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► **To cite this version:**

Joël Cariolle, Petros G Sekeris. How export shocks corrupt: Theory and evidence. *Journal of Government and Economics*, 2023, 8, pp.100057. 10.1016/j.jge.2022.100057 . hal-04217750

**HAL Id: hal-04217750**

**<https://uca.hal.science/hal-04217750v1>**

Submitted on 26 Sep 2023

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## How export shocks corrupt: Theory and evidence<sup>☆</sup>

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### ARTICLE INFO

#### JEL classification:

D73  
F19  
O17

#### Keywords:

Corruption  
Bribery  
Export shocks

### ABSTRACT

Corruption is an important topic for governments and economics. A widely held belief is that exposure to international trade helps reducing corruption. In this article we show through theory and evidence that the relationship between trade and corruption is more nuanced. We show that firm level corruption actually increases when exports experience booms or busts. The reason is that export booms result in stronger incentives to favor production rather than corruption in low export settings, and vice versa in high export settings. Consequently, export busts when exports are very low, and export booms when exports are high, lead both to higher corruption. We corroborate these findings with an extensive database of some 45,000 firms from 72 developing and transition economies, surveyed over 2006–2017. We also confirm the corruption-deterrent effect of institutional quality.

### 1. Introduction

Corruption is an important topic for governments and economics. Corruption distorts the behavior of the government and often makes the latter less effective in supporting a rule-based market economy. It is widely believed that openness to international trade helps reduce the extent of corruption. Indeed, to the extent that economic development maps into better governance and institutions, one should expect a drop of corrupt practices as a country's economy develops and opens to new markets (Treisman, 2000, 2007; Wei, 2000; Dutt and Traca, 2010). Yet, some high profile corruption cases in advanced and open economies may seem to suggest otherwise (Heilbrunn, 2005; Von Maravic, 2006; Smith, 2016; Campante and Do, 2014). Economic development indeed correlates with stronger institutions, higher incomes, and deeper markets, amongst others, and these elements should in turn reduce the ground for corrupt transactions. On the other hand, in wealthier economies high production maps in reduced returns to investment in production activities, as a consequence of which the relative profitability of bribing-to-export these goods may be high. Under such conditions, firms could be incentivized to expand corrupt practices.

This paper highlights a non monotonic relationship between corruption and a country's export market size. More specifically, our goal is to determine whether export market expansions (contractions) systematically map into reduced (increased) corruption. To answer that

question we propose a theory which shows that both export booms and busts can lead to higher levels of corruption and we empirically corroborate our theoretical predictions. Hence, although one could reasonably expect economic development to lead to reduced levels of corruption, we show that this relationship can be non-monotonic when focusing on the specific export-channel.

Our focus on bribes in the export market is motivated by the attention given to the topic by scholars (Hines Jr, 1995; Lambsdorff, 1998; Dutt and Traca, 2010; D'Souza, 2012; Lee and Weng, 2013; Ahsan, 2017; Couttenier and Toubal, 2017). Besides their paramount economic importance, exports are particularly salient to study rent seeking because of their inherent characteristics giving rise to corrupt practices (Dutt and Traca, 2010; Sequeira and Djankov, 2014).<sup>1</sup> Given this background, we are interested in better comprehending the relationship between exports and bribery.

Bribery in export markets is a very common practice that may reinforce a corrupt firm's position in foreign countries by providing access to public resources and privileged information in both home and destination countries, circumventing burdensome regulations, compensating the lack of social network in foreign markets and hedging against political risks (Krammer, 2019). In the home country, exporting firms may bribe to benefit from tax exemptions and subsidies, obtain

<sup>☆</sup> This paper benefitted from the support of FERDI (Fondation pour les études et recherches sur le développement international) and was funded by the Agence Nationale de la Recherche of the French government through the program "Investissements d'avenir" (ANR-10-LABX-14-01), through the IDGM+ initiative led by FERDI.

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<sup>1</sup> A quite large literature has instead focused on the effect of import restrictions on rent seeking, starting with Krueger (1974).

export licensing facilitation, secure faster customs' clearance and trade protection. This in turn enables firms to secure access to scarce resources, to exploit economies of scale, and to absorb trade-related costs so as to enhance their competitive advantage in export markets (Lee and Weng, 2013; Ahsan, 2017). In foreign markets, bribery of foreign public officials is so widespread that the OECD enacted in 1997 a convention that criminalizes acts of bribery of foreign public officials in international business transactions. Evidence shows that its progressive implementation by exporting signatory states has induced trade deflection in favor of less corrupt export markets, at the expense of more corrupt ones (D'Souza, 2012). This evidence comes in support to previous research that shows how improved anti-corruption standards in international trade might disadvantage exporters' performance in corrupt import markets (Hines Jr, 1995; Lambsdorff, 1998). Bribery in foreign markets is therefore a common practice, instrumental to export performance, which helps firms building networks, securing contracts, avoiding red tape, taxation, and non-trade barriers abroad (Dutt and Traca, 2010; Sequeira and Djankov, 2014; Couttenier and Toubal, 2017).

To address our research question, we develop a theoretical setup where we consider bribery as a complementary action to the production process: bribery at exports enables the firm gaining or entrenching its position in export markets (e.g. Lee and Weng, 2013; Krammer, 2019; Couttenier and Toubal, 2017), at the cost of foregone productive activity. The revenue firms derive from exporting goods depends both on the value of the export market subject to bribery and on the quantity of goods it supplies the market with.

We then show that the effect of export booms or busts – induced for instance by changes in international prices, exchange rates or interest rates – on bribery is conditioned by the export market size: for low levels of exports, export busts increase corruption, while for high levels of exports corruption increases as a consequence of export booms instead. The mechanism is rooted in a standard micro-economic reasoning. Bearing in mind that firms invest in bribing and product quantity, at equilibrium the marginal return from both activities is the same. An exogenous expansion of exports has three effects on the trade-off: (i) export market expansion increases the marginal return to bribing because of a “volume effect” since every increment of market share now maps in a larger market size accruing to the firms, (ii) export market expansion decreases the marginal return to bribing because of the revenue function's concavity, and (iii) export market expansion also reduces the incentives to bribe by increasing the marginal return to production. Consequently, in low exports setups, since the *marginal* revenue of an export windfall will be large and thence subject to strong diminishing marginal revenue, an exogenous expansion of the export market will result into a reduction of the marginal profitability of bribery because of the revenue function's concavity. Moreover, this effect is exacerbated by the complementarities between bribery and production which further pushes firms to invest in production rather than bribes, thence implying that export booms (busts) reduce (increases) equilibrium bribing. In contrast, for high levels of exports, the opposite holds true if complementarities are not too strong, a feat which is expected to be observed since both market size and produced quantities will then be large and complementarities will consequently be exhausted. Since the value of the claimed market will then be high, the marginal revenue generated through corruption will then increase by more than the marginal revenue of output production. Consequently, positive export shocks will increase the incentives to bribe.

We therefore uncover a non-linear relationship between export shocks and bribery, depending on the level of exports. We test this prediction using repeated cross-section survey data on bribe payments reported by some 45,000 firms located in 72 developing and transition economies, through 11 survey waves conducted between 2006 and 2017. Pooled OLS estimations including location, industry, and year fixed effects are conducted, thereby lowering the concern for omitted variable bias. Following the recent literature on economic and financial

fluctuations' causes and consequences, we measure the severity of aggregate export shocks with the skewness coefficient of a country's exports distribution around their trend value (Rancière et al., 2008; Cariolle and Goujon, 2015; Popov, 2014; Bekaert and Popov, 2019; Jensen et al., 2020). Estimates support that aggregate export booms and busts are both associated with a larger size and a greater probability of bribe payments. Observe that, in contrast to alternative measures of export shocks, the skewness measure does not merely capture momentary deviations of exports, but equally accounts for their recent evolution, thence embedding structural changes that are more likely to drive firms' decisions than single-period deviations. On the other hand, however, a weakness of our preferred variable lies in the delay with which early shocks affect later periods. In that regard, we supplement our benchmark findings with estimations measuring export shocks as simple deviations from export levels, and show that our results survive the analysis.

Our contribution nuances in a fundamental way the negative finding underlined throughout the literature according to which revenue windfalls map into rent seeking, bribery, and other corrupt activities.<sup>2</sup> Looking at the channels tying rents to corruption that have been identified earlier in the literature, an encompassing ingredient is that from an individual firm's perspective higher rents always map into more intense rent-seeking (e.g. Ades and Di Tella, 1999). The bulk of the evidence concerns *resource exports* (e.g. Treisman, 2007) with the core underlying mechanism being common to all studies: higher rents accruing either from more valuable markets (size and/or value) or from larger market power (and thus higher margins) generate higher rent-seeking incentives (Dalgaard and Olsson, 2008). Our contribution shows that higher rent-seeking could result from rent scarcities as well.

