# An Economic Analysis of Debarment*

Emmanuelle Auriol†

Tina Søreide‡

29 January 2017

**Abstract**

With a view to reducing the consequences of corruption in public procurement, many governments have introduced debarment of suppliers found guilty of corruption and some other forms of crime. This paper explores the market effects of debarment on public procurement. Debarment is found to make little difference in markets with high competition, while in markets with low competition it may deter corruption as long as firms value public procurement contracts in the future and there is a certain risk of being detected in corruption. On the other hand, debarment – when it works – has an anti-competitive effect, and this contributes to facilitate collusion between suppliers. If designed with an understanding of the market mechanisms at play, debarment can deter both collusion and corruption, thus improving the results of public procurement. If so, most current debarment regimes need modification.

**JEL Classification:** K21, K23, K42, L41, H57

**Keywords:** Corruption, Collusion, Procurement,

*Emmanuelle Auriol would like to thank the French Development Agency (AFD) for its financial support. We thank Erling Hjelmeng and Malin Arve for detailed comments and useful suggestions. All remaining errors are ours.

†Toulouse School of Economics, emmanuelle.auriol@tse-fr.eu

‡Norwegian School of Economics (NHH), tina.soreide@nhh.no

# 1 Introduction

In many jurisdictions, suppliers convicted of certain forms of crime, such as corruption, collusion, organized crime, or money laundering, are "debarred" from public tenders, meaning that they cannot be awarded any government contracts. Those who are only suspected of having been involved in illegal affairs, perhaps because of an ongoing investigation, can be debarred on a discretionary basis (that is, at the discretion of the procurement agent rather than automatically). The literature on debarment is written by legal scholars who address important procedural dilemmas related to the act of debarring, on due process, and on the legal status of those debarred.[1] As a result, the debarment instrument has been enacted in countries around the globe without the support of economic analysis. While debarment is expected to enhance integrity, no systematic attempts have been made to explore its impact in markets. This paper is motivated by the need for economic insights into the mechanisms at play.

Debarment was introduced as an element of modern public procurement regulations when the US Congress enacted a law in 1884 requiring the executive branch to award contracts only to the lowest "responsible" bidder, later established as an active preventive strategy by the Comptroller General in 1929.[2] However during the twentieth century, most governments rarely excluded contractors; when they did, it happened primarily as a result of criminal indictments and convictions. As concern about the consequences of corruption intensified, starting in the mid-1990s, the option of debarring fraudulent suppliers was brought to the fore by various actors in the development community. Debarment increasingly was seen as a strategy to curb the risk of corruption. This idea was advanced by nongovernmental organizations and multilateral organizations concerned about the propensity of private sector suppliers to exploit institutional weaknesses in developing countries, but also by the US government, the European Union (EU), the United Nations, and the Organisation for Economic Co-operation and Development (OECD). The United Nations Office on Drugs and Crime, for example, states "as anti-corruption initiatives around the world gain momentum, one device for fighting corruption – debarment, or blacklisting, of corrupt or unqualified contractors and individuals has emerged as an especially noteworthy tool." The same report maintains that "suspension or debarment from public contracts has proven to be an effective tool in the fight against corruption" (UNODC 2013: 25). The statement is made without any reference to empirical research, and we have not managed to find evidence that supports the claim.

Despite the lack of evidence of its efficiency, during the first decade of the 2000s, the debarment option

[1] Such as the question of identification (what unit is to be debarred – a company, its owners, a company division or country office?); whose judgment or verdict provides sufficient basis for debarment (which courts are accepted or not, whose suspicion or investigation should be taken into account); what rights pertain to the offender; and what a supplier must do to regain status as trustworthy (a process referred to as self-cleaning). For introductions, see Piselli (2000), Williams (2006) and Arnaiz (2009).

[2] For details, see the US Department of the Interior, "A Brief History of the Debarment Remedy," http://interior.gov/pam/programs/acquisition/upload/Brief-History-of-Debarment-Remedy_Final-3_2_15.pdf. The legal reference to responsible bidders can be found in the Act of July 5, 1884, Ch. 217, 23 Stat. 109.

extended in scope, with procurement agencies required to perform their own assessments of suppliers' trustworthiness, regardless of any criminal justice proceedings in the case. As a consequence, public procurement agencies were given authority to exclude suppliers (or threaten to exclude them) merely upon reasonable doubt of their integrity. Combined with more efficient whistleblower programs, increasing requests for suppliers' self-disclosure of fraudulent conduct, and rising voter demands for anticorruption vigilance, debarment from public procurement became a real concern for many suppliers.[3]

Today's debarment regimes send a signal to the private sector that access to public procurement markets requires compliance with laws and regulations, a signal that may well have a long-run positive effect on overall integrity and productivity. In practice, however, the debarment instrument implies challenging trade-offs. Excluding a competitor leads to reduced competition, and this in turn may result in higher prices or lower quality, quite the opposite of what procurement rules are supposed to deliver. Oligopolistic markets are particularly exposed to these risks, and this typically characterizes markets where large government contracts are awarded. Shifting to an alternative supplier may be costly and cumbersome, in some cases because of unique technical solutions with horizontal and/or vertical spillover effects on other acquisitions. From a legal perspective, exemptions from debarment rules are possible, and they are frequently used in practice, but this is not a good solution since it easily leads to a situation in which rules are applied differently depending on the player's market position. If debarment is only applied to firms operating under competitive pressure or whose services are not preferred in any case, we are left with rules that condone illegal practices by the strong and powerful. And for all we know, their market position could be a result of the very practices supposed to trigger debarment, that is, it may be based upon corruption or money laundering that provides the extra profits needed to outbid a competitor.[4]

This study is motivated by concerns about corruption in public procurement and about the market consequences of debarment, both of which represent departures from the premise of equal treatment and optimized price-quality combination. For insights, we need to analyze the economic trade-offs between excluding firms not found trustworthy and ensuring competition. Generally, the debarment instrument is introduced with wide discretion given to procurement agents, hence an implicit assumption that procurement agents are honest. In our perspective, however, corruption would not be a risk in these contexts if procurement agents were always honest. Since it takes two parties to cut a corrupt deal, this analysis place emphasis on the risk that the procurement agent herself can be corrupt; specifically, how she can facilitate bribery through the choice of acquisition mode. The direct consequence of excluding a com-

[3]For discussion of the altered use of the debarment instrument, see Gordon and Duvall (2013) and J. Crawford "How Proposed Debarment Became Equal To Suspension" at Law 360 on 2 February 2015, see http://www.law360.com/articles/616957/how-proposed-debarment-became-equal-to-suspension

[4]Several authors find a clear empirical correlation between corruption and market concentration, including Ades and Di Tella (1999), Søreide (2008) and Treisman (2007).

petitor follow from elementary microeconomics, with normative implications against debarment. What complicates that logic are the more general importance of trusting business partners, the need to secure state revenues against crime, and the desire to realize the long-term benefits of more integrity among actors in public procurement markets.

While internationally, there are hardly any systematically collected data on the actual debarment practices, for this article we have reviewed numerous cases that reveal severe difficulties in the enforcement of the rules. Section 2 presents a concise overview of what appears to be the main challenges. Next, in Section 3 we present the model and discuss its assumptions. Section 4 proposes an economic analysis of the impact of debarment in public markets, assuming the rules are properly enforced. To what extent can this tool be expected to prevent corruption and protect the gains from competitive bidding? And can it also be used to fight collusion as advocated by international development banks? Keeping the focus on incentives and payoffs, while ignoring subtle/indirect signal-effects on moral standards, the analysis shows that debarment is a tool that works under some market conditions, but not all, and which impact depends on predictable enforcement. The extent to which debarment deters suppliers from entering into corrupt schemes depends on how much value they place on future government contracts. This estimated value depends on the likelihood that they will win future procurement auctions, and this probability depends on the number of firms that may compete in the market in the future. With well-functioning debarment rules, the number of firms decreases as corruption is detected, and this fact influences the firms' estimated value of future contracts. In our stylized analytic framework we capture some of this dynamics in repeated purchase games.

