

# The voracity and scarcity effects of export booms and busts on bribery

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## Abstract

The evidence of a “voracity effect” of revenue windfalls reducing growth by fostering rent-seeking and corruption is widely documented by the literature. However, the reverse hypothesis of a “scarcity effect” of revenue downfalls, stimulating corruption by creating resource shortages, has theoretical foundations but little empirical support. This paper fills this gap by providing an empirical analysis of the voracity and scarcity effects of export booms and busts on firm bribery in developing countries. Exploiting 19,712 bribery reports from firms located in 36 developing countries, multilevel estimations of these effects are conducted. The results support a robust positive effect of both export booms and busts on bribery when democratic and financial institutions are weak. Conversely, a robust negative effect of booms and busts on bribery is evidenced when institutions are better off. Therefore, consistent with the literature, this paper provides additional evidence on the importance of institutional safeguards against corrupt practices in times of resource abundance. But more importantly, it provides new insights into their importance in times of shortage.

**Keywords:** corruption, rent-seeking, export shocks, financial markets, democracy, institutions

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## 1. INTRODUCTION

The literature in political economy provides various illustrations, theoretical mechanisms and empirical findings that highlight a “voracity effect” of revenue windfalls on growth (Tornell & Lane, 1999; Sachs & Warner, 2001; Mehlum et al, 2006; Dalgaard & Olsson, 2008; Arezki & Brückner, 2011, 2012). According to these studies, windfalls are detrimental to institutions when the resulting increase in rents accrues to grabbers rather than producers, and generates gains from specialization in influence and corrupt activities (Mehlum et al, 2006; Tornell & Lane, 1999; Murphy et al, 1991). As a result, corrupt transactions are found to spread during economic booms, when opportunities to enrich flourish and when institutional safeguards against malpractices are overwhelmed (Mehlum et al, 2006).

By contrast, the reverse hypothesis of a “scarcity effect” of adverse shocks on corrupt behaviors has not yet been considered by empirical studies. However, another strand of the literature shows that shortages can lead to antisocial behaviors (Prediger et al, 2014), expropriation (Bluhm & Thomsson, 2015; Mehlum et al, 2003) or civil conflicts (Miguel et al, 2004; Brander & Taylor, 1998). In fact, some researches have stressed that scarcity stimulates survival strategies aimed at the appropriation of resources (Grossman & Mendoza, 2003; Brander & Taylor, 1998). Because corruption can be considered an effective mean of taking control over public and private resources, it is possible to make the link between this mechanism and the theoretical literature on queuing models (Lui, 1985; Kulshreshtha, 2007) and auction models (Saha, 2001) of bribery. In these models, economic agents compete for scarce public resources, which give strong discretionary powers to agents charged with their allocation and allow them to extract bribes. Therefore, by creating shortages and by making people compete for the appropriation of resources, revenue downfalls may foster corrupt behaviors. This simple mechanism underlies the scarcity effect of economic busts on bribery.

As a result, both economic booms and busts may increase corruption prevalence. To test the concomitance of the voracity and scarcity effects, I estimate the separate effects of aggregate export booms and busts on firm-level bribery in a sample of developing countries. Following Mehlum et al’s (2006) findings on the critical role of institutions in the resource curse, I emphasize the importance of democratic and financial institutions in channeling the voracity and scarcity effects of shocks on corruption. These two key features of the institutional framework are indeed expected to affect the relative cost of engaging in corrupt transactions. On the one hand, effective democratic institutions increase the probability for corrupt agents of getting caught and sanctioned (Brunetti & Weder, 2003; Lederman et al, 2005; Bhattacharyya & Hodler, 2010, 2015), and support the protection of property rights and the freedom of choice (Farhadi et al, 2015). On the other hand, more efficient financial markets reduce production costs (Levine, 2005) and therefore increase the opportunity cost of rent-seeking and corruption (Dalgaard & Olsson, 2008).

Exploiting 19,712 bribe reports from firms located in 36 developing countries, multilevel cross-section estimations are conducted. The results support a positive effect of both export booms and busts on bribery when institutions are failing. Conversely, a significant and robust negative effect of booms and busts on bribery is evidenced when democratic and financial institutions are better

off. Therefore, this paper provides additional evidence on the importance of institutional safeguards against corrupt practices during revenue windfalls and new evidence on their importance during revenue downfalls.

The next section reviews the literature and sets the analytical framework. The third section details the data and the multilevel estimation framework. The fourth section presents the empirical results. The fifth section concludes.

## **2. LITERATURE REVIEW AND ANALYTICAL FRAMEWORK**

Many studies point out that if fragile states undergo resource windfalls, rent-seeking behaviors are likely to spread and growth rates are likely to fall (Tornell & Lane, 1999; Mehlum et al, 2006; Voors et al, 2011). This rise in opportunistic rent-seeking behaviors, stimulated by resource abundance, underlies the voracity effect of shocks highlighted by Lane and Tornell (1996) and Tornell and Lane (1999) and tested by many others (Arezki & Brückner, 2011, 2012; Mehlum et al, 2006).

On the other hand, many papers stress that resource scarcity fosters predation and appropriative competition (Prediger et al, 2014; Grossman & Mendoza, 2003; Brander & Taylor, 1998). Theoretical papers also suggest that rent-seeking and corruption may spread as a result of resource scarcity (Lui, 1985; Saha, 2001; Kulshreshtha, 2007). As a result, one can expect that revenue shortfalls increase corruption by making economic agents compete for scarce resources.

Therefore, while positive shocks may foster opportunistic corrupt behaviors by multiplying opportunities for personal enrichment, negative shocks may foster survival corrupt behaviors by increasing the appropriative competition for scarce resources.

### **2.1. The voracity effect of economic booms**

The effect of economic booms on institutional outcomes is well documented. In this regard, the seminal works of Lane and Tornell (1996) and Tornell and Lane (1999) explain how “voracious” appetites for wealth accumulation are stimulated by resource windfalls. Their predictions found a strong echo in the resource curse literature (Mehlum et al, 2006; Bhattacharyya & Hodler, 2010; van der Ploeg, 2011), which provides theoretical and empirical evidence on the negative effect of natural resource windfalls on growth passing through increased rent-seeking and corruption.

In a talent-allocation framework, Baland and François (2000), Torvik (2002) and Mehlum et al (2006) stress that larger natural resources incite entrepreneurs to engage in rent-seeking rather than production, which leads to lower growth and welfare. This point has also been highlighted by Bhattacharyya and Hodler (2010), who show that in nondemocratic countries, strong information asymmetries between politicians and the people allow the former to derive private benefits from natural resource abundance through corrupt means. Emphasizing the same mechanism, Arezki and Brückner (2012) show that international commodity price booms positively affect growth in homogeneous societies, while they increase corruption and expropriation in fragmented societies. Focusing the analysis on the African context, Voors et al (2011) and Dalgaard and Olsson (2008)

stress that positive income shocks incite agents to accumulate extra wealth through corrupt activities.

According to these studies, public and private agents are therefore likely to engage in bribery, extortion or other malpractices, when opportunities for personal enrichment flourish. Such “opportunistic” corrupt behaviors underlie the voracity effect of positive shocks on corruption.

## **2.2. The scarcity effect of economic busts**

The question of how corrupt transactions expand in a context of scarce resources can find a preliminary answer in the insightful study of Brander and Taylor (1998). These authors stress how demographic pressure over natural resource endowments in the Easter Island society exacerbated predatory behaviors, fastened the depletion of resources and hastened the decline of this ancient society. Building on this research, Grossman and Mendoza (2003) propose a model of appropriative competition, where transitory resource shortage increases the amount of time and effort spent by economic agents for appropriating resources. In this model, scarce resources combined with optimistic anticipations regarding future revenue intensify the struggle for survival, which in turn leads to resource depletion, conflict and expropriation. This high risk of antisocial behaviors in a context of scarcity was also evidenced in an empirical study by Prediger et al (2014). They conducted a “joy-of-destruction” experiment with pastoralists, and stressed that their inclination to reduce other players’ income was significantly higher when they came from resource-scarce areas. Therefore, according to these researches, scarcity is likely to lead to predation, conflict and expropriation.

To the best of my knowledge, there is no empirical evidence of a scarcity effect of revenue downfalls on corruption prevalence. However, theoretical mechanisms that could underlie such an effect have been highlighted in queuing models (Lui, 1985) and auction models (Saha, 2001) of bribery. These models focus on the demand side of bribery and emphasize how public servants may personally benefit from public resource shortages by extracting bribes from people competing for rationed public resources. Moreover, resource shortages can be exacerbated by corrupt public officials who can artificially slow down the speed of the queue or generate additional red tape, in order to extract more bribes from individuals (Aidt, 2003). From the supply side of bribery, adverse shocks may put firms under economic or financial stress, and may incite them to bribe in order to relieve the state burden and to get privileged access to public resources. Therefore, following Grossman and Mendoza’s (2003) terms, bribe payments may be driven by “survival” behaviors and their amount may be an informal pricing signal of resource scarcity. This mechanism underlies the scarcity effect of adverse shocks on corruption.<sup>1</sup>

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<sup>1</sup> In addition, other theoretical channels can explain how hardship may foster corruption prevalence. Becker and Stigler (1974) argue that raising public wages increases the relative cost for public agents of engaging in corrupt activities, and vice versa. Therefore, if they result in public wage cuts, adverse macro shocks may reduce the relative costs of engaging in corrupt transactions.