Our article also contributes to the literature on rent-seeking related inefficiencies in contexts of economic expansions. Murphy et al. (1993), Robinson (1994) and Acemoglu (1995) all develop theoretical setups where rent-seeking proves detrimental to the economy because of the adverse effect this has on the productive sector, thereby crowding out entrepreneurial activity. As such, revenue windfalls incentivize firms to reallocate resources to rent-seeking activities, eventually resulting into a reduced equilibrium entrepreneurial activity. Inefficiencies may equally emerge when groups with power and influence in the society push for increased redistribution in the presence of windfalls, and this in turn contains the incentives to invest in productive sectors, thereby resulting in lower growth rates. This mechanism has been coined the “voracity effect” (Lane and Tornell, 1996; Tornell & Lane, 1999), and is supported by empirical evidence (Abbott and Jones, 2013; Abbott et al., 2015). Rather than conceptualizing an economy composed of a rent-seeking sector and a productive sector, we instead consider the rent-seeking-production trade-off at the firm rather than the aggregate level, and view bribes as an input of a firm's revenue. By making the natural assumption that firms' revenues are non-linear in market size, bribes, and inputs, we uncover a non-linear relationship between exports and bribes, thus contrasting with all existing literature on the topic: economic expansions in low export contexts may indeed result in lower rent-seeking. Moreover, and always in contrast to much of the existing literature, the effects we uncover result from corruption strategies adopted by exporting firms operating in both the manufacture and the service sectors, and not in the resources sectors specifically (e.g. Treisman, 2007). Last, we also show that the nonlinear bribery effect of export shocks is transmitted from exporting firms to inward-oriented firms through location spillovers, suggesting that variations in exports might affect the prevalence of corruption in the whole economy, rather than only among firms active on foreign markets.

<sup>2</sup> In the specific context of exports, the reverse link through which corruption affects exports has equally received attention. These same incentives to corrupt officials have the potential of affecting the size of exporting markets (Lee and Weng, 2013; Olney, 2016).

Our study also confirms earlier findings on the attenuating effect of institutional quality when exploring the voracity effect of resource windfalls (Mehlum et al., 2006; Robinson et al., 2006). Institutions have been shown to play a central role in understanding the prevalence of corruption and rent-seeking activities. In fact, strong institutions, reflected by an efficient bureaucracy, well-designed regulations, or a stable democratic political system endowed with strong checks and balances, contain corruption by making public and private agents more accountable, by increasing the probability for corrupt agents of getting caught and sanctioned (Lederman et al., 2005; Brunetti and Weder, 2003; Bhattacharyya and Hodler, 2010), and by improving the protection of property rights and the freedom of choice (Farhadi et al., 2015; Banalieva et al., 2018). Interestingly, Mehlum et al. (2006) and Robinson et al. (2006) establish empirically that the natural resource curse is conditional on the presence of weak institutions, thence putting institutions on the spotlight. The attenuating effect of institutions on rent-seeking has been repeatedly confirmed thereafter (Bhattacharyya and Hodler, 2010; Ebeke et al., 2015). We therefore incorporate this dimension in the last part of our empirical analysis and emphasize the attenuating role of institutional quality on the effects of export booms and busts on corruption. Using a wide range of proxies for institutional quality, our results point that improvements in various dimensions of the governance framework – such as the rule-of-law, government effectiveness, corruption control, regulatory quality or even the time spent by firms dealing with regulations – cushion the positive effects of both export booms and busts on firms’ bribery without, however, canceling these effects.

The next section presents our theoretical model. The third section exposes our empirical framework, while the fourth section presents our empirical results.

## 2. The model

### 2.1. The setup

We consider an industry featuring  $n$  symmetric firms involved in bribery. The firms produce a good destined to the export market, and they are each endowed with a cash flow  $F$  that may be invested in inputs to produce goods, or in improving their access to the export market by bribing officials.<sup>3</sup> We denote respectively these investments for firm  $i$  by  $z^i$  and  $b^i$ . The total revenue of firm  $i$ ,  $R(m^i, z^i)$ , is a function of the value of the market controlled by firm  $i$ ,  $m^i$ , and of the inputs of the firm,  $z^i$ . We make the following assumptions on function  $R(m^i, z^i)$ :  $R(0, z^i) = R(m^i, 0) = 0$ ,  $R_m > 0$ ,  $R_{mm} \leq 0$ ,  $R_z > 0$ ,  $R_{zz} < 0$ , and  $R_{mz} \geq 0$ , where indices denote partial derivatives. Moreover, we impose the following Inada condition:  $\lim_{m^i \rightarrow 0} R_m = +\infty$ . We are thus assuming decreasing marginal revenues to both market value and the amount of inputs. The sign of  $R_{mm}$  reflects the decreasing opportunities (at the margin) of offering one’s products on a wider market, for a given level of output. Similarly, the sign of  $R_{zz}$  captures the decreasing marginal revenue from higher output, as is usually assumed. Last, the positive sign of the cross derivative reflects the fact that in the presence of more valuable markets, a firm has a higher marginal return on production, as is typically the case in most oligopolistic setups. Additionally, we make the following assumption on the functional form  $R(\cdot)$ :  $\epsilon_{R_m, m^i} = \frac{R_{mm}}{R_m} \leq -1 \Leftrightarrow m^i \leq \bar{m}$ , with  $\bar{m} > 0$ . We are thereby assuming that the revenue function is sufficiently concave in  $m^i$  for low-value markets so that the marginal revenue of controlling a more valuable market is highly elastic to market value; while when the market is of high value,

<sup>3</sup> Such bribes may aim at getting preferential access to export licences, exonerating firms from levies, or securing reductions in transaction costs by speeding up tolls and shipping processes.

the opposite holds true.<sup>4</sup> Observe that the latter assumption on the shape of the revenue function is in line with empirical findings in the related literature which establishes that larger and better performing firms’s revenues are less subject to fluctuations in market conditions, and in the exchange rate in particular (Berman et al., 2012; Chatterjee et al., 2013; Amiti et al., 2014), amongst others because of their ability to re-orient activities across markets and sectors of activity following a shock (Melitz, 2018).

The total size of the export market that is subject to bribery is denoted by  $X$ . We assume that officials allocate export licences and/or give preferential bureaucratic treatment to firms according to the relative size of their individual bribe  $b^i$ . In other words, we assume that the export licences for this industry are fixed (e.g. trade agreements), and the total size of the export market controlled by firm  $i$ ,  $s^i$ , is then given by:

$$s^i = \begin{cases} \frac{b^i}{\sum_j b^j} X & \text{if } \sum_j b^j > 0 \\ 0 & \text{otherwise.} \end{cases}$$

We are thence assuming that (i) if no firm decides to bribe authorities, then the export rights are not allocated to any firm,<sup>5</sup> and (ii) that the cost of export licences is endogenous since firms’ market shares depend on their relative bribe levels.

Next, the actual value of the export market controlled by firm  $i$ ,  $m^i$ , is defined as:

$$m^i = s^i - C.$$

The parameter  $C$  reflects an exogenous loss of market value, and captures an efficiency loss related to corruption. For instance, the firms’ reputation on the foreign market may be tarnished by their corrupt practices. To ensure that all firms are active in the bribe game at equilibrium, we impose the following parameter restriction:

$$\frac{X}{n} \geq C.$$

Given the above-described budget constraint, the firm’s inputs equal  $z^i = [F - b^i]$ .

All firms simultaneously decide the allocation of their cash flow between bribery and productive activities, and we solve for the Nash equilibrium.

### 2.2. Equilibrium

The optimization problem of any firm  $i$  reads as:

$$\max_{b^i} R \left( \frac{b^i}{\sum b^j} X - C, F - b^i \right). \tag{1}$$

We can then write the first order condition of this problem when dropping the functions’ arguments for clarity reasons as:

$$\frac{B^{-i}}{B^2} X R_m - R_z = 0, \tag{2}$$

where  $B = \sum_j b^j$ ,  $B^{-i} = \sum_{j \neq i} b^j$ , and indices denote partial derivatives.

The problem is globally concave if the following second-order condition is satisfied:

$$\frac{\partial^2 R(m^i, z^i)}{\partial b^i \partial b^j} = \left[ \frac{B^{-i}}{B^2} X \right]^2 R_{mm} - 2 \frac{B^{-i}}{B^3} X R_m - 2 \frac{B^{-i}}{B^2} X R_{mz} + R_{zz} < 0, \tag{3}$$

and this is always true.

Observe that the problem admits no bribes-free equilibrium. If  $b^i = 0$  for all players, then any firm has a profitable deviation since in such

<sup>4</sup> We extend below the analysis using a CES revenue function for which there is a range of elasticity of substitution parameters such that the above assumption is verified at equilibrium.

<sup>5</sup> Observe that any alternative assumption on the allocation of export licences in such instances would deliver the same equilibrium.

instance  $\frac{b^i}{B} = 1$  for any  $b^i > 0$ , thus implying that  $\lim_{b^i \rightarrow 0} R(m^i, z^i) = R(X - C, F) > R(0, F) = \{R(m^i, z^i)\}_{|b^i=0}$ . Moreover, if  $b^i = F$  for firm  $i$ , then  $z^i = 0$  and its payoff is therefore nil, thence implying a profitable deviation by setting a strictly positive investment  $z^i > 0$ .