In Section 5 we discuss the policy implications of our results. Debarment might deter corruption when the number of firms competing in the market is not too large, when they care about future sales, and when the probability of detection is substantial. However the policy tool needs to be managed by authorities with solid competence about the market situation and with incentives to secure consistent enforcement. Our review of cases show that this is a critical obstacle in its practical implementation. In addition to securing unbiased law enforcement, we propose to move the authority to debar suppliers from procurement agencies to antitrust institutions. Procurement agencies may themselves be involved in the corrupt deals or inclined to deviate from debarment rules, whereas antitrust institutions have proven to be very efficient in the fight against collusion. Moving the responsibility to antitrust institutions would also reduce the risk that indiscriminate debarment undermines leniency programs in competition law. The institutional change might contribute importantly to a more coherent regulatory approach to protecting markets against collusion and corruption.

## 2 Debarment practices

Over the past two decades, most countries around the globe have reformed their procurement rules, and while debarment of fraudulent suppliers is one of the principles associated with best practice legislation, there is no standardized way to introduce this instrument. The most important difference is between debarment administered by public procurement agencies and debarment imposed on suppliers as a criminal justice penalty. While many countries include debarment as one among alternative criminal law penalties, it is rarely used as such in practice. In the United States, where examples of debarment (or professional disqualification) used as a criminal justice verdict are most easily found, the prosecuting authorities are more inclined to point at such penalties as a threat thus speeding up their process toward a non-prosecution (or deferred prosecution) agreement with firms accused of for example corruption (Rose-Ackerman and Palifka 2016 Ch. 6). As the practice of actually imposing debarment as a punishment is rare, debates about debarment as a policy instrument refer, almost without exception, to how it is administered by public procurement agencies.

Within the world of public procurement, the specific rules and practices differ substantially across countries - especially regarding optional versus mandatory debarment, the use of registers to list debarred suppliers, and whether there is a clear time limit for debarment. The United States appears to have the most developed and predictable public procurement debarment regime, with a procedural system intended to ensure fair treatment, including options for appeal, and federal decisions applied to procurement at the state level.[5] In the European Union each country can determine the details of their debarment rules within the rules set forth by the EU procurement directive.[6] In Africa and Asia a good number of countries introduced debarment rules in the early 2000s; including the large economies of China, Nigeria, India, Indonesia, and Japan, but also for example Bangladesh, Liberia, Egypt, Mongolia, Pakistan, the Philippines, and Vietnam.

In lack of data it is difficult to describe enforcement patterns. By reviewing cases, we have nevertheless detected common challenges, which we now discuss in turn:

**i) Inconsistent rules and weak government oversight of enforcement practices**

Considering debarment in practice, we find that disqualified suppliers differ in size and industry, the alleged offenses differ, and the cases occur in countries at all income levels. Within countries the rules are enforced inconsistently, and there is no international consensus of what an efficient debarment regime might look like. For instance under some regimes, such as the World Bank sanctions regime, cartel collaboration is a stand-alone reason for debarment, while in others, as under the EU procurement rules,

[5] Sue Hawley, "Yawn and You'll Miss It: New EU Debarment Rules, Old Problems," Corruption Watch, March 4, 2015, www.cw-uk.org.

[6] Directive 2014/24/EU on public procurement provides for a combination of mandatory and facultative debarment, and governments have substantial space for detailing the rules (Hjelmeng and Søreide, 2014).

it is not.[7]In either case, firms that have benefitted from corruption, should be debarred.

The notion of debarment as an important anticorruption response is contingent on the assumption that governments enforce their own debarment rules. This is not necessarily the case. In 2014 Transparency International complained to the European Union, which spends around EUR 2.5 trillion a year on goods and services, that it had so far blacklisted only six companies for fraud and corruption.[8] According to a report by the OECD (2014), only two out of a total of 427 foreign bribery cases in the OECD area resulted in debarment. Also in the United States debarment is used irregularly. An audit report prepared by the US Department of Justice (2012) found that the rules when enforced at the state level leave too much space for discretion, and in practice, weak enforcement.

In other countries, debarment happens, yet governments rarely keep registers of debarred suppliers. In cases when a supplier should be debarred for criminal acts, it may be up to competitors to raise the issue, complain, and claim the competing supplier ineligible for tender participation, or the procurement agent can check if any supplier is registered with criminal acts. If none of these two reactions take place, a supplier convicted of corruption may well take part in public tenders.

**ii) High market concentration and cartel collaboration**

One reason why the rules are disregarded might be the importance of protecting competition. In all categories of countries, there are sectors with significant constraints on competition; this is especially a problem in infrastructure and utility provision, which represent the largest procurement expenses for many governments. According to Iimi (2011), who studied worldwide infrastructure projects financed by aid or development loans, the average number of bidders is 5.2 in the water and sewerage sector, 6.2 in the roads sector, and 4.6 in the electricity sector. In the majority of electricity works and water auctions only two or three firms were competing for the contracts (Iimi 2011: 129-140, see also Estache and Iimi 2012 and Pittman 2011).[9]

With few bidders, governments may find that they cannot afford to exclude a supplier for the sake of promoting integrity in markets. Such difficulties have led to calls for more flexible rules. Instead of strictly excluding (needed) suppliers, it has become common to reach an (administrative) settlement agreement, an option that gives procurement agencies discretion to list far-reaching demands. In exchange for a

[7]There are examples of circumstances where all suppliers present in a market have been found ineligible for future contracts. In 2009, for example, the World Bank debarred seven road construction companies on grounds of cartel collaboration for contracts in the Philippines. World Bank press release, January 14, 2009. The Philippine government's immediate reaction to the case raised suspicions that corruption could be part of the scam, as the president's response, widely quoted in the press, was, "We can always find another development bank."

[8]Transparency International, "Blacklisting the Corrupt: Why the EU Debarment System Does Not Work," January 13, 2014, http://www.transparency.org. The World Bank has debarred many more suppliers headquartered in the EU area for their involvement in fraud and corruption.

[9]This is not different in competition-friendly countries, like the United States. Studies some years ago found the average number of bidders for highway construction contracts to be around 5.0 in Florida (Gupta 2002) and 3.3 in Oklahoma (Da Silva et al. 2003).

shorter debarment period or even complete leniency, a supplier might agree to dismiss managers, accept external monitoring, or make some form of restitution payment (Gordon and Duvall 2013). For example, as part of a settlement with World Bank investigators, Siemens agreed to make a US $100 million payment to "support anticorruption work," while parts of the corporation were also debarred.[10]

However, such practical settlement solutions might be very hard to defend politically when companies have collaborated in a cartel facilitated by corruption.[11] This is exactly the problem in Brazil, where a major corruption scandal was revealed in the fall of 2014. A large number of suppliers to the national oil company Petrobras have been involved in corrupt schemes, with parts of their bribes being channeled to Brazil's political elite. The case involved both Brazilian and foreign suppliers, including several large Brazilian construction companies. These suppliers had formed a cartel, and according to the country's public procurement regulations, they should all be debarred. However, the government's demand for infrastructure and other construction services required exemptions from the rules.[12] The relationship between debarment, corruption and collusion is complicated yet a real concern in the enforcement of debarment rules, as analyzed in Section 4.4.

**iii) Debarment irrespective of perceived risk in the given market**

Most debarment rules stipulate that suppliers involved in corruption should be debarred regardless of where the corruption has taken place. The OECD and the World Bank, for example, emphasize the importance of operating with "universal debarment rules" in the global fight against corruption.[13] The geographical location or exact market where a supplier's involvement in corruption has taken place is not supposed to matter to a procurement agent. As long as bribery has been reliably confirmed, the supplier is supposed to be disqualified from bidding. Under the World Bank's debarment rules, for example, a firm found guilty of corruption in Argentina will be ineligible to place bids for contracts in Mongolia. Such rules imply that procurement agents' decision to debar a supplier should not depend on the risk of corruption in their own environment.