As a result, if the voracity and scarcity effects are concomitant, the effect of positive and negative shocks on corruption may be symmetric. The next subsection stresses how institutional safeguards against malpractices can make this symmetric effect either positive or negative.

### **2.3. The role of institutions**

In their seminal work, Murphy et al (1991) showed that talents in an economy are split between productive activities, which are conducive to growth through enhanced productivity and innovations, and rent-seeking activities, which are harmful to growth due to their negative effect on productivity and institutions (Murphy et al, 1993). Moreover, Mehlum et al. (2006), Robinson et al (2006) and Arezki and Brückner (2011) showed that the positive effect of resource booms on rent-seeking depends on the quality of institutions. Building upon this literature, I state that i) the voracity and scarcity effects of shocks on corruption depend on the attractiveness of rent-seeking compared to production, and ii) that this relative attractiveness relies on the quality of the institutional framework.

Mehlum et al (2006) propose a theoretical model stressing that the direction of the effect of natural resource windfalls on growth depends on whether institutions are more favorable to producers (“producer-friendly institutions”) or rent seekers (“grabber-friendly institutions”). In their model, resource booms are detrimental to growth if the resulting increase in rents accrues to grabbers rather than producers, thereby generating gains from specialization in influence and corrupt activities.

Could the same conditional effect hold during adverse shocks? In fact, good institutions – i.e. effective rule of law, efficient financial markets, well-functioning democracy and so on – make countries more resilient to adverse shocks (Rodrik, 1998, 2000; Isham et al, 2005), and therefore help keep productive activities appealing during economic hardships. By contrast, if institutions are bad and country resilience is low, adverse shocks may be detrimental to production and more conducive to rent-seeking and corruption.

To sum up, one can expect that “opportunistic corruption” spreads during positive shocks and that “survival corruption” spreads during negative shocks, when institutions are grabber-friendly. In contrast, opportunistic and survival corrupt behaviors are likely to decrease during positive and negative shocks, respectively, when institutions are producer-friendly. Table 1 summarizes this symmetric effect of positive and negative shocks, conditional on institutions.

**Table 1. Institutions, asymmetric corrupt transactions and the symmetric effect shocks**

	Economic shocks	Positive shocks	Negative shocks
Institutions			
Grabber-friendly institutions		+ opportunistic corruption	+ survival corruption
Producer-friendly institutions		- survival corruption	- opportunistic corruption

In this study, two specific dimensions of the institutional framework are emphasized: democracy and the financial market's performance. First, democracy makes governments more accountable, increases the probability for corrupt agents of getting caught and sanctioned (Lederman et al, 2005; Brunetti & Weder, 2003; Bhattacharyya & Hodler, 2010, 2015), and supports the protection of property rights and the freedom of choice (Farhadi et al, 2015). Strong democratic institutions should therefore be producer-friendly and be detrimental to rent-seeking and corruption. By contrast, weak democratic institutions are associated with insecure property rights and a weak rule of law, and should therefore favor predation and discourage production (Mehlum et al, 2003; Robinson et al, 2006). Second, easier access to financial markets and more transparent financial information increases the opportunity cost of rent-seeking by softening the liquidity constraint over productive firms and reducing information, enforcement and transaction costs related to production (Levine, 2005). Therefore, as evidenced in Altunbas and Thornton (2012), efficient financial markets should be detrimental to corruption.

### 3. EMPIRICAL FRAMEWORK

The voracity and scarcity effects are tested by analyzing the effect of rises and falls in export proceeds on firms' informal payments, conditional on the quality of institutions. Corruption is therefore expressed as a function of positive and negative export shocks, and a set of controls:

$$Corruption = E\{positive\ shocks, \ negative\ shocks | Institutions, \ Controls\} \quad (1)$$

Multilevel estimations of this corruption equation are conducted using micro data on firms' bribery as dependent variable, and macro-level measures of export booms and export busts as interest variables, along with a set of micro-level controls, macro-level controls and sector-dummy variables. Data sources and summary statistics are provided in Appendix A.

#### 3.1. WBES data on firms' experience of bribery and firms' characteristics

The WBES data provide a comprehensive and internationally comparable firm-level assessment of business environment conditions around the world, encompassing a wide range of information on

the supply side of bribery along with other firm-level characteristics.<sup>2</sup> From this data set, two dependent variables reflecting bribe prevalence among firms are used. The first dependent variable is the size of informal payments reported by firms, expressed as a share of their total sales. This dependent variable is bidimensional since an increase in this variable can be induced by both/either an increase in the incidence and/or an increase in the size of bribes. This variable is moreover subject to underreporting or overreporting by respondents (Clarke, 2011). To complement this variable and to address these issues, I compute a variable of bribe incidence, equal to one if it has reported an informal payment and zero if it has reported no informal payment. I therefore use two dependent variables – a “bribe-payment” variable and a “bribery-incidence” variable.

Moreover, the WBES data set allows information to be exploited on firms’ sector of activity and a range of firms’ characteristics that are expected to affect their inclination to engage in corruption to be controlled for. Building on studies on the determinants of firm-level corruption (Svensson, 2003; Hellman et al, 2003; Dabla-Norris et al, 2008; Diaby & Sylwester, 2015), I control for the logarithm of a firm’s total annual sales, for the share of direct and indirect exports in total sales, for the firm’s size (using dummy variables for medium-size and large-size firms, based on their number of employees), for the firm’s share of public ownership, for its share of working capital funded by internal funds, its share of working capital funded by public and private commercial banks, and its sector of activity (using sector dummies).

### **3.2. Export instability variables**

The emphasis placed by this study on the voracity and scarcity effects of export fluctuations is first justified. The rationale behind export boom and bust variables is then explained.

#### *3.2.1. Export shocks as a major and primary source of macroeconomic instability in developing countries*

The emphasis placed on export fluctuations is justified because of their destabilizing effect on developing economies, and because they reflect the effect of both external and internal primary shocks.

First, in developing countries, the instability in export earnings has been pinpointed as a major source of output fluctuations (Guillaumont, 2009; Guillaumont & Chauvet, 2001), with a dramatic impact on growth, investment, tax receipt, redistribution policy and development outcomes (Balassa, 1989; Bevan et al, 1993; Easterly et al, 1993; Cariolle et al, 2016). Export windfalls and downfalls therefore seriously affect, directly and indirectly, revenue inflows in the whole economy,

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<sup>2</sup> WBES data has been collected according to a stratified random sampling with replacement, based on firm size, geographic location and sector of activity. Enterprises were interviewed between 2006 and 2014 and asked the following question: “We’ve heard that establishments are sometimes required to make gifts or informal payments to public officials to ‘get things done’ with regard to customs, taxes, licenses, regulations, services etc. On average, what percentage of total annual sales, or estimated total annual value, do establishments like this one pay in informal payments or gifts to public officials for this purpose?”



thereby disrupting households' and firms' economic decisions, including decisions to engage in corrupt transactions.

Second, export instability is a primary source and mostly exogenous of macroeconomic instability, caused by external shocks such as ups and downs in international commodity prices, in terms of trade and in international interest rates; but also caused by internal shocks such as natural resource discoveries or climate-related shocks (Jones & Olken, 2010). In fact, Jones and Olken stress that, in developing countries, exports are more sensitive to temperature shocks than GDP, and that temperature shocks affect both agricultural and light manufacturing exports. Moreover, focusing on the effect of intermediate instabilities – related to growth, public spending or investment – would lead to a possible downward bias if governance is good and the country is resilient (Rodrik, 2000; Guillaumont, 2009), or an upward bias if governance is bad and the country is not resilient (Acemoglu et al, 2003).

### 3.2.2. *Identifying corruption responses to asymmetric shocks*

The literature often introduces periodic shock variables to study their impact on institutional outcomes (Voors et al, 2011). However, such an approach applied to corrupt transactions abuts on the inertia of corruption levels. In fact, corruption decisions are likely to be taken after successive or abrupt shocks, when these fluctuations challenge institutional safeguards against malpractices and make them unable to keep production more attractive than rent-seeking.