Consequently, expression (2) uniquely defines firm  $i$ 's best response function  $b^i(B^{-i})$  and the equilibrium bribe investment is thus implicitly defined by:

$$\phi^i = \frac{B^{-i*}}{(b^{i*} + B^{-i*})^2} X R_m \left( \frac{b^{i*}}{b^{i*} + B^{-i*}} X - C; F - b^{i*} \right) - R_z \left( \frac{b^{i*}}{b^{i*} + B^{-i*}} X - C; F - b^{i*} \right) = 0. \tag{4}$$

### 2.3. Export market expansion and contraction

We are interested in the effect of export market expansions and contractions on equilibrium bribes. We accordingly explore the effect of an exogenous change in  $X$  – the size of the export market – on equilibrium bribery  $b^{i*}$ . To do so, we first inspect how the firms' best response functions  $b^i(B^{-i})$  are impacted by a change in  $X$  in equilibrium, and then deduce how the equilibrium bribe levels are modified by an expansion of export markets. Applying the implicit function theorem on expression (4), and given that the second-order condition (Eq. (3)) is satisfied, we have that the sign of  $\frac{\partial b^i}{\partial X}$  is given by the sign of:

$$\text{sign} \left\{ \frac{\partial^2 R(m^i, z^i)}{\partial b^i \partial X} \right\} = \text{sign} \left\{ \frac{\partial \phi^i}{\partial X} \right\} = \text{sign} \left\{ \left[ \frac{B^{-i}}{B^2} \left[ R_m + X \frac{b^i}{B} R_{mm} \right] - \frac{b^i}{B} R_{mz} \right] \right\}. \tag{5}$$

Evaluating this expression at the symmetric equilibrium where  $b^i = b^*$ , the sign of  $\frac{\partial b^i}{\partial X}$  at equilibrium is thus given by the sign of:

$$\text{sign} \left\{ \frac{[n-1]}{nb^*} R_m + \frac{[n-1]}{n^2 b^*} X R_{mm} - R_{mz} \right\}. \tag{6}$$

The sign of this expression is ambiguous since the first term in (6) is positive, while the second and third terms are negative. We can then scrutinize each of these terms to disentangle the mechanisms underlying the overall effect. A larger export market will – all else equal – increase the marginal return of bribing public officials since any bribe now aims at expanding the controlled share of a larger market. This is captured by the expression's first term. The second term, however, nuances the first one due to the decreasing marginal revenues one obtains from controlling a larger market segment. Last, the third term gauges the effect of higher export markets on the opportunity cost of bribery: given the assumed complementarity between market size and inputs, positive export shocks will map into increased complementarities between the two components of the firm's total revenue, and thus in an increase in the opportunity cost of bribery, i.e. in foregone revenue due to a contraction of inputs.

We then inspect the sign of expression (6). A first observation is that  $s^{i*} = \frac{1}{n}$ , thence implying that  $m^{i*} = \frac{X}{n} - C, \forall i$ . It is immediate then to observe that  $m^{i*}$  is monotonically increasing in  $X$ , with  $m^{i*} \rightarrow 0$  as  $X \rightarrow Cn$  and  $m^{i*} \rightarrow \infty$  as  $X \rightarrow \infty$ . Assume first that  $m^* \rightarrow 0$ , in which case  $m^* < \bar{m}$ , and thus  $\epsilon_{R_m, m^*} < -1$ . This in turn implies that  $\left(\frac{X}{n} - C\right) R_{mm} + R_m < 0$ , so that the sum of the first two terms in (6) is then negative and that the entire expression (6) is negative since  $R_{mz} > 0$ . In such instances  $\frac{\partial b^i}{\partial X} < 0$  for all firms, so that we deduce by symmetry that  $\frac{db^*}{dX} < 0$ . If  $X \rightarrow \infty$ , and thus  $m \rightarrow \infty$ , we accordingly have that  $\epsilon_{R_m, m^*} > -1$ , and since  $\lim_{X \rightarrow \infty} \left(\frac{X}{n} - C\right) = \lim_{X \rightarrow \infty} X$ , we can deduce that the sum of the first two terms in (6) is positive. Hence, if  $R_{mz}$  is not too strong, as evidenced by the empirical literature showing that larger and high performing firms are more insensitive to external shocks because of their adaptation capacity (e.g. Berman et al. 2012, Chatterjee et al. 2013), it follows that  $\frac{\partial b^i}{\partial X} > 0$  for all firms at equilibrium,

so that we deduce by symmetry (and the fact we are identifying a stable equilibrium) that  $\frac{db^*}{dX} > 0$ .

We can then state our first result:

**Proposition 1.** *For low export levels bribery decreases with exports while for high export levels it increases with exports, provided revenue complementarities between market valuation and input use are not too strong.*

Proposition 1 establishes that the relationship between export shocks and bribery critically hinges on the size of the export markets  $X$ . An exogenous increase in the size of the export market impacts the firm's decision through three channels: (i) export market expansion increases the marginal return to bribing because of a “volume effect” since every increment of market share now maps in a larger market size controlled by the firm  $\left(\frac{B^{-i}}{b^i + B^{-i}} X\right)$  that each generates a marginal return of  $R_m$ , (ii) export market expansion decreases the marginal profitability of bribing because of the revenue function's concavity ( $R_{mm} < 0$ ), and (iii) export market expansion also reduces the incentives to bribe by increasing the marginal return to production ( $R_{mz} > 0$ ).

When the export market size is small, the marginal return from bribery ( $R_m$ ) is strong but weighted by a small weight, while the pace of decreasing marginal returns ( $R_{mm}$ ) is even stronger, making the revenue highly elastic to market value ( $\epsilon_{R_m, m^i} < -1$ ). Market value being positively related to export market size, an increase in the latter will induce a drastic reduction in the marginal revenue of controlling a larger market, while simultaneously boosting the marginal return from investing in the (exported) product because of the complementarities tying market size and output. Thence, bribery will drop with export markets expansion.

By contrast, when the export market is large, the marginal return from bribery ( $R_m$ ) is low, yet weighted by a large controlled market, while the rate at which marginal returns decrease ( $R_{mm}$ ) is so soft so as to make the revenue poorly elastic to market value ( $-1 < \epsilon_{R_m, m^i} < 0$ ), and thereby to bribery. In other words, the marginal return from bribery will not be very sensitive to changes in market value, and in such instances, if the revenue function does not exhibit too strong complementarities, positive export shocks will increase bribery. It bears attention that since for low export levels, production (bribes) increases (decrease) with further expansion of the export market, larger export levels imply that firms are already devoting many resources to production. Consequently, we are considering a situation where both arguments of the firm's revenue function are high (value of market controlled, and production), and complementarities will then mostly have been exhausted.<sup>6</sup>

In the next section we consider a CES production function to convince the reader that our results emerge in the context of very common technologies.

### 2.4. A CES production function

We now fully characterize the comparative statics results in the context of a widely accepted functional form that fits our setup, we thus consider the following CES revenue function:

$$R(m^i, z^i) = [\beta [m^i]^\rho + [1 - \beta] [z^i]^\rho]^{\frac{1}{\rho}}.$$

Optimizing gives rise to the next first order condition for any firm  $i$ :

$$\frac{\partial R^i}{\partial b^i} = \frac{1}{\rho} [ [m^i]^\rho + [z^i]^\rho ]^{\frac{1-\rho}{\rho}} \left[ \beta \rho [m^i]^{\rho-1} \frac{B^{-i}}{B^2} X - [1 - \beta] \rho [z^i]^{\rho-1} \right] = 0.$$

<sup>6</sup> It is indeed the case that as a market expands the marginal revenue of increased production will be larger when the said market is intermediate and the firm has scope for increasing the visibility of its product, as compared to when the market is already large and the product is therefore well known and established.

Imposing symmetry, this condition is verified if:

$$\beta \left[ \frac{X}{n} - C \right]^{\rho-1} \frac{n-1}{n^2 b^*} X - [1 - \beta][F - b^*]^{\rho-1} = 0.$$

Since the second-order condition can easily be shown to hold, the sign of  $\partial b^*/\partial X$  is (at the symmetric equilibrium) given by:

$$\begin{aligned} \text{sign} \left\{ \frac{\partial b^*}{\partial X} \right\} &= \text{sign} \left\{ \frac{\partial \phi}{\partial X} \right\} = \text{sign} \left\{ [\rho - 1] \frac{\frac{X}{n}}{\frac{X}{n} - C} + 1 \right\} \\ &= \text{sign} \left\{ X - \frac{Cn}{\rho} \right\}. \end{aligned}$$

We can then immediately observe that for CES revenue functions with mildly complementary arguments (i.e.  $\rho \in ]0, 1[$ ),  $db^*/dX \lesseqgtr 0 \Leftrightarrow X \gtrless \frac{Cn}{\rho}$ .