Compliance with these regulations has proven difficult for governments that need to buy services from a certain supplier, especially when they find the firm's past performance excellent and have experienced no problems with corruption. A court case from Norway, one of top-scorers when it comes to law enforcement,[14] shows the practical difficulty of debarring a supplier when the (local) risk of corruption is

[10] World Bank press release, July 2, 2009. Another example is a three-year World Bank debarment of parts of the Alstom corporation combined with a restitution payment of $9.5 million, see World Bank Press release, February 22, 2012.

[11] Lambert-Mogliansky (2011) explains how cartel collaboration is faciliated by corruption.

[12] The case has been well covered by the international press. See, for example, Joe Leahy, "Multinationals Face Scrutiny on Petrobras," Financial Times, February 22, 2015.

[13] See the OECD 2014 Draft Recommendation of the Council for Public Procurement (GOV/PGC7ETH(2014)7/REV3). Also see the World Bank website for various reports about its sanctions regime, including one by the Office of Suspension and Debarment (OSD 2014).

[14] See the Rule of Law Index by The World Justice Project: http://worldjusticeproject.org/rule-of-law-index

considered low. By a lower court in Norway, the firm Norconsult was found guilty of bribery in Tanzania. When brought up for an appeals court, the judges let the risk of debarment in public procurement affect their verdict on corporate criminal liability. According to the verdict, corporate criminal liability for bribery in Tanzania would have exposed the supplier to debarment from public procurement in Norway, on top of a debarment period imposed by the World Bank. The sum of consequences were deemed unreasonable, and thus the court found the supplier not criminally liable.[15] Such reasoning undermines the enforcement of debarment rules, as well as the aim of imposing predictable penalties upon corporate criminal liability, while at the same time, the case must be seen as a pragmatic attempt to reach a reasonable solution.

**iv) Discretion regarding evidence and identification**

In general, the enforcement of debarment principles are subject to broad discretion combined with an administrative judgment of evidence, and this discretion may lead to biases, both in terms of too many firms being debarred, or too few. In Tanzania, for example, the country's Public Procurement Regulatory Authority in a case from 2014 suspended 19 firms from competing for public procurement contracts for one year. While the suppliers were debarred due to their engagement in corrupt practice and their failure to fulfill contractual obligations, the details of each individual case were not provided. The authority justified its decision as a more efficient reaction against corruption than single-case contract termination.

For all we know, there may be clear evidence behind each of these debarments in Tanzania. In general, however, a tendency to exclude suppliers on the mere suspicions of corruption will pose different forms of risk to good procurement. One concern is a possible inflation in the number of firms found ineligible for bidding. Another concern is that the debarment rules may become a handy tool for those seeking a reason to exclude a supplier or terminate a contract. Society may find it difficult to tell in these cases whether the debarment decision is motivated by a supplier's lack of integrity, or by some challenge on the side of the procurement agency, such as lack of funds to finance the completion of a contract. Wide authorities to exclude suppliers on a discretionary basis may even be abused to extort bribes, thus completely undermining the purpose of the debarment regime.[16]

[15] Norwegian Supreme Court judgment of June 28, 2013, in case 2012/2114. Two Norconsult employees were found personally liable, while the corporation avoided any criminal sanctions.

[16] This unintended consequence is pointed out in the ADB/OECD (2006: 23) report: "Debarment is a two-edged sword: while it might deter corruption, it could also be part of a corrupt scheme of competitors or corrupt officials to extort bribes or to eliminate honest competitors, especially if the conditions for debarment are not clearly specified. Worse, under certain conditions, qualified and honest companies consider abstaining from bidding to avoid being subject to debarment". The risk of abuse is explicitly mentioned in the review of practices in Bangladesh, Kyrgyzstan, and Pakistan.

# 3 Assumptions and Framework for Analysis

Section 2 shows that in general debarment is not enforced properly, nor in a predictable way. Enforcement is challenged in different ways: It is impractical to disqualify the supplier of a good or service in high demand. The debarment of all suppliers in a market hits those in need of the services unreasonably hard. Debarment regardless of where the corruption has taken place implies exclusion from tenders with a very low risk of corruption. Discretional debarment can easily be exploited by corrupt public officers to serve other agendas than promoting value for money. For these different reasons, the rules do not function well, and while governments may claim they act against corruption when such rules are introduced, the anticorruption impact of the rules will be meagre if they are not consistently enforced. The question now is *if* the rules were applied properly, would debarment then deter corruption? Before promoting strict enforcement of these rules, we should be certain that it would have the intended effect. In what follows we will, therefore, try to answer the following question: under what circumstances will debarment of corrupt suppliers reduce the risk of corruption in public procurement?

## 3.1 Analytic preliminaries

To investigate the function of debarment rules we study the mechanisms at play within a stylized setting. Let us consider a society where the government (the principal) oversees public spending, while various public procurement agencies conduct contract allocations given stipulated procurement rules. These procurement agencies cannot be assumed 100% honest - since if so, there would be no need for anticorruption initiatives, and thus, for this study we assume that procurement agencies can accept bribes from suppliers. For simplicity we assume the procured services/goods to be homogenous as this simplification allow us to avoid unnecessary technicalities.

The government (the principal) aims at securing value for money to the benefit of society. Debarment rules are introduced as a strategy to promote this aim as dishonest suppliers are excluded from bidding while the remaining suppliers are more likely to be deterred from offering bribes. Regardless of the reviewed practical problems with debarment rules, we assume for now that the rules function as intended once they are introduced. With a certain probability, corruption is detected and the suppliers involved are truly debarred. Procurement agencies have sufficient information about disqualified suppliers to reveal any attempts of restructuring operations in order to compete for contracts, for example under a new company name.

In practice, procurement-related corruption takes many different forms. Public contracting can be manipulated to the benefit of a certain supplier at the planning and budgeting stage, through the tender criteria, during the bidding process, and after a contract has been allocated (for example in contract

renegotiations, sometimes informally agreed ahead of the tender).[17] The abuse of authority can affect the choice of supplier, the quality of what is procured, or the price. Moreover, the crime can happen in subtle ways (for example by exploiting politicians' discretionary authority), it can be done in ways that make it look like as if all procurement rules have been respected, or it can be done by exploiting the rules of exemption - which is a risk under most procurement regimes.

In our stylized analytic framework we lose precision if we try to keep room for the many forms of corruption, and for this reason, we will focus on a specific procurement decision that captures a central aspect of corruption, namely the opportunity to direct a contract to a specific supplier without competition. This is an obvious risk because in many settings, the decision to do sole source procurement can be made within a procurement agent's discretionary authority. Empirically Chong, Klien, and Saussier (2013) find a positive relationship between the use of negotiated procedures without prior notification and the weakness of governance across the European Union: in countries more prone to corruption, public purchasers more often deviate from the standard procurement procedures and use negotiated procedures. According to the Tenders Electronic Daily (TED) database, an archive of 4m purchases by European governments during the past decade, 17% of calls for tender in 2006 received only one bid. By 2015 that figure had risen to 30%. Explanations for reduced competition include bid-rigging and corruption. According to an article in The Economist, "procurement problems are worst in the EU's newer members. In many ex-communist countries, single-bid contracts are not the exception, but the rule... Croatia's former prime minister and other members of his party are on trial for allegedly taking donations in exchange for state contracts. Indeed, the worst offender on single-bid tenders is Croatia. In 2015 43% of government contracts went uncontested."[18] Corruption associated with single-bid contracts is consistent with earlier findings by Della Porta and Rose-Ackerman (2002) who show that in the 1990s in Italy public authorities were abusing emergency procurement procedures to bypass competition. More recent evidences by Auriol, Straub and Flochel (2016) illuminate the same problem in Paraguay. For now, therefore, *bribery* refers to the cases where a procurement officer in exchange for a bribe grants the supplier a contract without competition.