To study the effects of sharp and/or repeated asymmetric export movements on bribery, I build a measure of export booms and busts based on the skewness of the export distribution around a 15-year mixed trend.<sup>3</sup> According to Rancière et al (2008), the skewness provides a de facto measure of the asymmetry and abruptness of shocks around a reference value. Skewness variables are calculated over (t; t-3) and expressed as a share of their trend:

$$Skewness_i = 100 \times \frac{\frac{1}{T} \sum \left( \frac{y_{it} - \hat{y}_{it}}{\hat{y}_{it}} \right)^3}{\left( \frac{1}{T} \sum \left( \frac{y_{it} - \hat{y}_{it}}{\hat{y}_{it}} \right)^2 \right)^{3/2}} \text{ with } T=[t;t-3] \quad (2)$$

where  $y_{it}$  is the observed constant value of export in country  $i$  at time  $t$ , and  $\hat{y}_{it}$  the mixed trend. The four-year calculation time window has been arbitrarily chosen to capture the short-run effect of asymmetric fluctuations. In fact, enlarging the time windows is problematic as it supposes that, for a given skewness value, remote and recent asymmetric shocks have the same effect on bribery

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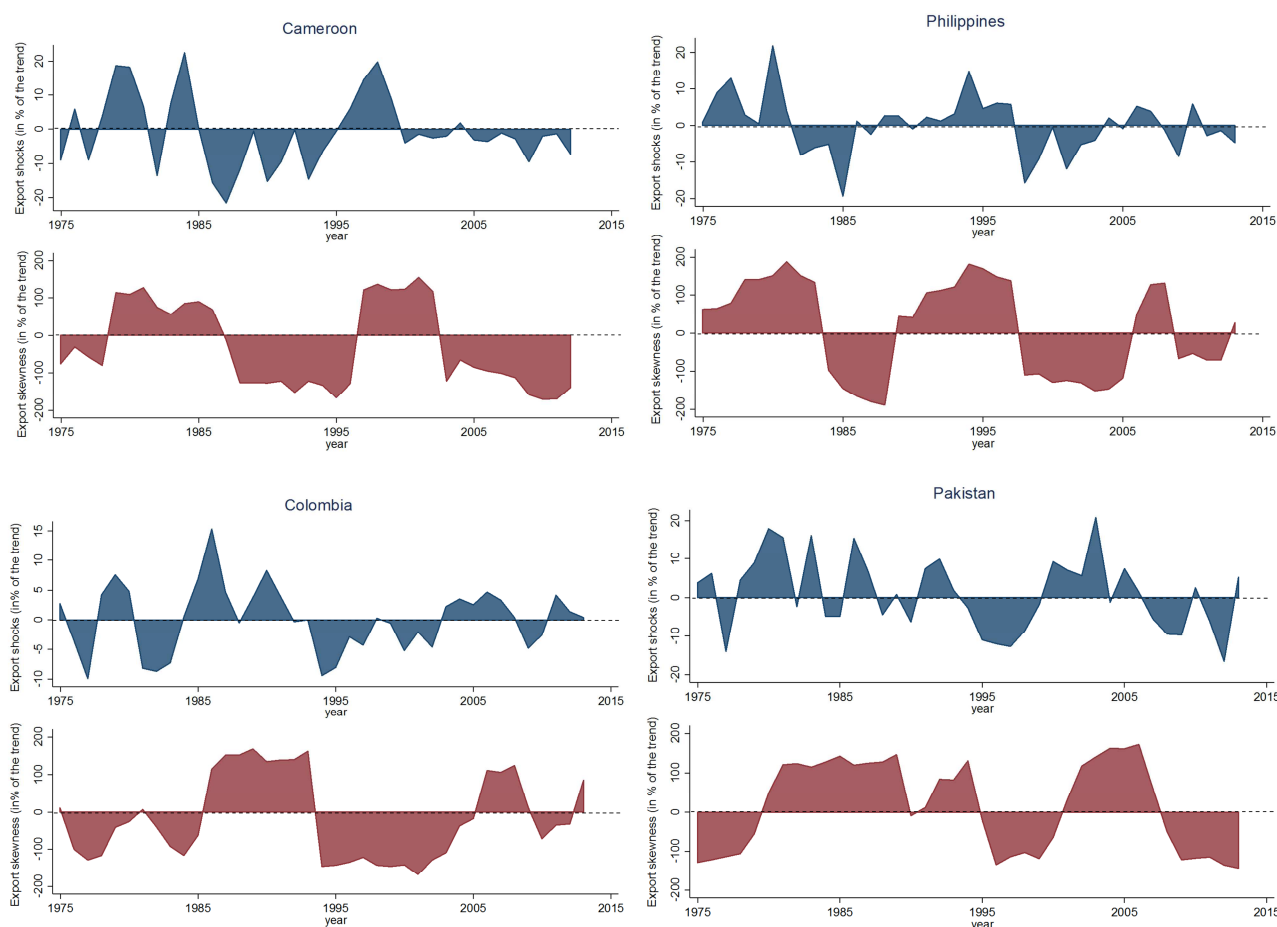
<sup>3</sup> A mixed trend exhibits both deterministic and stochastic paths, that is, a trend with the following shape:  $y_t = \alpha_0 + \alpha_1 \cdot t + \alpha_2 \cdot y_{t-1} + \xi_t$  with  $y$  being the constant value of exports,  $\xi_t$  a zero-mean i.i.d disturbance term and  $t$  a 15-year time trend. Each trend value is estimated over a 15-year time window but, in order to maximize sample size, a minimum of 10 observations (years) is set for trend estimates to be computed. See Cariolle and Goujon (2015) for a detailed discussion on this trend estimation method.

prevalence. In the robustness check section, estimations are conducted using a six-year skewness variable (computed over  $(t; t-5)$ ).

In a second step, because the analytical framework assumes the existence of asymmetric responses to booms and busts, a positive export skewness variable – equal to the value of the skewness if positive, 0 otherwise – and a negative export skewness variable – equal to the absolute value of the skewness if negative, 0 otherwise – are entered separately in the corruption equation. The resulting positive and negative skewness variables are used in a cross-section (pooled) analysis of firms' bribe payments, and are therefore matched with firm data according to firms' year of interview.

For illustration purposes, the co-movements between export shocks and export skewness time series are reported in Figure 1 for Pakistan, the Philippines, Colombia and Cameroon. One can see that, in contrast to periodic export shock variables (in blue), the skewness of exports (in red) synthesizes well the asymmetry of the recent history of shocks. In fact, one can see that values of skewness are positively affected by the abruptness and/or the repetition of the asymmetry of shocks.

**Figure 1. Export shocks and export skewness.**



Lastly, because a study of the effect of asymmetric shocks requires the effect of symmetric and normal fluctuations to be controlled for (Elbers et al, 2007), that is, related to the risk or uncertainty

in export movements, I include the long-run (10 years) standard deviation of exports around the same mixed trend<sup>4</sup> in the corruption equation. Doing this yields the following equation:

$$Bribes_{i,j,k} = E\{[skewness > 0]_i, [skewness < 0]_i | Export\ std\ deviation_i, Controls_{i,j,k}\} \quad (3)$$

Subscripts  $i, j$  and  $k$  refer to countries, sector and firms, respectively.

### 3.3. Institutional quality and other macro-level control variables

To test the effect of export booms and busts conditional on the quality of institutions, I emphasize the role of democracy and access to financial markets. Democracy variables are drawn from the Freedom House (FH) database, which provides three composite indices reflecting three dimensions of modern democracies: the extent of civil liberties (CL), of political rights (PR) and the freedom of the press (FotP).<sup>5</sup>

To proxy the imperfection of financial markets, I use three variables drawn from the World Development Indicators: the share of domestic credit provided by the banking sector in GDP as a proxy for access to credit markets (used as control variable in the baseline equation), the share of money and quasi-money (M2) in GDP as an alternative proxy for the overall financial development, and the index of credit information depth, which reflects the quality of credit information available through public or private credit registries.<sup>6</sup> While the two former variables provide a quantitative assessment of the banking sector performance, the latter provides a qualitative assessment of financial information. These institutional variables are used separately as interaction terms in the corruption equation.

Finally, the baseline corruption equation comprises macro-level controls reflecting determinants of corruption (Mauro, 1995; La Porta et al, 1999; Treisman, 2000) – that is, the GDP per capita, the primary completion rate, the share of natural resource rents in GDP, the share of government expenditures in GDP, the share of total trade (exports plus imports) in GDP, the logarithm of the population and the durability of the polity. I also use sector dummies to control for unobserved sector-specific shocks, as well as (non-nested) sectorial characteristics that could channel the voracity effect of revenue windfalls (James, 2015). In the same way as for instability variables,

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<sup>4</sup> Cariolle & Goujon (2015) show that the correlation between the standard deviation and the skewness of exports around the same trend is very low.