By considering a specific CES functional form, we are therefore in a position to fully characterize the comparative statics and to draw clear-cut predictions for our empirical framework. Beyond confirming the finding of Proposition 1, the use of a specific functional form allows us to convince the reader that the results derived earlier are verified with a widely accepted modeling setup: when revenue complementarities between market value and output are not too strong, for low (high) export levels, export market expansion reduces (increases) bribery.

### 3. Empirical framework

The theory developed in the previous section reveals a non-linear relationship between export booms and bribery that is conditioned by a country's level of exports. Our predictions point at a bribe-increasing effect of busts in countries with low total export-value and at a bribe-increasing effect of booms for economies featuring high total export-value. We now provide empirical evidence in support of these findings.

#### 3.1. Data

*Firm's bribe payments.* Our dependent variable reflects firms' involvement in bribery with public officials, drawn from the World Bank Enterprise Survey (WBES). The WBES is a comprehensive, standardized and internationally comparable firm-level dataset assessing business environment conditions around the world. These surveys cover an original representative sample of some 160,000 firms from 142 developing and transition economies, operating in the formal economy's non-agricultural manufacturing and service sectors, surveyed over the period 2006–2017.<sup>7</sup>

Our main bribery variable is the annual value of “gifts or informal payments to public officials to ‘get things done’ with regard to customs, taxes, licenses, regulations, services etc...”, reported by firms, and expressed as a share of their total sales. An increase in the value taken by this variable therefore reflects an increase in the average size of bribe and/or an increase in the incidence of bribe payments among firms.<sup>8</sup>

In the robustness analysis, to complement this variable and to address possible under or over-reporting biases of bribes (Clarke, 2011), we consider a second dependent variable of bribe incidence which equals to one if the firm reported an informal payment and zero otherwise.

<sup>7</sup> WBES data has been collected according to a stratified random sampling with replacement, based on firm size, geographic location and sector of activity.

<sup>8</sup> Information on bribery in foreign markets is not available in the WBES. However, because bribery at exports encompasses bribes paid in both foreign and domestic markets – this variable covers bribes to get export subsidies, licensing, but also bribes to benefit from a protection in domestic market – considering such payments, irrespective of their location is relevant for our analysis. In Section 4.3, we test whether firm's export activity explains the relationship between export shocks and bribery.

*Export booms and busts.* Our measure of export shocks is not confined to specific sources of export variations – such as natural resources (Isham et al., 2005) – but instead considers fluctuations in total exports (expressed in 2010 constant USD) since our theoretical predictions are not restricted to specific export types or markets.

Moreover, our empirical analysis focuses on episodes of sustained export booms and busts, rather than on simple (possibly temporary) variations in exports since the latter may reflect adjustments in international trade rather than sustained expansions or contractions of exports. As such, we view simple variations as imperfectly capturing the export market expansions and contractions studied in our theory, since in periods of recovery or in the presence of correction phenomena positive (negative) simple differences could be observed in periods of export busts (booms).<sup>9</sup>

Accordingly, our measure of export booms and busts is based on the skewness of exports, following the recent literature on the causes and consequences of economic and financial upheavals (Ranci re et al., 2008; Popov, 2014; Jord a et al., 2017; Bekaert and Popov, 2019; Jensen et al., 2020). The skewness is a measure of the asymmetry and abnormality of a variable's distribution around its trend, therefore isolating the impact of the large, infrequent, and abrupt export movements over a given time-frame, associated with export booms (for positive values) and busts (for negative values) (Cariolle and Goujon, 2015). For instance, the negative skewness of credit growth has been used by Ranci re et al. (2008) as a measure of credit bust, while Jensen et al. (2020) and Popov (2014) use it as a measure of expansionary (when above 0) or contractionary (when below 0) growth shocks. According to Ranci re et al. (2008), using the skewness instead of *ad hoc* crisis/boom indices has the advantage of being an objective, comparable, *de facto* measure of abnormal asymmetric patterns in a variable's distribution. In contrast therefore to alternative measures of export shocks, the skewness measure does not merely capture momentary deviations of exports, but equally relates these deviations to their recent evolution, thence accounting for structural changes that are more likely to drive firms' decisions than single-period deviations. On the other hand, however, a weakness of our preferred variable lies in the delay with which early shocks affect later periods, a limitation that we tackle later by showing that our results are robust to the use of simple deviations.<sup>10</sup>

The skewness of the distribution of exports around their trend is calculated, over a four-year time-window, and expressed as a share of their trend value, as follows:

$$S_{jt} = 100 \times \frac{\frac{1}{4} \sum_{t-3}^t \left( \frac{y_{jt} - \bar{y}_{jt}}{\bar{y}_{jt}} \right)^3}{\left[ \frac{1}{4} \sum_{t-3}^t \left( \frac{y_{jt} - \bar{y}_{jt}}{\bar{y}_{jt}} \right)^2 \right]^{\frac{3}{2}}}$$

where  $y_{jt}$  is the observed constant value of exports in country  $i$  at time  $t$ , and  $\bar{y}_{jt}$  a trend isolated by the Hodrick–Prescott (HP) filter.<sup>11</sup> The four-year time window used to compute the skewness variable has been set to match the average export cycle duration, reflected by the autocorrelation order in export cyclical components ( $\frac{y_{jt} - \bar{y}_{jt}}{\bar{y}_{jt}}$ ). In this regard, Table 1 reports the statistics of the Born and Breitung (2016) test for serial correlation, which stresses a third-order autocorrelation in export cycle components.<sup>12</sup>

<sup>9</sup> We nevertheless test our model prediction focusing on simple exports deviations from their trend in the robustness section.

<sup>10</sup> Estimations using annual export deviation variables are reported in robustness section 5.1.

<sup>11</sup> We impose a smoothing parameter set at 6, as recommended by Ravn and Uhlig (2002) and Maravall and Del Rio (2001). The HP filter is a two-sided filter, exploiting all the longitudinal data to separate the trend component from the cycle component in the series (see Cariolle and Goujon, 2015).

<sup>12</sup> In the robustness section, we extend this time-window to check the consistency of our results.

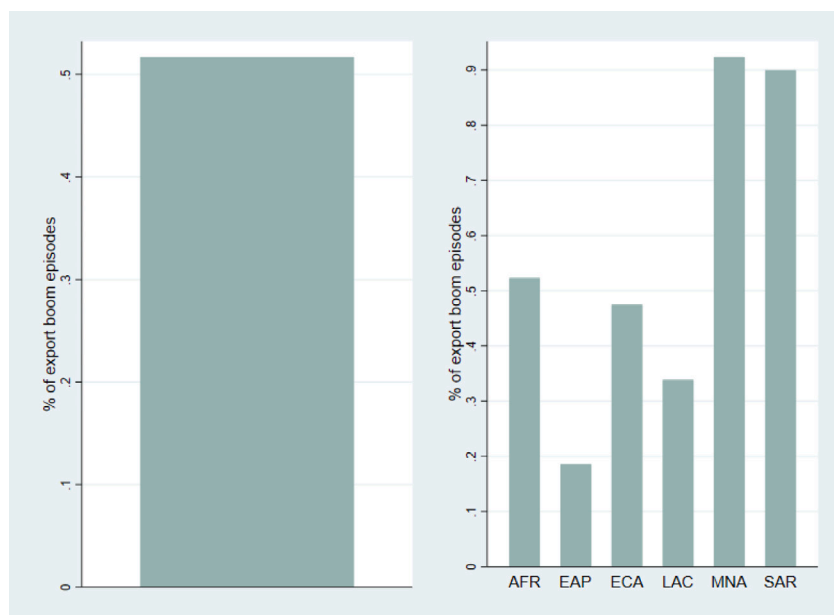


Fig. 1. Distributions of export boom and bust episodes, baseline sample shares.

Notes: Baseline sample of 44,790 firms. AFR: sub-Saharan Africa; EAP: East-Asia and Pacific; EAC: Eastern-Europe and Central Asia; LAC: Latin America and Caribe; SAR: South Asia Region. Distributions of export boom and bust episodes represented in this figure are based upon a dummy variable equal to 1 when the export skewness is positive, 0 when it is negative.

The skewness value is therefore easily interpretable, reflecting either episodes of export expansions when positive, or episodes of export contractions when negative. An increase in the skewness value reflects an increase in the occurrence of positive shocks relative to negative ones, and yet such an increase may very well occur in a context where negative shocks are predominant, i.e. in the presence of a negative skewness. Observe that this measure is reasonably exogenous since although the trend around which the (positive and negative) shocks are being evaluated may very well be endogenous, the deviations around this trend are much more likely to be exogenous. Indeed, the trend isolated by the HP with a low smoothing parameter is expected to capture both medium-term factors of exports movements such as the trade or tax policies, and longer-term factors such as structural change. On the other hand we expect the resulting fluctuations around this trend to be much more exogenous to domestic policy and economic matters.<sup>13</sup> To account for this important nuance, we split our skewness variable into two separate ones allowing us to disentangle export booms from export busts:

- **The positive export skewness** variable measures the intensity of export boom episodes and equals the value of the skewness if positive, and takes the value of zero otherwise;
- **The negative export skewness** measures the intensity of export bust episodes, and equals the absolute value of the skewness if negative, and takes the value of zero otherwise.