For several reasons, we find it necessary to briefly investigate how debarment will also affect cartel collaboration - even if debarment is associated primarily with other forms of corporate crime. A decreasing number of firms may increase the likelihood of future cartel formation as fewer firms make collusion more likely (Levenstein and Suslow 2006). Besides, as illustrated by the Petrobras case above, there are circumstances where corruption and cartel collaboration go hand in hand (Lambert-Mogliansky 2011). Moreover, while most governments seek to control cartel collaboration in their own markets, there is

[17] For explanation and examples, see Rose-Ackerman (1999), Della Porta and Vannucci (1999), Søreide (2002, 2012), OECD (2005), Piga (2012) and Guasch (2009).

[18] *The Economist* on 19. Nov. 2016: "Procurement spending: Rigging the bids"

generally a different law enforcement attitude when it comes to cartels in export markets.[19] However, all governments are responsible for promoting fair competition internationally, and debarment is one of the (few?) reactions that can be applied by "other governments" when cartel collaboration has taken place in a country where the enforcement of antitrust law for some reason is too weak. Since this is generally the case in developing countries, the five largest multilateral development banks[20] have agreed to mutually enforce each other's debarment actions with respect to four sanctionable practices, i.e. corruption, fraud, coercion, and collusion; a supplier excluded by one development bank, including for cartel collaboration, is automatically excluded by the four others in the sense of being excluded from all government-steered procurement covered by loans or grants from these institutions (Fariello and Daly 2013). Eventually, the main reason why we find it necessary to analyze the effect on cartel collaboration is the need for a more holistic approach to protecting markets against corporate crimes. For efficient prevention of complex forms of business-related crime, it is necessary to understand how a policy tool designed to address one form of crime may affect other forms of crime, an aspect we return to in the policy discussion, Section 5.

## 3.2 The model

We consider a repeated purchase game between a public purchaser and $N \geq 1$ potential suppliers. The horizon is infinite. The paper considers a three-tier hierarchy: principal, delegate, firms. The principal (i.e., an agency acting on behalf of the taxpayers), conventionally referred to as "he", wants to acquire in each period of time a commodity or a service on the best possible terms. He entrusts the responsibility of the acquisition to a delegate (i.e., a public purchaser), conventionally a "she". The principal's objective is to maximize the net social surplus associated with the public acquisition. All the players are risk-neutral.

The size of the market varies from one period to the next in a random way: $Q_t = \underline{Q} + \epsilon_t$ where $\underline{Q} > 0$ and where $\epsilon_t$ is independently and identically distributed over $[0, \overline{\epsilon}]$ $\forall t = 0, 1, 2...$, so that $Q_t \in [\underline{Q}, \overline{Q}]$ with $\overline{Q} = \underline{Q} + \overline{\epsilon}$. The distribution of $Q_t$ is common knowledge (in particular, the minimum size of the market, $\underline{Q} > 0$, is known to all), but not the random part $\epsilon_t \geq 0$ The idea is that there are random shocks affecting public demand, which therefore must be adjusted at each period. We denote by $EQ$ the expected value of $Q_t$. Procuring $Q_t$ generates in period $t$ a gross surplus $S(Q_t) \geq 0$ increasing with $Q_t$ ($S'(Q_t) > 0$). We assume that $S(\underline{Q})$ is large so that it is always worth producing the commodity even for the lowest possible quantity $\underline{Q} > 0$.

*The firms*: There are $N(\geq 1)$ firms in the economy that can produce the good. Since these firms procure the same type of goods or services they face some common costs, that without loss of generality,

[19] Martyniszyn (2012) points out that many governments have a strong inclination to ignore cartel collaboration among firms – provided the consequences are kept abroad.

[20] The African Development Bank Group, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank and the World Bank Group.

is set to 0.[21] However their production process are not perfectly identical, nor their economic activity outside the public procurement arena. We model this by assuming that at each period their cost to procure the commodity is affected by some random shock. To produce a quantity $q \geq 0$ the firm $i = 1, ..., N$ is confronted with cost

$$C(\beta_t^i, q) = \beta_t^i q \tag{1}$$

where the marginal cost $\beta_t^i$ is drawn in $[0, 1]$ according to the uniform distribution at the beginning of period $t = 0, 1, 2, ....$[22]

**Assumption 1** *$\beta_t^i$ is independently and uniformly distributed over $[0, 1]$ $\forall i = 1, ..., N$, $\forall t = 0, 1, ...$ .*

The firms are hence ex ante symmetric. We assume that at the pre-contracting stage a firm does not know the exact value of $\beta_t^i$. This assumption reflects the fact that there are idiosyncratic shocks affecting the production process. The firm needs to prepare a bid to discover the exact value of its marginal cost to serve the market in period $t$. Moreover, once it is revealed, $\beta_t^i$ is the private information of firm $i = 1, ..., N$. By contrast, the quantity produced by firm $i$, and the law of $\beta_t^i$ are common knowledge. Finally the firms all have the same discount factor $\delta < 1$.

*The delegate*: The delegate's job is to collect information to implement the optimal acquisition procedure. She has two options. She can negotiate the market with a producer, in which case she needs to identify one supplier without competition. If so, this corresponds to the case of limited tendering as termed by the General Procurement Agreement (GPA). Alternatively, she can allocate the contract through a competitive bidding procedure; this corresponds to open tender, as termed in the GPA. The optimal decision depends on the relative cost of fostering competition compared to the expected benefit. The cost of running an open tender is $K_t \geq 0$ $t = 0, 1, 2, ....$ It embodies the monetary and non-monetary (delay) costs of the procedure. In practice these costs may be very high and vary from one market to the next.[23] We assume that $K_t$ is independently and identically distributed in the set $[\underline{K}, \overline{K}]$. We denote by $EK$ the expected value of $K_t$. Intuitively it is more profitable to organize a competitive bidding

[21] The firms' marginal cost parameter is the sum of a common part, identical to all firms, and the idiosyncratic part, random and firm specific. Since it is common to all firms, the information on the common part of the cost can be extracted by the principal at zero cost by implementing some form of yardstick competition (see Auriol-Laffont 1992). The firms can have an informational rent solely on the independent part. To avoid introducing new notation we therefore set the common part to 0. This is done without loss of generality (i.e. the surplus function $S(Q)$ is defined net of this common cost part).

[22] The uniform distribution assumption is not crucial for our results but it allows us to find closed-form solutions.

[23] It takes time and money to organize open tenders. First the purchasing entity has to specify its need in writing. Next it has to advertise tender information in official gazettes, newspapers, bulletin boards, or bidding information journals. If the firms that receive the information are interested they have to work out detailed offers. The purchasing entity has to review and evaluate the offers, and finally, it has to write a report to justify its choice. For instance in 2011 the annual procedural costs of compliance with EU public procurement legislation were estimated by the European Commission at 5.3 billion euro in 2009 terms or 1.4% of the value of procurement covered by the EU Directives. Consistently with our assumption the study shows that procurement costs are independent of contract values (i.e., there are fixed cost). The average procurement procedure took 108 days to complete and the average cost per procedure was approximately Euro 28000, with considerable variance depending on the country and the nature of the market (see European Commission 2011).

procedure when $K_t/Q_t$, is low than when it is high.