<sup>5</sup> A description of indices is given at <https://freedomhouse.org/>. The Press Freedom Index ranges from 0 (the most free) to 100 (the least free), and reflects the “legal and regulatory environment in which media operate; the degree of partisan control over news content; political influences on reporting and access to information; the public’s ability to access diverse sources of information; violations of press freedom ranging from the murder of journalists and bloggers to other extra-legal abuse and harassment; and economic pressures on media outlets and their means of distribution” (Freedom House, 2015a). The Civil Liberties and Political Rights Indices range from 1 (the most free) to 7 (the least free), are derived from the Universal Declaration of Human Rights and respectively assess three and four sub-dimensions. The Civil Liberty Index assesses the degree of associational rights, the rule of law (including independent judiciary), the degree of personal autonomy and the freedom of expression. The Political Rights Index assesses the transparency and openness of the electoral process to electoral pluralism, and to the quality of government functioning.

<sup>6</sup> This index is drawn from Doing Business and scores countries’ ranges from 0 (the most opaque credit information) to 6 (the most transparent credit information).

country-level control variables are matched with micro-level variables according to the years of survey rounds.

### 3.4. Empirical method

The effect of export booms and busts on bribe payments and bribery incidence is estimated within a three-level (country-sector-firm) linear estimation framework, based on a maximum-likelihood procedure.

#### 3.4.1. General econometric framework

Pooled cross-section estimations of the following baseline econometric model are conducted:

$$Bribe_{i,j,k} = \beta_0 + \beta_1 \cdot [skew > 0]_i + \beta_2 \cdot [skew < 0]_i + \beta_3 \cdot X_i + \beta_4 \cdot Y_{i,j,k} + d_j + \varepsilon_{i,j,k} \quad (4)$$

where the dependent variable  $Bribe_{i,j,k}$  is either the amount or the incidence of informal payments,  $X_i$  the macro-level controls,  $Y_{i,j,k}$  the micro-level controls,  $d_j$  the sector dummies and  $\varepsilon_{i,j,k}$  an i.i.d. residual.

In a second step, drawing on a similar specification to Murphy et al (1991) and Bhattacharyya and Hodler (2010), I estimate the effect of export booms and busts conditional on institutional quality, by adding into the baseline model in equation (4) the interaction between export skewness variables (*skew*) and institutional variables (*instit*), which gives the following augmented model:

$$Bribe_{i,j,k} = \beta_0 + \beta_{11} \cdot [skew > 0]_i + \beta_{21} \cdot [skew < 0]_i + \beta_{12} \cdot [skew > 0 \times instit]_i + \beta_{22} \cdot [skew < 0 \times instit]_i + \delta \cdot instit_i + \beta_3 \cdot X_i + \beta_4 \cdot Y_{i,j,k} + d_j + \varepsilon_{i,j,k} \quad (5)$$

#### 3.4.2. Multilevel analysis

Multilevel models depict a hierarchical system in which units of observations are nested within groups, and groups nested within higher-level groups (Hox, 2010). These models exploit the hierarchical structure of micro data sets to relax the hypothesis of independence of observations that are nested within different levels of the data.<sup>7</sup> By doing this, these models enable the context of micro-economic decisions to be accounted for.

Various arguments can be invoked to apply multilevel models to the analysis of corrupt transactions. First, previous studies highlighting the holistic origin and the potential structuring role of corrupt systems in economic transactions (Williamson, 2009; Andvig, 2006; Graeff, 2005) strongly suggest that corruption is context-dependent. In fact, in the same way as exam performances are markedly affected by unobserved class and school characteristics, corruption decisions are driven by imbricated sector-level (Diaby & Sylwester, 2015) and country-level (Martin et al, 2007) unobserved characteristics. Second, it has been shown that “corruption may corrupt” (Andvig & Moene, 1990), i.e. that corrupt transactions may be contagious within a given group of

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<sup>7</sup> For instance, the country-province-village levels, or the academy-school-class levels.

individuals and are therefore correlated to each other.<sup>8</sup> Third, amounts of reported informal payments as well as missing data are also likely to be influenced by imbricated sector and country unobserved features. For all these reasons, a multilevel framework is particularly relevant for the analysis of firm-level corruption decisions.

In contrast to the usual single-level framework, the three-level framework applied in this study controls for intraclass correlation between units of observations at the sector and country levels. It includes in the intercept ( $\beta_0$ ) a country-level ( $\beta''_{0,i}$ ) and a sector-level ( $\beta'''_{0,i,j}$ ) component, so that  $\beta_0 = \beta'_0 + \beta''_{0,i} + \beta'''_{0,i,j}$ . These components are assumed to be random, so that

$$E\{\beta''_{0,i} | X_i, Y_{i,j,k}, d_j, \beta'''_{0,i,j}, \varepsilon_{i,j,k}\} = 0, \text{ and } E\{\beta'''_{0,i,j} | X_i, Y_{i,j,k}, d_j, \beta''_{0,i}, \varepsilon_{i,j,k}\} = 0.$$

The resulting “random-intercept model” allows intercept parameters to vary randomly across levels, in our case across countries and sectors.

In addition to country- and sector-specific random intercepts, the model also associates country-level random components ( $\beta''_{1,i}$  and  $\beta''_{2,i}$ ) with the coefficient slope of export skewness variables.<sup>9</sup> The resulting “random-slope model” allows slope parameters to vary randomly across countries. Applied to equation (4), the three-level estimation framework consists in estimating the following model through a maximum-likelihood procedure:

$$Bribe_{i,j,k} = [\beta'_0 + \beta''_{0,i} + \beta'''_{0,i,j}] + (\beta'_1 + \beta''_{1,i}) \cdot [skew > 0]_i + (\beta'_2 + \beta''_{2,i}) \cdot [skew < 0]_i + \beta_3 \cdot X_i + \beta_5 \cdot Y_{i,j,k} + d_j + \varepsilon_{i,j,k} \quad (4')$$

The same decomposition of the slope coefficient of shock variables applies to equation (5). When the binary dependent variable on corruption incidence is used, I perform a probabilistic linear multilevel modeling of equations (4) and (5), based on a maximum-likelihood estimation procedure, in order to avoid convergence problems (Caudill, 1988).<sup>10</sup>

### 3.4.3. Endogeneity issues

There are various reasons to expect that multilevel estimates of equations (4) and (5) reflect the causal effect of export booms and busts on firms' bribes. The use of firm-level data mitigates the issue of reverse causality from bribery to export shocks,<sup>11</sup> since it is very unlikely that a (corrupt) transaction undertaken by a single firm will have macro-level consequences (Héricourt & Poncet,

<sup>8</sup> This problem of so-called “intraclass correlation” induces loss of efficiencies and biases in coefficient estimations (Hox, 2010).

<sup>9</sup> Country-level random coefficients before interaction terms (modeled in equation (5)) are not included in the corruption equation because they impede the computation of variance estimates' standard errors. Including these components does not alter the results of the study.

<sup>10</sup> The resulting estimates are consistent with estimates obtained from a single-level probit estimation framework, presented in Appendix B.

<sup>11</sup> It is worth adding that the literature on the measurement of structural economic vulnerability (Guillaumont, 2009; Guillaumont & Chauvet, 2001) considers the instability of exports around a mixed (random and deterministic) trend as a structural variable independent from policy-related factors, the latter being reflected in the trend rather than in fluctuations around it.

2015; Farla, 2014). This argument therefore also holds with democracy and financial market variables used as interaction terms in equation (5).

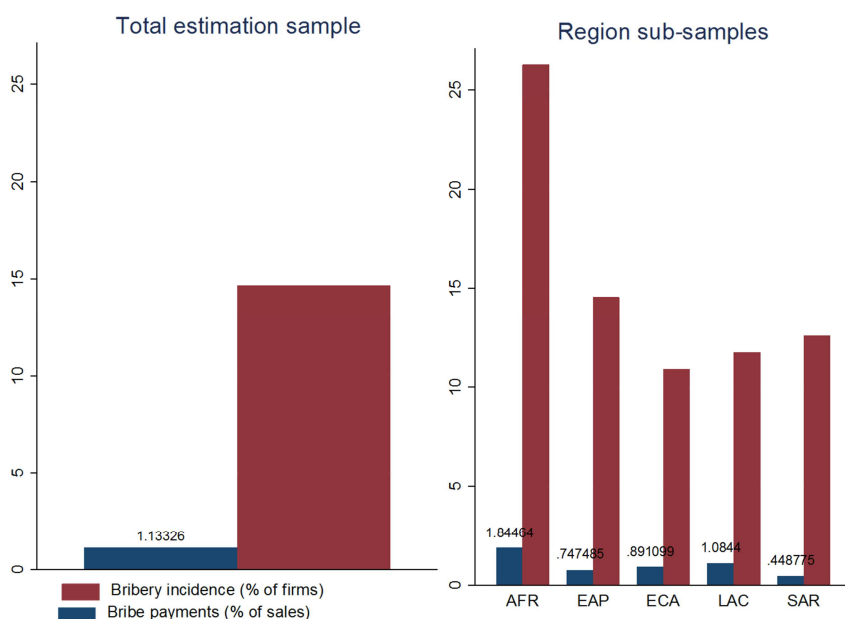
This argument may be questioned if corrupt transactions are contagious within groups of firms (Andvig & Moene, 1990) and make country exports fluctuate and institutions fail. However, the low prevalence of bribe payments in the sample at the country level (see Figure 2 and Appendix A.2) strongly weakens this counterargument. Moreover, one feature of the three-level estimation framework set earlier is that it controls for intraclass correlation between bribe payments, and hence for this source of endogeneity (Hox, 2010).<sup>12</sup> Last but not least, three-level modeling also takes into account sector-level and country-level unobserved characteristics, including those influencing firms' inclination to under- or overreport bribe payments.

