No	Yes	No	Yes	No	No
Value per Tonnage	No	No	Yes	No	Yes	Yes
Pre inspected Shipment	No	Yes	Yes	Yes	Yes	Yes
Consumer Product	No	Yes	Yes	Yes	Yes	Yes
Agricultural Product	No	Yes	Yes	Yes	Yes	Yes
Terminal	No	Yes	Yes	Yes	Yes	Yes
Shipment Date	No	Yes	Yes	Yes	Yes	Yes
Temperature Controls	No	Yes	Yes	No	No	Yes
Temperature Controls*Perishable	No	Yes	Yes	No	No	Yes
Observations	211	125	95	371	371	195
F-test	151.8	16.66	11.29	36.13	34.96	26.89
Adjusted R-squared	0.011	0.4	0.49			
Log Pseudo Likelihood				-502.77	-498.83	-341.33

[a] Source: Tracking Study at Maputo and Durban ports. Note: Dependent Variable corresponds to the natural log of bribe amounts paid (+1). OLS corresponds to standard ordinary least squares regression in columns (1) through (3) and columns (4) through (6) correspond to a negative binomial model. Log Tariff Levels corresponds to the natural log of the tariff level the product falls under; High Tariff Dummy equals 1 if tariff level is greater than 20%, and 0 if tariff level is between 0-10%; Differentiated Product corresponds to 1 if the product does not have a set price in international markets according to Rauch's (1999) categorization (conservative) and 0 otherwise; Large Firm equals 1 if the shipper is a large firm (defined as having more than 100 employees) and Log Storage Costs corresponds to the natural log of the storage cost the shipment would have to pay if it were stored at the port. Standard Errors clustered at the 4 digit harmonization code level and in parentheses. All regressions include clearing agents fixed effects. Significant at *** 1%, **5%, and *10%.

Table 9: **Corruption and Firms' Shipping Decisions**

Dependent Variable:	**OLS**	**OLS**	**OLS**	**Bootstrap OLS**	**Probit**
Firm Uses Port of Maputo	(1)	(2)	(3)	(4)	(5)
Log Tariff Level Mozambique	-0.14*	-0.14*			
	(0.071)	(0.07)			
Log Tariff Level South Africa	0.058	0.058			
	(0.043)	(0.043)			
High Tariff Dummy Mozambique			-0.35**	-0.3**	-0.31***
			(0.14)	(0.16)	(0.09)
High Tariff Dummy South Africa			0.16	0.19	0.39
			(0.16)	(0.2)	(0.35)
Log Relative Transport Costs	-4.03**	-3.72**	-3.83**	-4.9	-6.9
	(1.67)	(1.83)	(1.75)	(21.9)	(8.8)
Large Firm	-0.0343	-0.04	-0.090	-0.02	-0.04
	(0.121)	(0.11)	(0.12)	(0.13)	(0.07)
Low Inventory Dummy	-0.0015	-0.003	0.015	0.02	-0.04
	(0.049)	(0.049)	(0.045)	(0.06)	(0.05)
Log Value Average Shipment	0.0094	0.0021	-0.061	-0.02	-0.18*
	(0.11)	(0.10)	(0.14)	(0.06)	(0.1)
Differentiated Goods	-0.09	-0.089	-0.082	-0.08	-0.16
	(0.14)	(0.14)	(0.16)	(0.15)	(0.07)
Firm Imports	-0.51*	-0.46	-0.65*	-0.4**	-0.96
	(0.28)	(0.30)	(0.32)	(0.18)	(0.22)
Firm Exports	0.073	0.083	0.07	0.08	0.11
	(0.13)	(0.13)	(0.15)	(0.2)	(0.07)
Controls					
Frequency of Shipments	Yes	Yes	Yes	Yes	Yes
Firm Imports*Relative Transport Costs to Durban	No	Yes	No	Yes	Yes
Value Shipment*Relative Transport Costs to Durban	No	No	No	Yes	Yes
Observations	77	76	76	62	62
F Statistic	4.13	3.09	3.28		
Wald Statistic			19.17	84.14	
Adjusted R-Square	0.03	0.03	0.02	0.05	
Log Pseudo-Likelihood					-24.698