Fig. 1 depicts the percentage of export booms measured with the skewness variable for the full sample (left panel) and at the regional level (right panel). This figure reveals that about half of the sample

<sup>13</sup> Additionally, our baseline estimation framework controls for the long-run standard deviation of exports, which reflects a country’s usual exposure to shocks, that could be induced by policy factors (such as specialization, an economy’s exposure to natural resource extraction, or trade policies). Given the heterogeneity of our sample which comprises countries from all income groups—a heterogeneity that is necessary to test our theoretical mechanisms—we, we have proved unable to find an instrument, or a quasi-natural experimental setup, that is both common to all countries and can explain large and asymmetric export movements.

Table 1  
Born and Breitung (2016) Q(p)-test for serial correlation: cyclical component of exports (HP-filtered).

Lags	Q(p)-stat	p-value	N	Max T
1	6.81	0.01	207	60
2	7.10	0.03	207	60
3	7.50	0.06	207	60
4	7.60	0.11	207	60
5	8.07	0.15	207	60

Notes: Under  $H_0$ ,  $Q(p) \sim \chi^2(p)$ .  $H_0$ : No serial correlation up to order  $p$ .  $H_a$ : Some serial correlation up to order  $p$ .

of firms experienced episodes of export booms, while the other half has experienced episodes of export busts. Yet, this distribution appears to be quite uneven across regions. While East-Asia and the Pacific region (EAP) and Latin America (LAC) have mostly experienced export bust episodes, the Middle-East and North Africa (MENA) and South Asia (SAR) have mostly experienced export booms episodes. Last, episodes of export booms and busts are overall balanced for Sub-Saharan Africa (SSA) and Eastern Europe and Central Asia (ECA).

**Control variables.** Our set of control variables comprises the relevant country-level and firm-level determinants of corruption that have been identified in the literature (Mauro, 1995; La Porta et al., 1999; Treisman, 2000; Svensson, 2003; Diaby and Sylwester, 2015). The specificity of our study commands the inclusion of additional variables. First, we focus on the effect of asymmetric abnormal shocks and we therefore ought to control for the effect of symmetric and normal fluctuations, i.e. for the inherent risk (or uncertainty) in export movements (Elbers et al., 2007). We accordingly include the four-year standard deviation of exports around the HP trend in the corruption equation. Second, our mechanism operates through the level of exports which should correlate with determinants of socio-economic development. We therefore control for the logarithm of GDP per capita, the logarithm of the population size, and the level of democracy. Third, we control for various determinants of the size of rents in the economy: the shares of different types of natural resource rents in GDP (mineral rents, gas rents, oil rents), the shares of government expenditures and tax revenues in GDP. Last, we control for various micro-level determinants

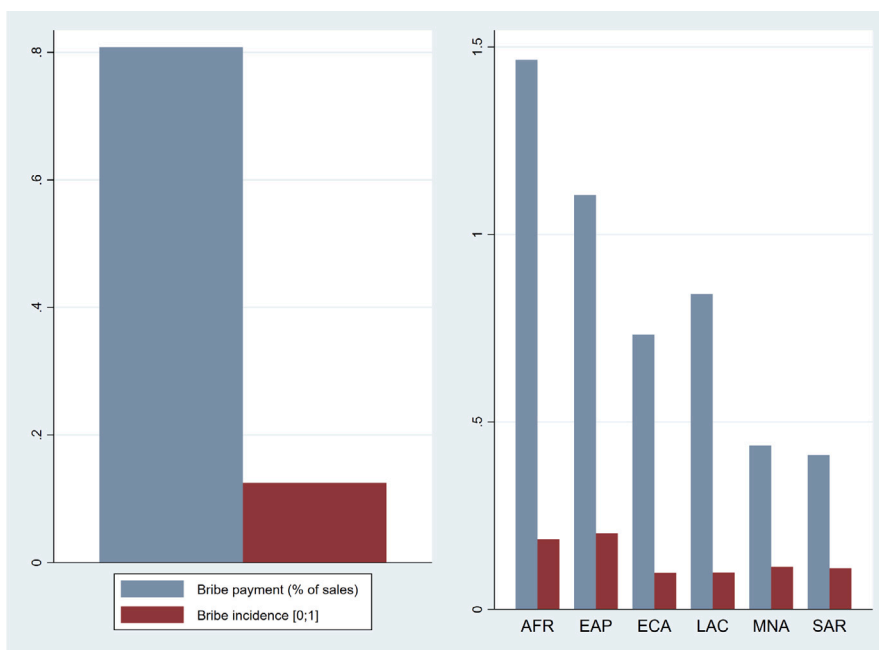


Fig. 2. Bribe prevalence, baseline sample averages.

Note: Baseline sample of 44,790 firms. AFR: sub-Saharan Africa; EAP: East-Asia and Pacific; EAC: Eastern-Europe and Central Asia; LAC: Latin America and Caribe; SAR: South Asia Region.

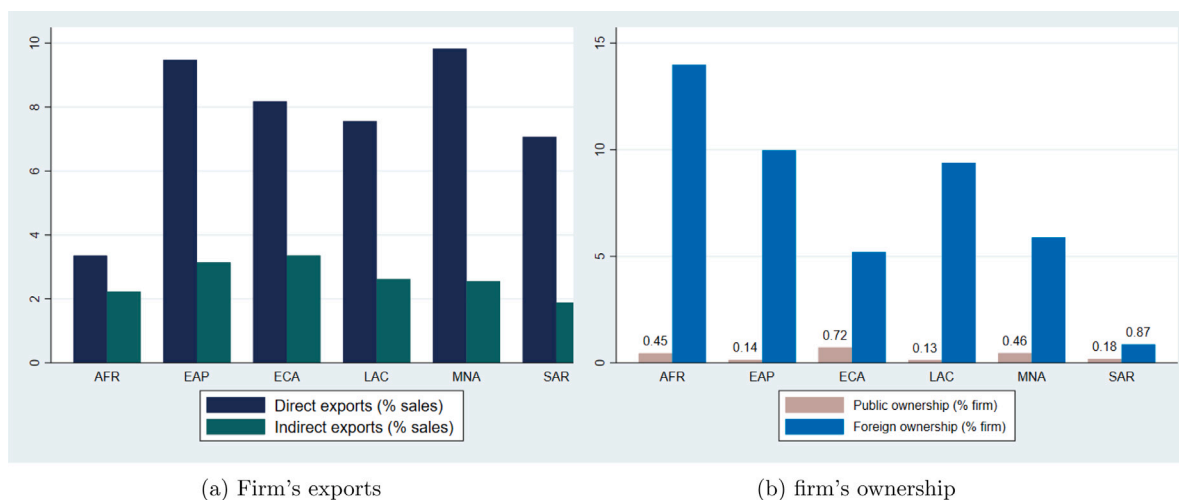


Fig. 3. Firm's exports and ownership structure.

Note: Baseline sample of 44,790 firms. AFR: sub-Saharan Africa; EAP: East-Asia and Pacific; EAC: Eastern-Europe and Central Asia; LAC: Latin America and Caribe; SAR: South Asia Region.

of a firm's inclination to bribe: its total sales, its workforce size, the share of direct and indirect exports in total sales, the firm's shares of public and foreign ownership, its share of working capital funded by internal funds, and its share of working capital funded by public and private commercial banks. Table 2 reports dependent, interest and control variables' summary statistics for the baseline estimation sample.

Further in the analysis, we also test the mitigating effects of institutional quality by including key dimensions of a country's governance framework, as identified by the World Governance Indicators<sup>14</sup>: the regulatory quality, voice and accountability mechanisms, government effectiveness, political stability, corruption control, and the rule of law.