### 3.5. The sample

Appendices A.1 and A.2 present the summary statistics of variables used in the empirical analysis, and detailed statistics related to bribery and firms' exports, by country and region. The baseline estimation sample consists of pooled data covering 19,712 firms, surveyed in 2006, 2007, 2009, 2010, 2011 and 2012, located in 36 developing countries. Some 51% of observations concern firms located in Latin America and the Caribbean, 19% from Sub-Saharan Africa, 10% from East Asia and the Pacific, 16% from Eastern Europe and Central Asia, and the remaining 4% comes from South Asia. As shown in Figure 2, Sub-Saharan Africa appears to be the area where the average amount of bribe (almost 2% of sales) and the incidence (26.2% of respondent firms reported an informal payment) of bribery are the highest.

**Figure 2. Bribe prevalence, estimation sample averages.**

Baseline sample: 36 developing countries, 19,712 observations.



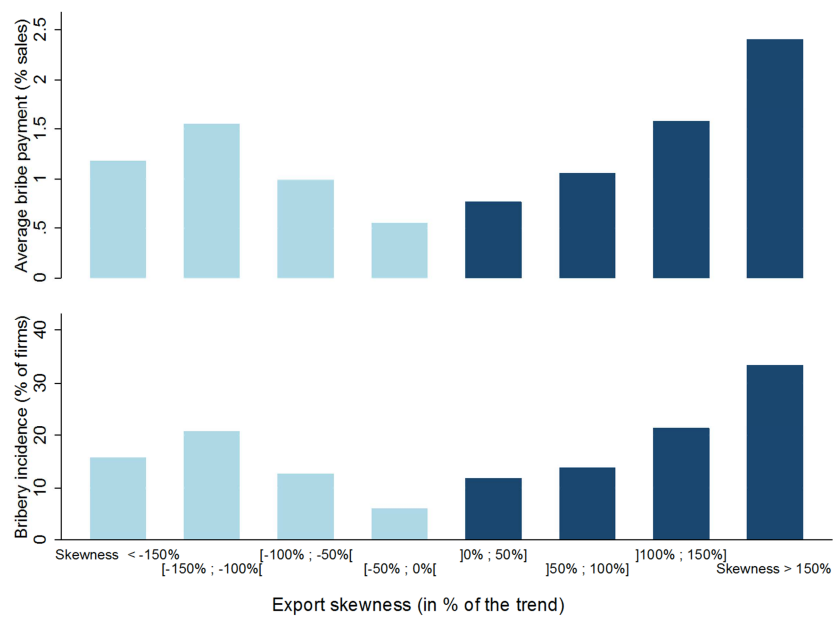
<sup>12</sup> In so far as this contagion effect plays at the sector and/or the country levels.

#### 4. EMPIRICAL ANALYSIS

Figures 3a and 3b present preliminary graphical evidence of the relationship between the skewness of exports and bribery variables. In Figure 3a, variables of bribe payments and bribery incidence have been averaged by different ranges of skewness values, for an extended sample of 80 developing countries and 41,182 observations. It shows that the prevalence of bribery is strictly increasing with the intensity of positive shocks, indicating that opportunistic corruption spreads during export booms, in line with the literature's findings. A positive relationship between the intensity of export busts and bribery is also apparent but non monotonic. Figure 3b plots country averages of bribe payments and bribery incidence against average values of export skewness for the estimation sample, covering 36 countries and 19,712 observations. It provides an additional illustration of the symmetric positive correlation between export booms, export busts and corruption prevalence in developing countries.

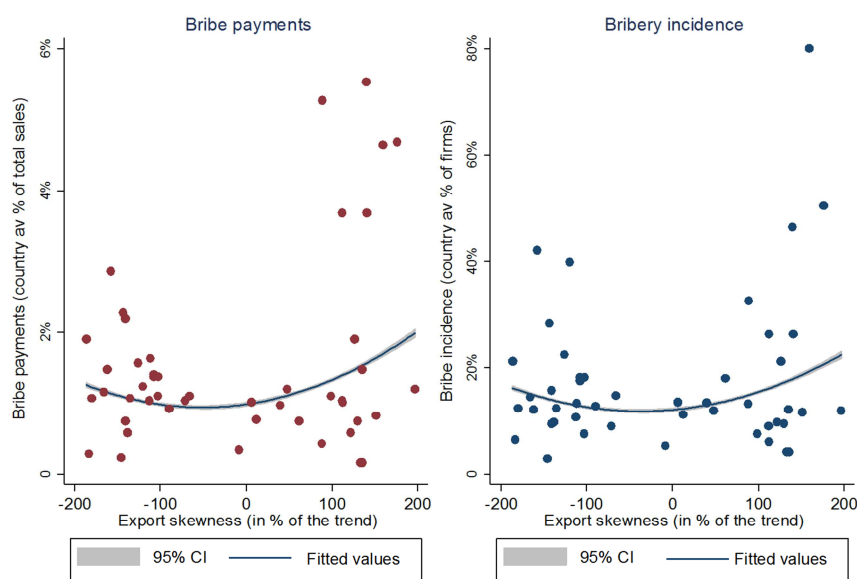
**Figure 3a. Bribery and the intensity of export shocks.**

Extended sample: 80 developing countries, 41,182 observations.



**Figure 3b. Correlation between country averages of bribery variables and export skewness**

Estimation sample: 36 developing countries, 19,712 observations.



#### 4.1. Baseline results

The baseline multilevel estimates of equation (4) are reported in Table 2, and tend to support previous graphical relationships. For comparison purposes, OLS and logit estimates of the baseline corruption equation are reported in Appendix B, and are consistent with multilevel estimates.

First, the analysis of random-effect coefficients in columns (1) and (2) stresses that random intercepts are found to vary significantly across countries, suggesting that a significant part of the residual variance is explained by unobserved country characteristics. Multilevel estimates of control variables are consistent whether the bribe payment variable or the bribery incidence variable is used as dependent variable. Natural resource endowments are found to increase bribe payments, which is consistent with the natural resource curse hypothesis. Higher primary education rate and improved media independence and political rights are negatively associated with firm bribery. Surprisingly, greater civil liberties have a positive and significant effect on bribery (an increase in the index corresponds to a deterioration of democracy), but this effect may result from a larger scope for private initiatives, a larger private sector size and hence an increased supply of bribes.<sup>13</sup> Lastly, firms' characteristics related to firms' liquidity constraints are significantly and negatively correlated with bribery: the logarithm of their total sales, the extent of their internal and external funding and their share of public ownership.

Second, columns (3) and (4) report estimations of the random-slope model including instability variables without controls, while columns (5) and (6) report estimations of the random-slope model

<sup>13</sup> In fact, Cariolle (2016) finds that the positive effect of civil liberties on bribery is partly explained by a combination of greater personal autonomy and weaker rule of law.



including skewness variables and the whole set of controls. The estimates in columns (3) and (4) support that both export booms and busts are found to significantly increase bribery, thereby providing additional evidence on the voracity and scarcity effects of export shocks on bribery. However, the estimations reported in columns (5) and (6) show that the mere voracity effect of export booms on bribe payments is robust to the inclusion of control variables.

Third, it is worth noting that the 1%-significant positive effect of natural resource rents on bribe payments evidenced in column (1) is neutralized once export skewness variables are introduced. With the bribery incidence variable, the effect of natural resources is still significant and positive (column (7)), but cut by almost a half once skewness variables are introduced (column (8)). This empirical pattern suggests that part of the effect of natural resource windfalls on corruption is captured by export shock variables.

To sum up, this first body of evidence highlights a consistent positive symmetric effect of export shocks on firms' bribery, but the voracity effect of booms appears to be more robust than the scarcity effect of busts to the inclusion of controls. However, these estimations omit the critical role of democratic and financial institutions in channeling both effects. Therefore, I further examine the channeling role of the institutional framework in the following section.