[a] Notes: Dependent variable corresponds to a dummy variable equal to 1 if a firm ships through Maputo and 0 otherwise. The first three columns correspond to standard ordinary least squares models. Column (4) represents a bootstrap OLS regression with 1,000 replications. Column (5) presents marginal effects from a probit regression. In columns (1) through (3), the sample is restricted to firms established two years before the reopening of the port and in columns (4) and (5) the sample is restricted to firms established prior to the end of the civil war in Mozambique (11 years before the reopening of the port). Log Tariff Level in Mozambique and South Africa corresponds to the natural log of the tariff level the product falls under according to the Mozambican and South African Tariff Code respectively. High Tariff Dummy Mozambique and South Africa equal 1 if the tariff falls under a high tariff category (above 20%) or low tariff category (below 10%) according to the Mozambican and South African code respectively. Log Relative Transport Costs corresponds to the natural log of the ratio of transport costs between each firm and Maputo over the transport costs to Maputo (including the cost of road transport and all border fees). Differentiated Product corresponds to 1 if the product does not have a set price in international markets according to Rauch's (1999) categorization (conservative) and 0 otherwise; Large Firm equals 1 if the shipper is a large firm (defined as having more than 100 employees); Low Inventory Dummy equals 1 if firm has inventory levels below the median for a firm of its size and industry grouping and 0 otherwise; Firm imports/exports equals 1 if the firm imports and 0 otherwise. Standard errors clustered at the level of the two-digit industry grouping. Significant at *** 1%, **5%, and *10%

Table 10: **Cargo Characteristics by Port**

	Maputo Mean	**SD**	**Durban Mean**	**SD**	**P-value Durban=Maputo**
Value per Tonnage (USD)	85,894	518,432	263,539	265,847	0.01
Tonnage per Shipment	124	979.8	129	216.7	0.94
	Maputo Percentage	**Durban Percentage**	**P-Value Durban=Maputo**		
High Tariff Cargo	37%	33%	0.19		
Consumer Goods	63%	68%	0.03		
Friday Arrival of Shipment	19%	15%	0.17		
Differentiated Good	75%	61%	0		

[a] Source: Tracking Study at Maputo and Durban ports. Upper Panel: P-value for two-side t-test with unequal variances. Lower Panel: P-value for Chi Square test.

Table 11: **Determinants of Bribe Payments at the Border Post**

Dependent Variable: *Log (1+ Bribe Amount Paid)*	**OLS** (1)	**OLS** (2)	**Negative Binomial** (3)
Log Tariff Mozambique	0.03***	0.026*	
	(0.009)	(0.016)	
High Tariff Dummy			0.31*
			(0.19)
Differentiated Product		-0.17	-0.023
		(0.12)	(0.19)
Agricultural Product		-0.39**	-0.32
		(0.19)	(0.25)
Consumer Product		0.078	-0.009
		(0.13)	(0.19)
Log Value Shipment		0.015	0.0056
		(0.038)	(0.047)
Large Firm			-1.24***
			(0.47)
Observations	49	49	49
F-Test/Chi-Square	11	11.3	20.7
Adjusted R Squared	0.12	0.33	
Log Pseudo-Likelihood			-104.438

Source: Tracking Study at Maputo and Durban ports. Note: Dependent Variable corresponds to the natural log of bribe amounts paid (+1). OLS corresponds to a standard ordinary least squares regression in columns (1) and (2) while columna (3) and (4) to a negative binomial model. Log Tariff Levels corresponds to the natural log of the tariff level the product falls under; High Tariff Dummy equals 1 if tariff level is greater than 20%, and 0 if tariff level is between 0-10%, Differentiated product corresponds to 1 if the product does not have a set price in international markets according to Rauch's (1999) categorization (conservative) and 0 otherwise; Large Firm equals 1 if the shipper is a large firm (defined as having more than 100 employees). Bootstrapped Standard Errors, significant at ***10%, ** 5%, *1%