*The sample.* The baseline estimation sample consists of pooled data covering 44,790 firms interviewed through 11 survey rounds, between 2006 and 2017, and located in 72 developing and transition economies. Some 29.5% of the surveyed firms are located in Latin America and the Caribbean, 19.5% in South Asia, 19% in Eastern Europe and Central Asia, 14% in East-Asia and the Pacific area, 10.5% in Sub-Saharan Africa, and the remaining 7.5% in the Middle-East and North Africa (Table 3). 12% of firms in the sample have made informal payments, amounting to 0.8% of their total sales on average, while 10.2% of their sales are direct or indirect exports. Sub-Saharan Africa is the region with the lowest share of firm exports (5.6% of sales are direct and indirect exports), the area with the second highest bribery incidence rate (18%), and where the average amount of bribe (almost 2.1% of sales) is the largest. Eastern Asia and the Pacific region is the area with the greatest share of exporting firms (12.6% of sales are direct and indirect exports) and where the incidence of bribery is the highest, as

<sup>14</sup> <https://info.worldbank.org/governance/wgi/>



**Table 2**  
Summary statistics.

	Mean	Std. Dev.	Min	Max
<b>Dependent variables</b>				
Bribe payments (% of total sales)	.8039389	4.432122	0	100
Bribery incidence (% of firms)	.123532	.3290506	0	1
<b>Firm-level controls</b>				
Total sales (USD, Ln)	13.31373	2.55702	0	29.20451
State ownership (% of firm)	.3246037	4.537276	0	100
Foreign ownership (% of firm)	7.204039	24.21368	0	100
Indirect exports (% of firms' sales)	2.659011	12.94766	0	100
Direct exports (% of firms' sales)	7.537397	22.03343	0	100
Internal funds (% of working capital)	68.47563	34.94427	0	100
External funds (% of working capital)	15.46054	25.95713	0	100
Workforce size (# workers, Ln)	3.466268	1.341818	0	11.06796
<b>Export shock variables</b>				
Export 4-year skewness(in % of trend)	2.068915	115.0369	-191.4861	170.9461
Export 4-year std. dev. (in % of trend)	3.8103	2.954509	.7632416	22.77878
<b>Country-level controls</b>				
Ln GDP per capita (2005 Constant USD)	8.233451	.8999738	6.133235	10.3859
Ln population	17.55523	1.924559	12.32254	20.96489
Exports (% in GDP)	30.38149	13.87499	8.149135	85.6584
Imports (% in GDP)	34.14649	15.6465	11.2546	112.0518
Democracy level index (Freedom House)	7.18061	2.210975	1.166667	10
Oil rents (% of GDP)	2.284596	5.577015	0	43.3093
Gas resource rents (% of GDP)	.5159028	.986977	0	3.761766
Mineral rents (% of GDP)	2.105993	4.129648	0	20.94604
Gov. expenditures (% of GDP)	13.50417	4.10142	5.20998	40.44422
Tax revenue (% of GDP)	14.55172	4.894262	5.835822	39.25777

Dependent variables and firm-level controls are drawn from the WBES. Export shock variables are based on export data drawn built from the World Development Indicators (WDI). Country-level controls are also drawn from the WDI, except for the democracy index drawn from the Freedom House database.

**Table 3**  
Sample composition, by region.

Region	Freq.	Percent	Cum.
Sub-Saharan Africa	4,805	10.73	10.73
East-Asia & Pacific	6,181	13.80	24.53
Eastern Eur. & Central Asia	8,471	18.91	43.44
Latin America & Caribe	13,196	29.46	72.90
Middle East & North Africa	3,392	7.57	80.48
South Asia	8,745	19.52	100.00
Total	44,790	100.00	

20% of firms have paid at least one informal payment in the last fiscal year. Figs. 2 and 3 depict graphically this information, while Table 2 provides additional summary statistics.

### 3.2. Econometric framework

Our theory delivers the testable prediction (Proposition 1) that a drop in exports in low export settings and an increase in exports in high export settings should both map into more bribes. Given the nature of the skewness measure capturing periods of export expansions and contractions, we test this implication by estimating the following corruption equation:

$$B_{ijt} = \beta_0 + \beta_1 \cdot S_{jt} + \beta_2 \cdot S_{jt}^2 + \beta_3 \cdot X_{ijt} + D_j + D_t + D_s + \epsilon_{ijt}. \quad (7)$$

In (7)  $B_{ijt}$  is a measure of bribery (bribe payment or incidence) made by firm  $i$  in country  $j$  at survey-time  $t$ .  $S_{jt}$  is an aggregate export shock variable in country  $j$  at survey-time  $t$ , which is measured by the skewness of exports.  $X_{ijt}$  is a matrix of micro-level and country-level control variables, described in Section 3.1, and  $\epsilon_{ijt}$  an error term.  $D_j$ ,  $D_t$ , and  $D_s$  are respectively firm's location (country), survey time and industry fixed effects, included to reduce concerns related to omitted variable biases. Given that  $S_{jt}$  is aggregated at the country-year level, we cluster the standard errors at the same level.

If the hypothesis of both export booms and busts increasing bribery holds, then estimates of (7) should support a U-shaped relationship centered around a null skewness value. Accordingly we would then expect the separate effects of export booms and busts to be salient as captured by the following specification:

$$B_{ijt} = \beta_0 + \beta_1 \cdot S_{jt}^+ + \beta_2 \cdot S_{jt}^- + \beta_3 \cdot X_{ijt} + D_j + D_t + D_s + \epsilon_{ijt}, \quad (8)$$

where  $S_{jt}^+$  refers to a positive export skewness variable (equal to the skewness value if positive, zero otherwise), and  $S_{jt}^-$  refers to a negative export skewness variable (equal to the absolute skewness value if negative, zero otherwise).  $\epsilon_{ijt}$  is an error term, and standard errors are again clustered at the country-year level.

## 4. Results

### 4.1. Baseline estimations

Table 4 presents some baseline estimations in support of our theoretical mechanism. In column (1) we inquire the effect of positive export shocks on bribery, conditional on export market size. Estimates support that export market size condition the effect of export shocks on bribery in the expected and significant way. Observe that the export skewness variable does not allow us to properly identify episodes of export booms and export busts. To estimate their separate effects on bribery, we then introduce in Column (2) the squared term of the skewness variable as shown in Eq. (7), expecting a U-shaped effect of positive export shocks on bribery, with a threshold value lying around 0 if both booms and busts increase bribery. Column (2) of Table 4 reports estimates of Eq. (7), while Fig. 4 depicts their associated marginal effects. The shift in the direction of the effect of export skewness on bribes is not directly observable in the table, but marginal effects clearly stress a U-shaped relationship with a turning point located approximately at skewness values around 0. In Column (3) we decompose the export skewness variable into a positive and a negative skewness and include separately these variables in our econometric specification, as specified

**Table 4**  
Export shocks and market size.

Dep. var: Bribe payments	(1)	(2)	(3)	(4)	(5)
Export skewness (t; t-3)	-0.0768 (0.0211)	0.00319 (0.00146)			
Export skew. × ln exports per cap.	0.0101 (0.00278)				
Export skewness <sup>2</sup>		0.00007 (0.00003)			
Export skew> 0 (t; t-3)			0.0123 (0.0050)	-0.3265 (0.0346)	-0.0077 (0.0100)
Export skew<0 (t; t-3)			0.00773 (0.0035)	0.00766 (0.0026)	0.0979 (0.0395)
Export skew> 0 × ln exp. per cap.				0.04488 (0.0047)	
Export skew<0 × ln exp. per cap.					-0.0135 (0.0059)
N	44,790	44,790	44,790	42,140	42,140
R2	0.125	0.125	0.125	0.115	0.115

Std err. in parentheses, corrected for heteroscedasticity and clustered at the country-year level. Control variables, location, time and sector fixed effects are included in regressions but not reported in the table.

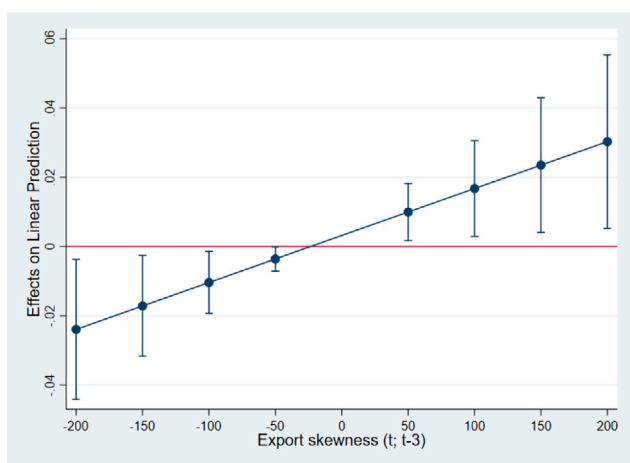


Fig. 4. Marginal effects of export skewness on bribery, Eq. (7).

in Eq. (8). The resulting estimates support at a 5% significance level our previous findings that both export booms and busts are conducive to bribery, as suggested by our theoretical model.

To further convince the reader of the salience of the mechanism, in Columns (4) and (5) we test the following hypotheses, which are important predictions of our model:

- During export boom episodes, bribery should increase in countries displaying larger exports market size.
- During export busts episodes, bribery should increase in countries displaying smaller export market size.

Therefore, we respectively interact the positive skewness and negative skewness measures with export levels as measured by the natural logarithm of exports *per capita*. The positive (negative) coefficient for the interaction of the positive (negative) skewness measure with export levels further confirms that the non-linear effect of export shocks on bribing is driven by the export market size (columns (4) and (5)).

Our empirical analysis therefore confirms that both export expansions and contractions may increase bribe prevalence.