**Table 2. The baseline equation**

Dependent variable:	Multilevel estimations					
	Bribe payments	Bribery incidence	Bribe payments	Bribery incidence	Bribe payments	Bribery incidence
	(1)	(2)	(3)	(4)	(5)	(6)
Export skewness >0			0.012*** (0.00)	0.001*** (0.01)	0.010** (0.02)	0.001 (0.30)
Export skewness <0			0.005*** (0.01)	0.001** (0.04)	0.003 (0.17)	0.001 (0.38)
Macro controls						
Export standard deviation	0.003 (0.81)	0.001 (0.78)	-0.004*** (0.00)	-0.000 (0.49)	-0.008* (0.06)	0.005* (0.09)
GDP per capita	0.000 (0.93)	0.000 (0.81)			0.000 (0.54)	0.000 (0.19)
Primary completion rate	-0.067*** (0.00)	-0.017*** (0.00)			-0.023*** (0.00)	-0.010** (0.03)
Nat. resource rents (% GDP)	0.096*** (0.00)	0.023*** (0.00)			0.008(0.59)	0.014*** (0.09)
Gov. expenditures (% GDP)	-0.071 (0.24)	-0.004 (0.56)			-0.018 (0.62)	0.028 (0.16)
Trade (% GDP)	-0.004 (0.69)	-0.0001 (0.97)			-0.000 (0.92)	-0.002 (0.36)
Log population	-0.123 (0.30)	-0.022 (0.38)			-0.069*** (0.01)	0.032 (0.24)
Polity regime stability	0.005 (0.81)	0.006 (0.13)			0.007 (0.36)	0.006 (0.25)
Freedom House – Press	0.077*** (0.00)	0.012*** (0.00)			0.025* (0.09)	0.032*** (0.00)
Freedom House – Political rights	0.393 (0.11)	0.181*** (0.00)			-0.086 (0.48)	0.246*** (0.00)
Freedom House – Civil liberties	-1.255*** (0.00)	-0.243*** (0.00)			-0.015 (0.96)	-0.556*** (0.00)
Credit private sector (% GDP)	0.028* (0.09)	0.013*** (0.00)			-0.004 (0.48)	0.008** (0.05)
Firm controls						
Firms’ total sales (log)	-0.049** (0.03)	0.001 (0.41)			-0.050** (0.02)	0.001 (0.50)
% firms’ public ownership	-0.005 (0.45)	-0.001* (0.10)			-0.005 (0.43)	-0.001 (0.11)
% of indirect exports	0.001 (0.61)	0.000 (0.86)			0.001 (0.66)	0.000 (0.84)
% of direct exports	-0.001 (0.71)	-0.000 (0.72)			-0.001 (0.70)	-0.000 (0.82)
Internal funding <sup>(a)</sup>		-0.0005***				
	-0.005*** (0.00)	(0.00)			-0.005*** (0.00)	-0.0005*** (0.00)
Bank funding <sup>(b)</sup>	-0.002 (0.31)	-0.0002 (0.12)			-0.001 (0.38)	-0.000 (0.17)
Constant	8.151*** (0.00)	0.886** (0.05)	0.596*** (0.00)	0.091*** (0.00)	4.033*** (0.00)	-0.893 (0.18)
Dummies	Firm size and sector		No		Firm size and sector	
Country-level random effects						
Intercept	3.069***	0.149***	0.000	0.002	0.000	0.125***
Slope skew > 0			0.0002***	2.58e-06***	0.0002***	0.000
Slope skew < 0			0.00002***	6.84e-07***	0.000	0.000
Sector-level random effects						
Intercept	0.049	0.001***	0.106***	0.002***	0.036	0.001***
Wald Stat (R2 or pseudo R2)	170.7 ***	515.0***	17.3***	10.9***	140.3***	576.1***
LR Stat	323.2***	1216.2***	567.4***	1936.0***	250.1***	1219.2***
#Countries (#obs)	36(19,712)					

P-values in parenthesis. \*significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%. An increase in Freedom House variables corresponds to a deterioration of democracy. (a) % of working capital funded by internal funds. (b) % of working capital funded by public and private commercial banks. When possible, estimates are rounded up to three decimal places.

## 4.2. The role of financial markets

Table 3 gives striking empirical evidence of the role played by financial markets in channeling the effect of export booms and busts on both corruption payments and incidence. It reports the estimates of equation (5) using separately as interaction terms the share of domestic credit provided to the private sector in GDP, the share of money and quasi-money in GDP and the index of credit information depth.<sup>14</sup>

Multilevel estimates provide significant and robust evidence of a nonlinear symmetric effect of export booms and busts on bribery, depending on financial market performance: Export booms and busts are found to increase bribery when access to credit is restricted and when financial information is opaque, while they are found to reduce it when access to credit is improved and when information on borrowers and lenders is more transparent.

On the one hand, a 10% increase in the average positive skewness leads to a 0.15 percentage point increase in the average bribe payment size (corresponding to almost a one sixth increase of the sample average) when the domestic credit share is below 47% of the GDP. On the other hand, a 10% increase in the average negative skewness leads to a 0.30 percentage point increase in the average bribe payment size when the domestic credit share is below 41% of the GDP. Above these thresholds, export booms and busts are both found to reduce bribe payments.

With regard to the financial information channel, a 10% increase in the positive and negative asymmetries of the export distribution respectively lead to a 0.16 and a 0.09 percentage point increase in bribe payment size below a credit information score of 6. In countries with a credit information score equal to 6 (corresponding to 32% of the sample), both booms and busts are found to reduce bribery.

Thus, empirical evidence strongly supports the existence of a scarcity effect of export busts concomitant with a voracity effect of export booms, and suggests that financial market performance dampens these effects.

## 4.3. The role of democracy

The results in Table 4 highlight the role of three major pillars of democracy – press freedom, civil liberties and political rights – in mitigating the voracity and scarcity effects of export shocks on corrupt transactions.

Multilevel estimates provide strong evidence of a nonlinear symmetric effect of export shocks on bribery, depending on the strength of the democracy (decreasing when FH indices' scores increase). The results indeed support a positive effect of export booms and busts on bribery when press freedom, civil liberties and political rights worsen. Conversely, estimations highlight a negative effect of booms and busts on bribery when these pillars of democracy are better off. It

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<sup>14</sup> Estimated coefficients of institutional variables put in interaction are not reported in the table.

should, however, be noted that civil liberties do not significantly dampen the effects of export shocks on bribery incidence, and that press freedom is found to be relatively ineffective at mitigating the voracity effect of export booms.

On the one hand, estimations suggest that a 10% increase in the average positive skewness leads to a 0.12 percentage point increase in bribe payments when countries' FotP score exceeds 31 and their PR score exceeds 2.<sup>15</sup> This same increase leads to a 0.18 percentage point increase in bribe payments when countries' CL score is above 2. On the other hand, a 10% increase in the average negative skewness leads to a 0.30 percentage point increase in the average bribe payment when countries' FotP score is above 43, and to a respective 0.23 and 0.18 percentage point increase in bribe payments when countries' CL and PR scores are above 2. Below these democracy thresholds, export booms and busts are both found to reduce bribe payments.

To sum up, there is strong and robust empirical evidence, consistent with the findings in the literature, on a nonlinear symmetric effect of export fluctuations on bribery, driven by asymmetric responses to shocks – opportunistic and survival corruption – and conditional on the quality of financial markets and democratic institutions. To be more specific, the credit provided domestically by the private sector and the depth of the financial information on the one hand, and independent press and enforced political rights on the other, appear to be effective, robust and significant channels for the nonlinear symmetric effect of export shocks on firms' bribe payments. Last but not least, the scarcity effect of export busts in weak institutional contexts is found to be of larger magnitude than the voracity effect of export booms.

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<sup>15</sup> Appendix E details how these effects have been calculated.

**Table 3. The financial market channel – three-level estimations**

Dep. variable:	Bribe payments				Bribery incidence	
	(1)	(2)	(3)	(4)	(5)	(6)
Export skew>0	0.038*** (0.00)	0.042*** (0.00)	0.037*** (0.00)	0.008*** (0.00)	0.013*** (0.00)	0.003 (0.31)
Export skew<0	0.039*** (0.00)	0.034*** (0.00)	0.021*** (0.00)	0.010*** (0.00)	0.013*** (0.00)	0.006** (0.05)
Skew>0 × Credit	-0.0008** (0.00)			-0.0002*** (0.00)		
Skew<0 × Credit	-0.0009*** (0.00)			-0.0003*** (0.00)		
Skew>0 × M2		-0.0007** (0.03)			-0.0003*** (0.00)	
Skew<0 × M2		-0.0006*** (0.00)			-0.0003*** (0.04)	
Skew>0 × Info			-0.0058*** (0.00)			-0.0008 (0.15)
Skew<0 × Info			-0.0037*** (0.00)			-0.001*** (0.01)
<b>Country-level random effects</b>						
Intercept	0.000	0.000	0.000 <sup>(a)</sup>	0.043	0.042	0.115**
Slope skew > 0	0.0002***	0.0002***	0.0001 <sup>(a)</sup>	0.000	8.94e-06*	0.000
Slope skew < 0	0.00003***	0.00002	0.000 <sup>(a)</sup>	0.000	0.000	0.000
<b>Sector-level random effects</b>						
Intercept	0.037	0.040	0.032 <sup>(a)</sup>	0.001***	0.001***	0.001***
<b>Wald Stat</b>	147.3***	139.2***	256.6***	592.5***	587.1***	589.2***
<b>LR stat (p-value)</b>	224.2***	239.7***	134.3***	1133.5***	1139.2***	876.6***
Dummies	Sector & firm size					
Controls	Yes					
#Countries/#Firms	36/19,712					

Controls, as well as institutional variables put in interaction, are not reported. P-values in parenthesis. \*significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%. Some point estimates are rounded up to three decimal places. (a) Standard errors of estimated variance parameters could not be computed.