*Sole Sourcing:* In the sole source case, $N = 1$, the acquisition cost is equal to the monopoly price $t(1) = Q_t$. The sole-source case corresponds to fixed-price purchase. The identity of the producer then is irrelevant to the taxpayers. The principal's net surplus is $W(1) = S(Q_t) - Q_t$ and the firm's net expected profit is $\pi(1) = \frac{Q_t}{2}$.[24]

*Competitive Bidding:* Since the firms' cost parameters are independently and identically distributed, it is optimal under asymmetry of information to organize a type of second-price auction (Myerson 1981). The rent expected by a producer $i = 1, ..., N$ when being one of $N$ bidders in this auction is (see appendix 7.1):

$$\pi(N) = \frac{Q_t}{N(N+1)}. \tag{2}$$

The producers are ex-ante symmetric so their expected rent is symmetric. The sole source case is simply obtained by setting $N = 1$ in (2). For all $N \geq 2$ the rent in (2), which decreases with $N$, is strictly lower than the monopoly expected rent and converge to 0 when $N \to +\infty$.

We show in appendix 7.1 that the variable expected government surplus from competitive sourcing with $N$ bidders is:[25]

$$W(N) = S(Q_t) - \frac{2Q_t}{N+1} \tag{3}$$

The net expected surplus from competitive sourcing with $N$ bidders is: $W(N) - K_t$. A comparison of the government surplus under sole sourcing with its surplus under competitive bidding, omitting the fixed cost, yields $W(N) - W(1) = Q_t \frac{N-1}{N+1} \geq 0$. By introducing competition, the delegate reduces the producers' expected rent. Since this rent reduction implies a gain on the principal, competitive bidding increases his surplus by the same amount. The benefit grows as competition intensifies (i.e., it increases with $N$). Indeed, when the number of bidders is large they collectively bid more aggressively, which reduces the final cost.[26] We define $k(N)$ as the marginal social benefit of introducing competition:

$$k(N) = \frac{N-1}{N+1} \tag{4}$$

The choice between sole sourcing and competitive bidding is now reduced to a trade-off: Competitive bidding yields a fixed procedural cost $K_t$ but gives a higher probability of a small acquisition cost, resulting in a net effect that is captured by $k(N)Q_t$ (i.e., the sampling effect).[27] We deduce the following

[24] With a single producer we drop for simplicity the index of the firm. Its expected profit is : $\pi(1) = Q_t \int_0^1 (1-\beta) d\beta = \frac{Q_t}{2}$.

[25] In this model the "welfare" refers to public aims only, and as expressed, the winning supplier's profit is not included in this expression. It could also be referred to as benefit for the public, or government payoff/surplus.

[26] They individually bid the same, but since the price paid is the second lowest bid, an increase in the number of bidders make it more likely to obtain a lower second price.

[27] For more on the sampling effect, see Auriol and Laffont (1993) and Auriol (1996).

result.

**Proposition 1** *Competitive bidding is the optimal acquisition strategy if and only if* $k(N)Q_t \geq K_t$. *Otherwise, sole sourcing is the superior strategy.*

Competitive acquisition is more valuable when the number of bidders $N$ is large and when the level of procedural cost $K_t$ is low. Moreover, the expected gain associated with competitive bidding increases with $Q_t$. The impact of a decrease in the marginal acquisition cost is proportional to the market size. This is why most countries operate with minimum thresholds for open tendering. With this framework for analysis we now turn to the optimal delegation scheme when the delegate is corruptible.

# 4 Analysis of debarment

In this section we examine the impact of corruption in the setting described above, first in the stage game, thereafter in the case of repeated purchase and debarment. We next turn to analyze how debarment may affect collusion between bidders. The case of entry of new firms is discussed at the end of the section.

## 4.1 Corruption in the stage game

As $K_t$ and $Q_t$ are unknown ex ante, the benefit of organizing a competitive procedure is uncertain. The optimal acquisition policy consists of choosing open tendering whenever $K_t$ is lower than $Q_t k(N)$ and limited tendering otherwise. Since debarment is a strategy to fight capture (i.e., grand corruption), we focus on cases where capture can occur. Appendix 7.2 shows that capture is a threat whenever:

$$\frac{\underline{K}}{\overline{Q}} \leq k(N) \leq \frac{EK}{EQ} \tag{5}$$

Condition (5) implies that if $\frac{\underline{K}}{\overline{Q}} \leq \frac{K_t}{Q_t} \leq k(N)$ the optimal acquisition strategy is competitive bidding, while if $k(N) < \frac{K_t}{Q_t} \leq \frac{EK}{EQ}$ the optimal acquisition strategy is sole sourcing (see Proposition 1). Moreover, since $EK \geq k(N)EQ$, the acquisition strategy is sole sourcing in the absence of additional information.

The job of the delegate is to choose the acquisition strategy to maximize value for money, which, under assumption (5), requires to collect information on the appropriateness of implementing an open tender. The delegate holds information, denoted $\sigma \in \{C, M, \emptyset\}$, on the subset, $C = [\frac{\underline{K}}{\overline{Q}}, k(N)]$ or $M = (k(N), \frac{EK}{EQ}]$, in which $K_t/Q_t$ is drawn from. Following Laffont and Tirole (1993) we assume that the information acquisition process is exogenous (see appendix 7.2):

**Assumption 2** $\nu = Prob(\sigma = C) \in (0, 1)$

The optimal acquisition procedure is sole sourcing when either $\sigma = \emptyset$ or $\sigma = M$; it is competitive bidding when $\sigma = C$. When the procurement agent is informed that implementing competitive bidding is optimal she can prove it in court (i.e., $\sigma = C$ is hard evidence). However the signal received by the delegate is not always informative so that she can always hide her information and pretend that she learned nothing (i.e. $\hat{\sigma} = \emptyset$). This claim is impossible (or extremely costly) to verify.

*The timing:*

$t = 1$ The principal sets the delegate's contract and the acquisition rules. He entrusts the enforcement of the acquisition rules to the delegate.

$t = 2$ Nature chooses $K_t \in [\underline{K}, \overline{K}]$ and $Q_t \in [\underline{Q}, \overline{Q}]$; The delegate obtains information $\sigma \in \{C, M, \emptyset\}$.

$t = 3$ The delegate and a firm meets; side contracting occurs;

$t = 4$ The delegate announces $\hat{\sigma} \in \{\emptyset, \sigma\}$; competitive bidding or sole sourcing is implemented according to the rule edited by the principal based on $\hat{\sigma}$.

− If competitive bidding, the delegate opens the market by sinking $K_t$, which value has been chosen by nature at stage $t = 2$; nature chooses $(\beta_t^1, ..., \beta_t^N)$; the $N$ potential producers discover $\beta_t^i$.

− If sole sourcing, the delegate selects a firm; nature chooses $\beta_t^i$; the firm discovers $\beta_t^i$.

$t = 5$ $Q_t$ is revealed to all. Bidding or direct negotiation takes place. Contracts are signed, production and transfer occur.

Stage 3 corresponds to the corruption stage. To avoid competition with the other producers, a firm is willing to pay up to the additional rent it makes in a monopoly position. It is not important which firm pays the bribe and is chosen; at stage 3, they are all symmetric (i.e., $\beta^i$ is still unknown to all and the bribe depends on the firm's future expected profit). Then if a firm successfully captures the delegate, the principal ends up with the wrong decision, namely limited tendering in favor of the briber, whenever $\sigma = C$.