#### 4.2. Testing the mitigating effect of institutions

We now extend our empirical analysis to test the robustness of our findings to the inclusion of institutions. Scholars have recurrently pointed at the mitigating effect of institutions on rent seeking and

corruption, with the deleterious effect of, e.g., resource windfalls being potentially flipped in the presence of strong institutions (e.g. Mehlum et al. (2006) and Robinson et al., 2006). Although our theory does not actually feature institutions it is immediate to show that amending the model to account for institutional quality would result in a reduction of bribery for any level of exports.<sup>15</sup> In line with this literature and with intuitions derived from our theory, good institutions as measured by an efficient bureaucracy, well-designed regulations, and strong check and balances, should contain firms' inclination to allocate their resources to bribes and instead incentivize them to invest in inputs and boost their output. We therefore expect key features of the institutional framework to mitigate the positive effect of export booms and busts on bribery. Accordingly, we interact the export boom and bust variables with various proxies of institutional quality, as follows:

$$B_{ijt} = \delta_0 + \delta_1 \cdot S_{jt}^+ + \delta_2 \cdot S_{jt}^- + \delta_3 \cdot S_{jt}^+ \times Inst_{jt} + \delta_4 \cdot S_{jt}^- \times Inst_{jt} + \delta_5 \times Inst_{ijt} + \delta_6 \cdot X_{ijt} + D_j + D_t + D_s + v_{ijt}. \tag{9}$$

Where  $Inst_{jt}$  is a measure of institutional quality, and  $v_{ijt}$  the error term. Standard errors are clustered at the country-year level.

We consider good governance as a direct outcome of institutional quality, and measure it using the World Bank Governance Indicators (WBI), which reflect six independent dimensions of governance quality: *Regulatory Quality*, *Voice and Accountability*, *Political Stability*, *Government Effectiveness*, *Corruption Control*, and *the Rule of Law* indexes.<sup>16</sup> In addition, we build a disaggregated measure of “red tape” within the sector where the firm operates, by computing the average share of senior management's time spent in dealing with government regulations, a variable drawn from the WBES. An increase in this *red tape* variable reflects a deterioration of governance quality at the country-sector level.

<sup>15</sup> Technically, instead of viewing the revenue function as given by  $R\left(\frac{b^j}{\sum b^j} X - C, F - b^j\right)$ , we could consider the alternative formulation  $R\left([1 - \phi] \frac{b^j}{\sum b^j} X + \phi \frac{X}{n} - C, F - b^j\right)$ , where  $\phi \in [0, 1]$  would reflect institutional quality. Solving this modified model and conducting comparative statics with respect to  $\phi$  immediately implies that  $\partial b^* / \partial \phi < 0$ .

<sup>16</sup> According to the World Bank, “Governance consists of the traditions and institutions by which authority in a country is exercised. This includes the process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound policies; and the respect of citizens and the state for the institutions that govern economic and social interactions among them”. Definitions and sources of these variables can be found at <http://info.worldbank.org/governance/wgi/Home/Documents>.

**Table 5**  
The mitigating effect of institutional quality, Eq. (9).

Dep. var: Bribe payments (%)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Export skew> 0	0.143 (0.0445)	0.281 (0.0380)	0.0198 (0.0186)	0.149 (0.0312)	0.0694 (0.00869)	0.2170 (0.0766)	0.00447 (0.00739)
Export skew<0	0.0633 (0.0190)	0.0861 (0.0103)	0.00955 (0.00880)	0.0658 (0.0143)	0.00914 (0.00378)	0.1017 (0.0342)	-0.00323 (0.00709)
Export skew> 0 × Reg. Qual.	-0.0550 (0.0183)						
Export skew<0 × Reg. Qual.	-0.0239 (0.00819)						
Export skew> 0 × Voice Account.		-0.107 (0.0148)					
Export skew<0 × Voice Account.		-0.0332 (0.00417)					
Export skew> 0 × Pol. Stab.			-0.00517 (0.0102)				
Export skew<0 × Pol. Stab.			-0.00202 (0.00423)				
Export skew> 0 × Gov. Effect.				-0.0753 (0.0167)			
Export skew<0 × Gov. Effect.				-0.0337 (0.00762)			
Export skew> 0 × Corr. Cont.					-0.0320 (0.00525)		
Export skew<0 × Corr. Cont.					-0.00716 (0.00216)		
Export skew> 0 × Rule of Law						-0.1361 (0.0508)	
Export skew<0 × Rule of Law						-0.0649 (0.0240)	
Export skew> 0 × Red tape							0.000578 (0.000258)
Export skew<0 × Red tape							0.000780 (0.000326)
Additive interaction terms	3.675 (2.264)	2.196 (1.210)	0.350 (0.863)	5.546 (1.531)	-3.333 (0.688)	-0.0710 (0.0295)	-0.07096 (0.02949)
N	44,790	44,790	44,790	44,790	44,790	44,774	44,774
R2	0.125	0.125	0.125	0.125	0.125	0.125	0.115

Std err. in parentheses, corrected for heteroscedasticity and clustered at the country-year level. Control variables, location, time and sector fixed effects are included in regressions but not reported in the table. Sector red tape is the sector average time spent by managers dealing with regulations. Other interaction variables are drawn from the World Bank Governance Indicators. Additive interaction terms stand for WBGI's Regulatory Quality, Voice and Accountability, Political Stability, Government Effectiveness,

Results are presented in Table 5. Except for the WBGI's Political Stability index (column (3)), all other WBGI's governance quality variables are found to significantly mitigate the positive effect of both export booms and busts on bribery; while the existence of red tape faced by managers is, as expected, found to mediate it. Therefore, good governance – which is facilitated by strong institutions – is found to attenuate the positive effect of export booms, as already pointed by the literature, but also the positive effect of export busts on bribery.

4.3. Identification channel: firm's export activity

Our results this far have highlighted that corruption may increase both with export booms and busts, depending on the export levels of the country in which a firm operates. Observe that our results have not accounted for the focal firm's export activity, thereby casting potential doubts on the causal mechanism. Indeed, our theory relates bribing incentives to the size of firms' controlled export market, and yet our data does not allow us to measure directly expansions or contractions of this variable at the firm level. Failing to identify the channel implies that bribes could be paid by non-exporting firms and therefore be driven by indirect redistribution schemes such as public transfers (as suggested by Lane & Tornell, 1999).

We try to overcome this data limitation and to provide evidence that the export channel is directly involved in the previously evidenced relationships by interacting a measure of the firm's orientation towards foreign markets with export booms and busts. The intuition is that the effects of export booms and busts on bribery should be greater for firms selling a large share of their output in foreign markets compared to firms selling a small share, and should be null for firms that do

not export at all. To test this, we augment Eq. (8) by interacting our variables of export booms and busts with a firm-specific proxy of export orientation,  $O_{ijt}$ , as follows:

$$B_{ijt} = \delta_0 + \delta_1 \cdot S_{jt}^+ + \delta_2 \cdot S_{jt}^- + \delta_3 \cdot S_{jt}^+ \times O_{ijt} + \delta_4 \cdot S_{jt}^- \times O_{ijt} + \delta_5 \cdot O_{ijt} + \delta_6 \cdot X_{ijt} + D_j + D_t + D_s + v_{ijt}. \tag{10}$$

$v_{ijt}$  is the error term, and standard errors are clustered at the country-year-sector level. We proxy  $O_{ijt}$  using the firm's export share in its total sales. The share of exports is measured with direct exports, indirect exports, or both direct and indirect exports, and estimates are respectively reported in columns (1) to (3) of Table 6. Our findings support that the previously estimated relationships are particularly salient for exporting firms, thus revealing that the bribery effect of export shocks is indeed driven by exporting firms as assumed in our theoretical model. More specifically, our estimates highlight that the share of direct exports in firms' total sales drives the positive effect of export booms and busts on bribery. They also reveal that the effect of export booms and busts is no longer different from zero when the share of (direct) exports is nil (columns (1) and (3)). Therefore, this first piece of additional evidence suggests that our earlier findings do operate through the firms' export channel.