**Table 4. The democracy channel – three-level estimations**

Dep. variable:	Multilevel estimations					
	Bribe payments			Bribery incidence		
	(1)	(2)	(3)	(4)	(5)	(6)
Export skew>0	-0.021 (0.16)	-0.034** (0.02)	-0.021** (0.02)	-0.003 (0.25)	-0.001 (0.85)	-0.004* (0.10)
Export skew<0	-0.031*** (0.00)	-0.024** (0.00)	-0.013*** (0.01)	-0.018*** (0.00)	-0.005 (0.24)	-0.009*** (0.00)
Skew>0 × FotP	0.0007** (0.02)			0.0001* (0.07)		
Skew<0 × FotP	0.0007*** (0.00)			0.0004*** (0.00)		
Skew>0 × CL		0.016*** (0.00)			0.0001 (0.93)	
Skew<0 × CL		0.010*** (0.00)			0.001 (0.38)	
Skew>0 × PR			0.011*** (0.01)			0.002*** (0.01)
Skew<0 × PR			0.006*** (0.00)			0.003*** (0.00)
Country-level random effects						
Intercept	0.000	0.000	0.000	0.000	0.163***	0.000
Slope skew > 0	0.0002***	0.0002***	0.0001***	7.43e-06*	0.000	0.000
Slope skew < 0	0.00002	0.000	0.000	0.00001*	0.000	0.00002*
Sector-level random effects						
Intercept	0.035	0.031	0.000	0.001***	0.001***	0.001***
<b>Wald stat</b>	143.5***	175.6***	154.8***	639.3***	627.0***	635.1***
<b>LR Test</b>	217.7***	189.1***	178.8***	1171.1***	1031.8***	1051.9***
<b>#Countries/#obs</b>	<b>36/19,712</b>					
Dummies	Sector & firm size					
Controls	Yes					

Controls, as well as institutional variables put in interaction, are not reported. P-values in parenthesis. \*significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%. When possible, estimates are rounded up to three decimal places. CL is Freedom House's Civil Liberty index, PR, Freedom House's Political Right index and FotP is Freedom House's Freedom of the Press index. An increase in Freedom House's indices corresponds to a deterioration of democracy.

#### 4.4. Robustness checks

Two empirical issues are addressed in this robustness section. The first issue is related to a possible small sample bias, and is addressed by excluding countries with fewer than 200 observations. The second issue relates to the sensitivity of the results to the choice of the export skewness time window. This sensitivity is tested by enlarging this time window to a six-year period ( $t$ ;  $t-5$ ). Estimations are run with the bribe payment variable only and the results are presented in Appendices C and D.

##### 4.4.1. *Estimations with a restricted estimation sample*

Since country-level variance estimation may be biased in countries with a small number of observations (Hox, 2010), estimations of the conditional effect of export booms and busts on bribe payments (equation (8)) are run over a sample excluding countries with fewer than 200 observations, thereby encompassing 19,083 bribe reports from 30 developing countries.<sup>16</sup> The results are presented in Appendix C.

First, compared to the estimates in Table 3, this robustness check nuances the role of credit information depth in channeling the nonlinear effect of export booms on bribery (column (3)), but confirm the deterrent effect of access to credit on the size of bribe payments during export busts (columns (1) and (2)). While restricted access to domestic credit is still associated with a positive effect of export booms and busts on bribe payments, the mitigating role of improved access to credit during export booms is less significant (column (1)). Second, compared to the estimates in Table 4, this robustness check does confirm the role of media independence, political rights and civil liberties in dampening the scarcity effect of export busts, but does not support at a reliable confidence level this mitigating role regarding the voracity effect of export booms (columns (7), (8) and (9)).

In general, estimates tend to support the previously evidenced nonlinear symmetric effect of export booms and busts on bribe payments, conditional on the quality of financial and democratic institutions. However, while this robustness check confirms the effectiveness of democracy and financial institutions in mitigating the scarcity effect of export busts on bribery, it slightly nuances the role of such institutions in mitigating the voracity effect of export booms.

##### 4.4.2. *Estimations with six-year skewness variables*

To check whether the estimated effects of export booms and busts are affected by the period over which export skewness variables are computed, I rerun equations (4) and (5) using 6-year skewness variables, computed over the current year (of the interview) plus the last five years (preceding the interview). Estimates are reported in Appendix D.

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<sup>16</sup> In the same way as the previous rule of thumb imposed a minimum of 30 observations by country, we choose a minimum of 200 observations by country so that the restricted sample comprises 30 countries.

Estimates of the financial institutions channel in columns (2), (3) and (4) support previously evidenced voracity and scarcity effects of export shocks conditional on access to credit and credit information transparency. However, evidence on the effect of export booms conditional on democracy is less robust to the extension of the coverage period of export skewness variables.

Again, estimates tend in general to support the symmetric effect of export booms and busts on bribe payments, conditional on the institutional framework. However, while these additional estimations confirm the effectiveness of democracy and financial institutions in mitigating the scarcity effect of export busts on bribery, they slightly nuance the role of such institutions in mitigating the voracity effect of export booms. This evidence may be explained by a difference in the persistent effects of positive and negative shocks on firms' behavior, the former being probably less persistent than the latter and therefore more sensitive to a change in the export skewness time window.

## **5. CONCLUDING REMARKS**

This paper provides strong empirical evidence of a "voracity effect" of export booms and a "scarcity effect" of export busts on bribery. These effects are estimated within a three-level estimation framework, which enables a contextualization of corrupt transactions at the sector and country levels, and sector and country unobserved features that could induce measurement errors, omitted variable bias and reverse causality bias to be controlled for.

Multilevel estimates support a nonlinear symmetric effect of export booms and busts on bribe payments and bribery incidence. On the one hand, export booms are found to foster bribe payments and bribery incidence when financial and democratic institutions are failing, and to reduce them when institutions are better off. On the other hand, estimates indicate that export collapses in weak institutional contexts may also foster corruption, by inciting firms to compete for scarce resources and to divert them through malpractices. Interestingly, this scarcity effect of adverse export shocks tends to be stronger than the voracity effect in weak institutional contexts, and is found to be particularly robust to alternative econometric specifications.

Therefore, consistent with the literature, this paper provides additional evidence on the importance of institutional safeguards against corrupt practices in times of abundance. But more importantly, it provides new insights into their importance in times of shortage.



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## APPENDICES

### A. SUMMARY STATISTICS

#### A.1. Sample summary statistics

	Source	Mean	Std. Dev.
Bribe payments (in % of total sales)	WBES	1.13	4.72
Bribery incidence (in % of firms]		14.62	35.34
Log total sales		16.95	3.20
State ownership (% of firms)		0.3	4.70
Indirect exports (% of firms' sales)		2.58	12.82
Direct exports (% of firms' sales)		6.54	20.46
Internal funds (% of working capital)		65.99	36.39
Public and private commercial funding (% of working capital)		13.37	24.26
% of large-size firms		18.71	39.00
% of medium-size firms		33.13	0.47
% of small-size firms		48.15	0.50
Export std dev (in % of trend)	World Development Indicators  (Doing Business)	10.33	22.40
Export skewness > 0 (in % of trend)		38.59	55.51
Export skewness < 0 (in % of trend)		76.21	69.10
Primary completion rate		90.27	16.89
GDP per capita (2005 Constant USD)		3616	2558
Log population		15.40	2.72
Dom. credit to private sector (% GDP)		34.74	20.61
M2 (% of GDP)		42.45	15.06
Depth of credit info index		4.26	2.12
Gvt final consumption (% of GDP)		13.30	3.62
Trade openness (% in GDP)		66.88	27.89
Natural resource rents (% of GDP)		10.65	8.11
Political regime durability (in years)	Polity IV	17.29	12.62
FotP global index	Freedom House	51.91	15.88
CL global Index		3.27	1.13
PR global Index		3.19	1.67
Skew>0 × Credit		1201.13	2066.92
Skew<0 × Credit		2936.58	3734.27
Skew>0 × M2		1540.59	2390.95
Skew<0 × M2		3331.82	3473.01
Skew>0 × Info		175.10	278.46
Skew<0 × Info		323.41	380.03
Skew>0 × FotP		1806.89	2672.63
Skew<0 × FotP		4372.62	4675.87
Skew>0 × CL		111.65	168.53
Skew<0 × CL		278.51	297.95
Skew>0 × PR		108.95	181.34
Skew<0 × PR		281.97	344.14