Capture is damaging to society because it involves sole sourcing instead of competitive bidding when $\sigma = C$ is pivotal information. The variable social loss associated with capture is[28]

$$L(N) = W(N) - W(1) = k(N)Q_t = \frac{N-1}{N+1}Q_t. \tag{6}$$

$L(N)$ is increasing and concave in $N$, the number of bidders that would have competed in a fair open procedure. It varies between $L(N) = \frac{Q_t}{3}$ when $N = 2$ and $L(N) = Q_t$ when $N \to +\infty$. This result is consistent with the empirical study by Iimi (2006) on procurement auctions for official development assistance. It shows that the bid prices decrease with the number of bidders in a convex fashion. Moving

[28] We need to subtract the fixed cost $K_t$ of this variable loss as it is not sunk when the procedure is sole sourcing. The net loss is $L(N) - K_t$ which is positive when $\sigma = C$.

from open to limited tender hence yields a loss increasing and concave in $N$. In comparison the firm's benefit from capture is:

$$\Pi(N) = \pi(1) - \pi(N) = \frac{Q_t}{2} - \frac{Q_t}{N(N+1)}. \tag{7}$$

The firm's benefit from capture is smaller than the variable social loss from capture: $L(N) - \Pi(N) = L(N)\frac{N-2}{2N} \geq 0 \ \forall N \geq 2$. There is therefore a whole range of the parameters, where in addition to undermining taxpayers' confidence in public institutions and inflating the price they pay for the public commodities, capture implies a social dead-weight loss.[29]

In case of corruption, the firm has to give a bribe to the public official to obtain the market without having to compete with other firms. The bribe rate is $b \in [0,1]$ so that the net expected profit of the firm when it engages in corruption, assuming there is no risk of detection, is $\pi(1)(1-b) = (1-b)\frac{Q_t}{2}$. The maximum bribe rate $\overline{b}^{static} \in [0,1]$ that the firm is willing to pay ex-ante to avoid competition requires that: $\pi(1)(1-b) = \pi(N)$. It yields:

$$\overline{b}^{static} = 1 - \frac{2}{N(N+1)}. \tag{8}$$

## 4.2 Corruption in repeated purchases and debarment

In a static context debarment is not a problem for the firm as there is no future contractual relationship. It becomes relevant only in a dynamic context. We consider the infinite repetition of the purchase stage game. To keep the exposition simple we assume that when the optimal acquisition procedure is sole sourcing (i.e., when either $\sigma = \emptyset$ or $\sigma = M$) the delegate picks a firm at random to serve the market.[30] We introduce some notations to ease the exposition. Let $E_C Q$ denote the expected value of $Q_t$ conditional on the fact that it belongs to set $C$ and let $E_{\sigma \neq C} Q$ denote the expected value of $Q_t$ when $\sigma \neq C$. We have: $E_{\sigma \neq C} Q < EQ < E_C Q$.[31] Corruption might arise when the delegate information at period $t$ is $\sigma = C$, which, according to assumption 2, occurs with probability $\nu$.

In the infinite repeated public purchase game the expected payoff of a firm when there is no corruption is:

$$\sum_{t=0}^{+\infty} \left\{ \frac{\nu E_C Q}{N(N+1)} + \frac{E_{\sigma \neq C} Q}{2N} \right\} \delta^t = \left\{ \frac{\nu E_C Q}{N(N+1)} + \frac{E_{\sigma \neq C} Q}{2N} \right\} \frac{1}{1-\delta}. \tag{9}$$

By contrast, if the selected firm is corrupt, in addition to the bribe it has to pay to the public official,

[29] When $K_t \leq L(N)\frac{N-2}{2N}$, even if the principal could tax the corrupt firm and the delegate to distribute their excess profits back to the taxpayers, he would not be able to restore efficiency.

[30] The honest delegate does so because of her duty and integrity, while the corrupt delegate does so to avoid being detected when she favors a firm in her inner circle in exchange for a bribe. For smaller markets she allocates contracts randomly so that allocation patterns looks normal (i.e. there is variation in what supplier gains the contract).

[31] Let $E_M Q$ be the expected value of $Q_t$ conditional on that it belongs to set $M$. Then $E_{\sigma \neq C} Q = Prob(\sigma = \emptyset) EQ + Prob(\sigma = M) E_M Q$. Since $Prob(\sigma = \emptyset) + Prob(\sigma = M) = 1 - \nu$ and since $E_M Q < EQ$, we have that $E_M Q < E_{\sigma \neq C} Q < EQ$.

the firm faces the risk of detection and punishment (i.e., debarment). Let $1-p \geq 0$ be the probability that corruption is uncovered (i.e., $p$ is the probability that corruption is not discovered). If corruption is detected the firm is debarred permanently from the public market.

There are two options for debarment. Either debarment is market specific or it is universal. If it is market specific the firm will be debarred from the market where corruption occurs but it will be able to operate in other markets. If it is universal it will be debarred from all future public procurement markets, including those of other procurement agencies that enforce the same procedure of debarment. A ratio which plays an important role in the analysis below, denoted $\Delta Q$, is the volume of public contracts available outside the corrupt transactions relative to the volume of corrupt public contracts. In case of universal debarment this ratio is larger because the firm loses both the access to the markets managed by the current procurement agency and to the markets managed by other agencies that cross-debar suppliers. The variation in the ratio $\Delta Q$ is therefore a measure of the additional loss imposed on the firms by universal debarment. To keep the exposition simple we focus in what follows on the case where

$$\Delta Q = \frac{E_{\sigma \neq C} Q}{E_C Q}. \tag{10}$$

However our results are robust to the introduction of an exogenous loss of contracts of net value $U \geq 0$, outside the current flow of public procurement contracts. The larger $U \geq 0$, the bigger the impact of cross-debarment.[32]

If corruption occurs, there is a probability $1-p$ that a firm will disappear from the pool of potential bidders. The probability that a corrupt firm is not debarred and therefore is around in the next period is $1-\nu(1-p)$. To ease the computation of the firms' payoff, we assume that if corruption occurs it is always the same firm that is chosen for the corrupted deals until it is permanently debarred. Also in practice, the firms that benefit from corrupt deals tend to do so repeatedly (e.g., because of a political connection).[33] The corrupt firm's expected payoff is:

$$\sum_{t=0}^{+\infty} \frac{(1-b)\nu E_C Q + \frac{E_{\sigma \neq C} Q}{N}}{2} \big(1-\nu(1-p)\big)^t \delta^t = \frac{1}{1-\delta(1-\nu+\nu p)} \left\{ \frac{(1-b)\nu E_C Q}{2} + \frac{E_{\sigma \neq C} Q}{2N} \right\} \tag{11}$$

[32] In this case $\Delta Q = \big(\frac{E_{\sigma \neq C} Q}{N} + 2U\big)/\nu E_C Q$. This expression denotes the value of public contracts available outside the corrupt transactions (i.e., $\frac{E_{\sigma \neq C} Q}{2N} + U$) relative to the value of corrupt public contracts (i.e., $\frac{\nu E_C Q}{2}$). In case of universal debarment the firm loses both the access to the procurement contracts of the principal (i.e., $E_C Q$ and $E_{\sigma \neq C} Q$)) and to the contracts from other agencies enforcing universal debarment, which is captured by the exogenous value $U \geq 0$. All our results are preserved (the computations are available upon request).

[33] We assume that the procurement agent allocates the small contracts randomly to avoid that the same firm be always awarded all the contracts. Indeed such a repetition could alert a monitoring agency and induce it to exert a bigger effort to detect corruption. However in countries where corruption runs high there is rarely an efficient, or even independent, monitoring agency. In practice firms that are awarded lucrative public contracts tend to be always the same: they are the firms with connection to politicians (see for instance Auriol, Straub and Flochel 2016, Goldman, Rocholl and So 2013).

A firm is not willing to enter into a corrupt deal if its payoff (11) when it pays a bribe to win the contract is smaller than its payoff (9) when it is honest:

$$\frac{1}{1-\delta+\delta\nu(1-p)}\left\{\frac{(1-b)\nu E_C Q}{2}+\frac{E_{\sigma\neq C}Q}{2N}\right\}\leq\frac{1}{1-\delta}\left\{\frac{\nu E_C Q}{N(N+1)}+\frac{E_{\sigma\neq C}Q}{2N}\right\} \tag{12}$$

We show in appendix 7.3 that the forever-honest strategy is subgame perfect when (12) holds.