As a second step, we split our sample between direct exporters on the one hand, and indirect exporters and non-exporters on the other hand, and re-estimate Eq. (8) separately on these sub-samples. We expect at least a stronger effect of export booms and busts on bribe payments made by direct exporters compared to indirect exporters and non exporters. Results in Table 6 support this expectation, but also highlight a lower but still 10%-significant positive effect of booms

**Table 6**  
Identification channel: firm's export activity.

Dep. var: Bribe payments	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Full sample			Dir. exp.	Indir. & non-exp.	Dir. exp.	Indir. & non-exp.
Export skew> 0	0.0115 (0.0076)	0.0122 (0.00756)	0.0108 (0.00764)	0.0238 (0.00676)	0.0108 (0.00603)	0.0410 (0.0184)	-0.00845 (0.0124)
Export skew<0	0.0062 (0.0047)	0.00774 (0.0046)	0.0058 (0.0048)	0.0108 (0.00403)	0.00796 (0.00409)	0.0216 (0.0115)	-0.00566 (0.00798)
Export skew>0 × Dir. Exp. (%)	0.00019 (0.00012)						
Export skew<0 × Dir. Exp. (%)	0.00038 (0.0002)						
Export skew>0 × Indir. Exp. (%)		0.0000565 (0.00006)					
Export skew<0 × Indir. Exp. (%)		-0.0000192 (0.00007)					
Export skew> 0 × Dir. & indir. Exp. (%)			0.00015 (0.00009)				
Export skew> 0 × Dir. & indir. Exp. (%)			0.000259 (0.00014)				
Local bribe spillovers						-31.43 (27.24)	63.02 (18.79)
N	44,790	44,790	44,790	8,105	36,685	8,102	36,640
R2	0.126	0.125	0.126	0.185	0.141	0.190	0.150

Std err. in parentheses, corrected for heteroscedasticity and clustered at the country-year-sector level in columns (1) and (2), and clustered at the country year level in columns (3) to (6). Control variables, additive interaction variables, location, time and sector fixed effects are included in regressions but not reported in the table.

and busts on bribe payments of indirect exporters and non exporters. Since our theoretical model focuses exclusively on exporting firms, the mechanism uncovered by our theory cannot help to rationalize this result. A plausible interpretation of this result is the presence of bribe spillovers from direct exporters to other firms. In fact, as pointed by [Andvig and Moene \(1990\)](#), “corruption may corrupt” and bribes made by non-exporting firms may be spurred by an environment where bribery at exports is pervasive. In other words, there may be spatial spillovers between bribes made by exporting and non exporting proximate firms.

To address this spillovers issue, we introduce in the corruption equation a variable that gauges the local spillover effects of bribe payments made by direct exporters. This variable consists in computing the share of direct exporters who declared having paid bribe in the universe of direct exporters in each location where the firm (exporter or not) operates.<sup>17</sup> The larger the incidence of bribers among direct exporters, the greater the likely spillover effect on indirect exporters and non exporting firms. We hence re-estimate Eq. (8) on these sub-samples with this bribe spillovers variable and report estimates in columns (6) and (7) of [Table 6](#). Once controlling for these spillover effects, the effect of export booms and busts on bribery is no longer significant in the sub-sample of indirect exporters and non exporters while remaining significant in the sub-sample of direct exporters. Interestingly, the spillovers variable is significant at the 1% level of significance and positive in the sub-sample of indirect exporters and non exporting firms, but non significant in the sub-sample of direct exporters.

#### 4.4. Robustness checks

In this section, we undertake a range of checks aimed at testing the robustness of our empirical results. First, we estimate our model using alternative and more common export shock variables, based on simple export deviations from their trend. We also re-run estimations while considering wider export skewness time-windows. We then use a binary bribery variable as the dependent variable in order to reduce a possible estimation bias related to the risk of firms under-reporting the actual size of bribe payments.

<sup>17</sup> Excluding the firm's own decision to bribe in this calculus, and imposing a minimum number of 10 firms in locations.

We re-estimate Eq. (7) after replacing the export skewness variable by a simple measure of export deviations from their trend,  $\frac{y_{jt} - \bar{y}_{jt}}{\bar{y}_{jt}} \times 100$ . Using such a shock variable and interacting it with key conditioning variables underpinned by the theory requires controlling for the effect of past deviations as well. Indeed, since our dataset does not have a panel structure, the effect of a positive export shocks on bribery at a given point of time will differ if it occurs after a period of predominant negative shocks, positive shocks, or mixed ones. Controlling for the effect of past deviations, however, comes at a cost of possible multicollinearity issues, because of autocorrelation in the cycle components of exports variations highlighted in [Table 1](#).

In Column 1 we interact the export deviation variable with the exports *per capita* variable, while additionally controlling for lags 1 to 3 of the export deviation variable, based on the skewness computation time window and therefore on the serial correlation order previously detected by the [Born and Breitung \(2016\)](#)  $Q(p)$ -test. Results support our model's prediction and confirm the conditioning effect of export market size at the 1% confidence level.

In Column 2 we re-estimate (7) while extending the skewness computation time-window to (t; t-5). The estimates confirm our earlier findings, and thus suggest that the previously estimated relationships are not affected by the export skewness time-window.

Last, we partially address potential measurement error concerns. [Clarke \(2011\)](#) stresses the risk of under and over-reporting biases in bribe declarations, which may, in turn, bias estimated relationships when our dependent variable is the size of informal payments expressed as a share of total sales. One way of circumventing this drawback consists in using instead a binary variable of bribe incidence, equal to one if the firm has reported an informal payment, and zero otherwise. We thus re-estimate in Column 3 of [Table 7](#), Column 1 of [Table 4](#) with this binary bribery variable, and the resulting estimates are consistent with previous estimations.

#### Conclusion

Economic development is typically assimilated to an improvement of socio-economic indicators, including a reduction in corruption, red tape and bribing. It is nevertheless quite common to witness a proliferation of corrupt practices in more advanced economies. In this article we have focused on bribing activities in contexts notoriously exposed to corruption – i.e. export markets – and have attempted

**Table 7**  
Alternative shock variables.

Dep. var: Bribe payments (%)	(1)	(2)	(3)
Export deviation (%)	-14.60 (2.120)		
Export dev × exp. per capita	2.077 (0.304)		
Export skewness (t; t-5)		-0.0709 (0.0211)	
Export skew.(t; t-5) × exp. per capita		0.0093 (0.0027)	
Export deviation in t-1	-0.905 (0.141)		
Export deviation in t-2	0.768 (0.0949)		
Export deviation in t-3	0.0236 (0.0151)		
Ln exports per cap.	-37.75 (5.892)	-13.71 (5.219)	
Export std dev. (10 years, %)	-2.355 (0.339)		
<hr/>			
Dep. var: Bribe Incidence			
Export skewness (t; t-3)			-0.0078 (0.0049)
Export skew × exp. per capita			0.0010 (0.0006)
Ln exports per cap.			-0.618 (0.980)
<hr/>			
N	44,790	43,626	47,532
R2	0.125	0.125	0.574

Std err. in parentheses, corrected for heteroscedasticity and clustered at the country-year level. Control variables, location, time and sector fixed effects are included in regressions but not reported in the table. *Export deviations* are computed as follows:  $\frac{y_{jt} - \bar{y}_{jt}}{\bar{y}_{jt}} \times 100$  with  $\bar{y}_{jt}$  being the trend component of exports isolated by the Hodrick–Prescott filter.

rationalizing such observations. We propose a theory that explains both why export booms and export busts spur bribery. The mechanism we highlight is quite intuitive. Exporting firms decide how to allocate their cash flow between producing goods and bribing officials to secure more valuable export markets in a set-up where both components are conceptualized as arguments of the firm’s total revenue. In low export settings, the *marginal* revenue of an export windfall will be large, and thence subject to strong diminishing marginal revenue. Consequently, an exogenous expansion of the export market will result into a reduction of the marginal revenue of bribe because of the revenue function’s concavity, and this effect will be exacerbated by the complementarities between bribery and production: export booms decrease bribe payments. In contrast, for high levels of exports, the opposite holds true if complementarities are not too strong. Since the value of the claimed (corrupt) export market will then be high, the marginal revenue generated through corruption will then increase by more than the marginal revenue of output production. Consequently, positive export shocks will increase the incentives to bribe.

Despite data limitations that do not enable the direct measurement of bribery in relation to export activities, our empirical evidence support the conclusions of our model, by confirming that both export booms and busts are conducive to bribery. Using a large repeated cross-section survey database of some 45,000 firms located in 72 developing and transition economies covering the 2006–2017 period, we uncover that—in line with our theory—export booms and busts are associated with a larger size and probability of bribe payments. Quite interestingly, we show that the effects are driven by exporting firms, while also uncovering the existence of positive spillovers of bribing on non-exporting firms. Our results are shown to be robust to alternative measures of booms and busts, and of bribery. Moreover, we confirm the widespread view that strong institutions mitigate rent-seeking practices, and thus corruption in the context of our study,

without, however, eradicating the effect of booms and busts on bribing. We however highlight that this effect is conditioned by the existence of red tape in the sector where the firm operates.

Rationalizing and establishing empirically the non-monotonic effect of export market expansions on bribery as well as the conditioning effect of export market size helps us nuance the myth that corruption is a problem of the poor, while equally tempering findings exclusively tying windfalls to corruption. Although empirical evidence comforts us viewing this result as robust, further research should be conducted with disaggregated data on corruption at exports, or with the aim of checking whether similar non-linearities are at play between other types of resources and rent-seeking practices.

**Declaration of competing interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**Acknowledgments**

We grateful to Gaëlle Balineau, Elise S. Brezis, Olivier Cadot, Jean-Louis Combes, Vianney Dequiedt, Bernard Gauthier, Michaël Goujon, Patrick Guillaumeont, Jan Gunning, Aurélie Lepine, Alexis Le Nestour, Laurent Wagner, and Peng Zhang, for their valuable help and suggestions.

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