*A.2. Sample composition, by regions and countries*

<b>Region</b>	<b>#firms</b>	<b>% of sample</b>	<b>Bribe payments (% sales)</b>	<b>Bribery incidence (% of respondent firms)</b>	<b>Direct + indirect exports (% sales)</b>
Sub-Saharan Africa	3,672	18.63	1.84	26.2	4.9
East Asia and Pacific	1,988	10.09	0.75	14.5	14.8
Eastern Europe and Central Asia	3,067	15.56	0.89	10.9	7.2
Latin America and Caribbean	10,095	51.21	1.08	11.7	10
South Asia Region	890	4.52	0.45	12.5	10.8
<b>Total/Average</b>	<b>19,712</b>	<b>100</b>	<b>1.13</b>	<b>14.6</b>	<b>9.1</b>

Country	#observations							% of sample	Bribe payments	Bribery incidence
	Total	2006	2007	2009	2010	2011	2012		(% sales)	(% firms)
Argentina	510	510	0	0	0	0	0	2.59	1.38	19.9
Bolivia	520	343	0	0	177	0	0	2.64	2.21	25
Botswana	257	257	0	0	0	0	0	1.30	1.31	20
Bulgaria	725	0	725	0	0	0	0	3.68	0.69	10.5
Burkina Faso	217	0	0	217	0	0	0	1.10	1.07	6.4
Cameroon	286	0	0	286	0	0	0	1.45	2.88	43
Chile	894	0	0	0	894	0	0	4.54	0.05	1
Colombia	1,469	675	0	0	794	0	0	7.45	1.06	9.1
Costa Rica	30	0	0	0	30	0	0	0.15	1.1	13.3
Dominican Republic	299	0	0	0	299	0	0	1.52	0.37	5.7
Ecuador	768	462	0	0	306	0	0	3.90	0.81	10.3
El Salvador	596	328	0	0	268	0	0	3.02	1.11	12.6
Gambia, The	135	135	0	0	0	0	0	0.68	4.68	5
Guatemala	722	309	0	0	413	0	0	3.66	1.24	8
Honduras	455	204	0	0	251	0	0	2.31	1.45	12.7
Indonesia	1,024	0	0	1,024	0	0	0	5.19	0.43	12.4
Madagascar	55	0	0	55	0	0	0	0.28	10.53	96
Mali	444	0	444	0	0	0	0	2.25	1.25	21.6
Mauritania	191	191	0	0	0	0	0	0.97	4.61	80.1
Mexico	912	829	0	0	83	0	0	4.63	1.26	17.6
Mozambique	463	0	463	0	0	0	0	2.35	1.63	13.3
Namibia	277	277	0	0	0	0	0	1.41	0.83	11.5
Nicaragua	478	195	0	0	283	0	0	2.42	1.29	12.1
Pakistan	429	0	429	0	0	0	0	2.18	0.59	18.4
Panama	410	387	0	0	23	0	0	2.08	3.20	22.5
Paraguay	225	0	0	0	225	0	0	1.14	1.24	12.9
Peru	1,195	431	0	0	764	0	0	6.06	0.58	9.5
Philippines	964	0	0	964	0	0	0	4.89	1.08	16.8
Russian Federation	2,342	0	0	0	0	0	2,342	11.88	0.95	11
Senegal	494	0	494	0	0	0	0	2.51	1.57	22.5
Sri Lanka	461	0	0	0	0	461	0	2.34	0.32	7.1
Swaziland	280	280	0	0	0	0	0	1.42	1.26	40
Togo	101	0	0	101	0	0	0	0.51	0.91	12.9
Uruguay	495	78	0	0	417	0	0	2.51	0.17	4
Venezuela, RB	117	0	0	0	117	0	0	0.59	3.06	36.7
Zambia	472	0	472	0	0	0	0	2.39	1.12	16.1
<b>Total/average</b>	<b>19,712</b>	<b>5,891</b>	<b>3,027</b>	<b>2,647</b>	<b>5,344</b>	<b>461</b>	<b>2,342</b>	<b>100.00</b>	<b>1.13</b>	<b>14.6</b>

## B. OLS AND LOGIT (SINGLE-LEVEL) ESTIMATIONS OF EQUATION (4)

	OLS	Logit
<b>Dependent variable:</b>	Bribe payments	Bribery incidence
Export skewness >0	0.009*** (0.00)	0.004*** (0.00)
Export skewness <0	0.004* (0.07)	0.001 (0.26)
<b>Macro controls</b>		
Export standard deviation	-0.008*** (0.00)	-0.005*** (0.00)
GDP per capita	-0.000 (0.66)	0.000 (0.20)
Primary completion rate	-0.28*** (0.00)	-0.011*** (0.01)
Nat. resource rents (% GDP)	0.031*** (0.00)	0.011* (0.08)
Gov. expenditures (% GDP)	-0.083*** (0.01)	-0.040*** (0.00)
Trade (% GDP)	0.011 (0.11)	0.008*** (0.00)
Log population	-0.081*** (0.01)	-0.042*** (0.00)
Polity regime stability	0.019** (0.04)	0.004 (0.29)
Freedom House – Press	0.035* (0.08)	0.007 (0.45)
Freedom House – Political rights	-0.175 (0.33)	-0.019 (0.75)
Freedom House – Civil liberties	0.072 (0.76)	0.108 (0.52)
Credit private sector (% GDP)	-0.003 (0.66)	-0.008*** (0.01)
<b>Firm controls</b>		
Firms' total sales (log)	-0.038 (0.37)	0.008 (0.69)
% of firms' public ownership	-0.007* (0.07)	-0.004 (0.11)
% of indirect exports	0.002 (0.47)	-0.000 (0.89)
% of direct exports	-0.000 (0.77)	0.000 (0.82)
Internal funding <sup>(a)</sup>	-0.005*** (0.00)	-0.002*** (0.00)
Bank funding <sup>(b)</sup>	-0.001 (0.42)	-0.0003 (0.62)
Constant	2.387*** (0.05)	-0.036 (0.95)
<b>Dummies</b>	Sector, firm size	
<b>#Countries (#obs)</b>	36(19,712)	
<b>R2 – pseudo R2</b>	0.02	0.07

P-values in parenthesis. In columns (1) and (2), standard errors are clustered by country. \*significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%. An increase in Freedom House variables corresponds to a deterioration of democracy. (a) % of working capital funded by internal funds. (b) % of working capital funded by public and private commercial banks. When possible, estimates are rounded up to three decimal places.



### C. MULTILEVEL ANALYSIS WITH A RESTRICTED ESTIMATION SAMPLE – THREE-LEVEL ESTIMATIONS

Dep. variable:	Bribe payments					
	Financial channel			Democracy channel		
	(1)	(2)	(3)	(7)	(8)	(9)
Export skew>0	0.010*** (0.01)	0.015*** (0.00)	0.012 (0.31)	-0.009 (0.28)	-0.007 (0.14)	-0.001 (0.76)
Export skew<0	0.017*** (0.01)	0.018** (0.02)	0.005 (0.55)	-0.034*** (0.00)	-0.018*** (0.00)	-0.011** (0.04)
Skew>0 × Credit	-0.0001 (0.13)					
Skew<0 × Credit	-0.0004** (0.01)					
Skew>0 × M2		-0.0002** (0.03)				
Skew<0 × M2		-0.0004** (0.04)				
Skew>0 × Info			-0.001 (0.61)			
Skew<0 × Info			-0.0005 (0.74)			
Skew>0 × FotP				0.0003 (0.11)		
Skew<0 × FotP				0.0007*** (0.00)		
Skew>0 × CL					0.005** (0.02)	
Skew<0 × CL					0.007*** (0.00)	
Skew>0 × PR						0.003 (0.11)
Skew<0 × PR						0.005*** (0.00)
#Countries/obs			30/19,083			
Dummies			Sector, firm size			
Wald stat	313.4***	318.9***	284.5***	327.0***	317.0***	321.8***
LR Test	42.9***	66.4***	35.9***	86.1***	54.2***	80.4***

Controls, including institutional variables put in interaction, are not reported. P-values in parenthesis. \*significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%. When possible, estimates are rounded up to three decimal places. CL is Freedom House's Civil Liberty index, PR, Freedom House's Political Right index and FotP is Freedom House's Freedom of the Press index. An increase in Freedom House's indices corresponds to a deterioration of democracy.

*“Sur quoi la fondera-t-il l’économie du monde qu’il veut gouverner? Sera-ce sur le caprice de chaque particulier? Quelle confusion! Sera-ce sur la justice? Il l’ignore.”*

Pascal



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