Moreover one can easily check that condition (12) is equivalent to $b\geq\overline{b}$, where

$$\overline{b}=1-\frac{2}{N(N+1)}-\frac{\delta(1-p)}{1-\delta}\left\{\frac{2\nu}{N(N+1)}+\frac{\Delta Q}{N}\right\} \tag{13}$$

The maximal bribe rate $\overline{b}$ that the public official can demand increases with $N$ and $p$, and decreases with $\delta$. Comparing equations (8) and (13) it is straightforward to check that $\overline{b}<\overline{b}^{static}$ for all $p<1$ and $\delta>0$. By contrast if either $p=1$ or $\delta=0$ then $\overline{b}=\overline{b}^{static}$. This result is intuitive. If the firm does not care about the future (i.e., if $\delta$ is very small), debarment is useless as a deterrence tool. Similarly if the probability of being caught is 0 the debarment threat carries no weight. If $p>0$ the risk of being detected and punished by debarment reduces the benefit of corruption, and hence, the public purchaser's room for demanding bribes. This is the desired effect of debarment rules. The effect is larger when debarment is universal than when it is market specific: $\overline{b}$ decreases with $\Delta Q\geq 0$ so that an exogenous increase of $\Delta Q$ increases the potence of debarment. The wider the debarment (i.e., outside the current transaction/market jurisdiction) the more efficient the treat is and the less the firm will be inclined to pay bribes.

Now it remains to be seen whether the effect is sufficient to deter corruption. Let

$$\delta_p=\frac{N(N+1)-2}{N(N+1)-2+(1-p)\big(2\nu+(N+1)\Delta Q\big)}\leq 1\qquad\forall p\in[0,1]. \tag{14}$$

We deduce the next result.

**Proposition 2** *Debarment will deter corruption if and only if $\delta\geq\delta_p$.*

*Proof:* See appendix 7.4.

If the probability of corruption detection, $1-p$, is almost 0 then $\delta_p\to 1$ and the public official can ask for large bribes. Conversely if $1-p$ and $\Delta Q$ is large enough, then $\delta_p$ is small, and the firms are less willing to pay bribes. Universal debarment implies the loss of a larger production volume of public procurement than market specific debarment. This additional loss matters when the detection threat is real and the firm is patient enough. If the firm values future payoffs almost as much as its payoff today (i.e., $\delta$ is larger than $\delta_p$), then the firm will never want to bribe the public official.

### 4.3 The dynamics of debarment: endogenous $N_t$

We focus in this section on cases where $p < 1$ and initially $N$ is large so that corruption occurs in equilibrium. As time passes, and corrupt suppliers are debarred, the number of firms qualified to compete for the market will be reduced. Indeed, in each period there is a probability $\nu(1-p)$ that a firm is caught and debarred. Let $N_t$ denote the number of firms that are allowed to compete for the market at time $t \geq 0$. We can rewrite the maximum value in (14) as follow:[34]

$$\delta_{tp} = \frac{N_t(N_t+1)-2}{N_t(N_t+1)-2+(1-p)\big(2\nu+(N_t+1)\Delta Q\big)} \tag{15}$$

If the probability of detection $1-p>0$ is low and $N_0$ is large, debarment will be an ineffective strategy to prevent corruption at date 0. From the welfare point of view, if debarment is not effective in preventing corruption, it does not decrease the cost of the purchase for the taxpayers. Indeed, if debarment is ineffective society ends up with the same decision as without debarment (i.e., sole sourcing in both cases). However, with debarment measures in place, the number of firms that are not debarred decreases over time, as more and more get caught, until $N_t$ is either too low for competitive bidding to be optimal or for corruption to be a preferred strategy for the firm. In other words debarment has an anti-competitive effect that can undermine the debarment mechanism's intended incentive effect. Let

$$\underline{N}_c = \frac{\overline{Q}+\underline{K}}{\overline{Q}-\underline{K}} \tag{16}$$

If $N_t$ falls below $\underline{N}_c$ then the anti-competitive effect of debarment is so strong that organizing a competitive procedure is no longer optimal. That is, if $k(N) = \frac{N-1}{N+1} \leq \frac{\underline{K}}{\overline{Q}}$ the optimal acquisition strategy is always to implement sole sourcing. In this particular case debarment has only costs and no benefit. The number of firms decreases with debarment, without reducing the risk of corruption, until this number is so low that organizing a competitive bidding procedure is no longer optimal. This negative effect is stronger if debarment is universal.

More positively, debarment works as intended when $N_t$ reaches the critical number $\underline{N}_d$ that determines whether corruption is attractive to firms when debarment measures are in place. The number $\underline{N}_d$ is so that (13) is equal to 0.[35] This second-degree equation admits two roots. Only one is positive.

$$\underline{N}_d = \frac{\sqrt{\Big(1-\frac{\delta(1-p)}{1-\delta}\Delta Q\Big)^2 + 4\big(2+\delta\frac{1-p}{1-\delta}\big)(2\nu+\Delta Q)} - 1 + \frac{\delta(1-p)}{1-\delta}\Delta Q}{2}. \tag{17}$$

[34] As $N_t$ decreases over time, $k(N_t) = \frac{N_t-1}{N_t+1}$ decreases too so that $EQ_{ct}$ increases. However this does not change the result from equation (12), and the limit value in (14) is preserved.

[35] That is $\underline{N}_d$ is so that $0 = (1-\delta)\big(N(N+1)-2\big) - \delta(1-p)\big(2\nu+(N+1)\Delta Q\big)$.

Let $Int\{X\}$ denote the inferior integer part of $X$. We deduce the following result:

**Proposition 3** *In the long run debarment reduces the number of firms to*

$$N_\infty = Int\{max\{\underline{N}_d, \underline{N}_c\}\}, \tag{18}$$

*below which corruption does not occur anymore.*

As a result, once $N_t$ has fallen below $N_\infty$ because of debarment procedures, corruption stops. A critical parameter in determining whether debarment is effective in fighting corruption is the probability that firms will actually get caught while bribing a public official. Indeed, the threshold $\underline{N}_d$ decreases with $p$, that is, with the probability that the firms' corruption goes undetected. For $p$ close to 1 (i.e., corruption is rarely uncovered) or for $\delta$ close to 0 (the firms do not care much about future contracts) $\underline{N}_d = 1$. In this case debarment has only an anti-competitive effect and no incentive effect. It yields a higher social loss than the status quo.

For $p < 1$ (i.e., corruption is uncovered sometimes) and $\delta \to 1$ (the firms are extremely patient), corruption will never occur in equilibrium: $\underline{N}_d \to +\infty$. It is worth noting that $\underline{N}_d$ decreases with $\Delta Q$. Provided that firms care about future sales and are patient enough, universal debarment is more effective at preventing corruption than market specific debarment. One drawback of universal debarment is its anticompetitive effect in markets where corruption is low. This cost is not captured here because we focus on the anti-corruption effect of debarment in a market were corruption occurs. With universal debarment corrupted countries/agencies impose a cost on virtuous countries/agencies. This negative externality is poorly internalized when the debarment decision is taken in a decentralized way.

Our analysis shows that debarment will be efficient in reducing corruption if (i) the firms are in (an implicit) long-term relationship with the principal and value future sales; (ii) if the number of firms is not too large (i.e., lower than $N_\infty$); and (iii) if the probability of corruption detection is high enough. In other cases debarment will fail to prevent corruption. It should be noted that in this analysis we have considered only one instrument, debarment, a tool that concentrates reactions against corruption on the suppliers in public procurement. A combination of different law enforcement measures could help to cleanse public procurement of corruption, including when these conditions are not met. As Rose-Ackerman (2010) points out, bribery is deterred if at least one side of the corrupt transaction faces penalties that reflect its own expected gains. In principle, either side can be punished for the sake of imposing a deterring reaction, but in practice, there are obstacles to the use of optimal sanctions, and deterrence may require reaction against both sides of the transaction. Criminal law sanctions against public officials as well as firms and managers- with fines and prison terms in case of conviction as well as liability in tort and contractual nullity, might be far more efficient in terms of deterring corruption than

debarment (Auriol 2006, Hjelmeng and Søreide 2016), a debate we return to below.[36]

What should be noted in terms of market implications, is how debarment with the aim of fighting corruption may have an anti-competitive effect by as it prevents debarred firms from competing in future public markets. This in turn leads to a different concern: if there is a limited number of bidders in the market they can more easily collude in a bidding ring. If collusion occurs the principal ends up again with the monopoly price. The next section studies how the debarment mechanism might affect the risk of collusion.

## 4.4 Debarment and cartels

As discussed in section 2 there is variation across countries and multinational development banks in their design of debarment mechanisms. To the extent that cartel collaboration is listed among the crimes for which suppliers can be debarred, the common rule is to debar all suppliers involved. This section studies whether the debarment mechanism can be used efficiently to prevent collusion, or not. An important policy issue, that we will return to below, is whether all firms in a cartel should be debarred, or if certain members of the cartel, ring leaders for instance, should be sanctioned more severely.

To keep the exposition simple we rule out any other corporate crimes such as corruption and we focus on cases where collusion can occur. To be more specific we assume that $Q_t$ is sufficiently large compared to $K_t$ so that organizing a competitive bidding procedure is either optimal or mandatory. For instance when $k(N)\underline{Q} \geq \overline{K}$ the public procurement officer has no influence on the acquisition procedure: she has to organize a competitive bidding procedure (see appendix 7.2). Since for $N \geq 2$ $k(N) \geq 1/3$, it is a sufficient condition for competitive bidding being mandatory that $\underline{Q} \geq 3\overline{K}$. With large repeated purchases, a cartel of firms can easily emerge and stall competition. The next result characterizes how debarment rules might help in fighting such collusive practices.

**Proposition 4** *Debarment will deter collusion if and only if the probability of cartel detection d is so that:*

$$d \geq 1 - \frac{1}{\delta} \frac{2\delta + (N-1)(N+1)(1-\delta)}{2\delta + N(N+1)(1-\delta)} \tag{19}$$

*Proof:* See appendix 7.4.

If $\delta$ is small the $RHS$ is negative and (19) always holds. If $\delta$ is large enough,[37] then the $RHS$ is strictly positive and the probability of detection must be large enough to deter collusion.

[36] Auriol (2006) focuses on the optimal contracts that should be offered to the public procurement officer to deter corruption. It derives optimal procurement guidelines and optimal wage structure to fight both capture and extortion at the receiving end. By contrast the debarment mechanism puts all the sanctions on the firms, as analyzed in the paper. Hjelmeng and Søreide 2016 discusses the importance of private enforcement as complements to public enforcement.

[37] The exact condition is $\delta > \frac{(N-1)(N+1)}{N(N+1)-2}$ (see appendix 7.4).

It is worth noting that if the probability of detection is positive but lower than the threshold in (19) then debarment entails a competitive cost without generating any benefit: Debarment alters the set of bidders in future auctions. This is especially true if all the firms involved in the collusive conspiracy are debarred upon discovery. In this case debarment is an inadequate instrument to fight collusion as the principal would end up with nobody to serve its public markets. A better mechanism would be to debar the firm that has benefited from the collusive agreement in the procurement process where the cartel is detected, and let the other cartel members compete for future public tenders. This mechanism has exactly the same disincentive effect as the debarment of all the firms but will not impede future procurement. With debarment reserved for the ringleader or the specific beneficiary in the case when collusion was detected, the debarment instrument can in fact work as a tool that reduces suppliers' propensity to be involved in collusion.

As in the case of corruption , we have considered the impact of only one instrument, namely debarment, and not considered how it might function in combination with other reactions. Yet in most jurisdictions (at least in advanced economies) competition authorities (CAs), along with the other detection and investigation tools at their disposal, rely heavily on leniency programs. These programs, that may reduce or eliminate fines upon infringement of competition rules, have proven very successful in fighting cartels.[38] Typically, leniency may be granted if the firms confess and cooperate with the CAs in prosecuting the other members of the cartel. Because CAs cannot grant leniency for debarment imposed by public procurement agencies, the danger of debarment will make it less likely that firms will apply for leniency. In this sense, debarment of firms for their involvement in cartel collaboration in public procurement will tend to undermine the efficiency of the leniency programs established by CAs. Hence, the total effects of debarment on cartel formation and the possibility of cracking cartels (exits) with leniency inducements, are far from trivial.

## 4.5 Allowing entry

So far we have considered that the number of firms that can serve the market is at most $N$, so that with debarment in place, and corruption and/or collusion going on, the number of firms decreases over time. In our analysis there is no new entry to replace the debarred firms. This assumption is consistent with public purchases being marginal in comparison to the volume of private purchases. If public markets represent a small fraction of the business of the sector, $N$ is not determined by the public sector activity, and is therefore exogenous to it. In other words, if $N$ is determined by the private sector activity, debarment will have no impact on the number of potential suppliers in the sector. The anti-competitive effect of

[38] For instance in the EU most cartels recently detected (i.e., 83% in 2008, 86% in 2009 and 100% in 2010 to 2013) were revealed by cartel member applying for leniency program (see Marvao 2016).

debarment on the public purchases will be as analyzed in the paper.

Another polar case is when public purchases are the suppliers' main source of business. In this case debarment policy will lead the excluded firms into bankruptcy, which leaves room for presumably some new entry. If each time a firm is debarred a new one is created to replace it, then debarment will have no impact on $N$, which means it will have no impact on corruption, unless the steady state number of firms with free entry is low enough (i.e., unless $N \leq N_\infty$ see Proposition 3).

For intermediate cases where some entries of new firms occur to replace a fraction of the firms exiting the market, $N_t$ will be the result of this mixture of exit and new entry. The logic of the model will still hold, but with $N_t$ replaced by the actualized value (i.e., it will be larger than in the case of pure exit), $N_t$ would decrease at a slower rate.

# 5 Discussion

Better understanding of the mechanisms of debarment is relevant for policy makers. Not only is debarment a powerful tool - as the option to debar allows discretion under circumstances where the acquisition would otherwise be strictly steered toward the best price-quality combination; its application is also high on the policy agenda for government institutions: The EU 2014 public procurement directive makes debarment mandatory while it also leaves substantial space for member states to decide the nuances of their rules on debarment. How to use that space is something governments will now need to consider.[39] In the United States and Canada, there are frequent debates about the functionality of debarment rules, with particular concerns about arbitrary exclusion of bidders and about consequences for the economy.[40] International development banks boldly apply debarment rules to their own procurement operations and those of their clients, although no attempts have been made to investigate the impact of the sanctions.[41]

The presented analysis shows that debarment can make a difference. It will deter suppliers from offering bribes as long as the probability of corruption detection is not negligible and the bidders place a sufficiently high value on the profits from future public procurement contracts. In contexts when these conditions are not met, it is difficult to defend a debarment strategy as a policy against corruption. With regard to deterring collusion/cartel collaboration, debarment is found to be an inadequate tool if

[39] See Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC, OJ 2014 L 94/65. Hjelmeng and Søreide (2014) describe the space that EU member states have for nuancing their procurement rules.

[40] For an early critical debate about debarment, see the collection of papers in The George Washington University Law School Public Procurement Law Review Volume 13, and especially Schooner (2004). More recently, Tillipman (2013) discusses the motivation behind debarment rules and warns against using these rules to supplement criminal law sanctions. In Canada it has been suggested that an automatic ten-year ban on convicted suppliers will harm the economy. See Barrie McKenna, "SNC Case Shows Downside of Ottawa's Strict Anti-corruption Regime," Globe and Mail, February 19, 2015.

[41] Seiler and Madir (2012), Williams (2007), Søreide, Gröning and Wandall 2016).

application means to exclude all bidders in a market. A deterrent effect can still be achieved by excluding only the ring leader or "debar" representatives of the management from professional service.

A main difficulty for those who use the policy tool, is to balance crime deterrence against the value of competition. We have explained why debarment will have little effect when there is a large number of firms in the market. However, when there are few firms in the market, it is more costly to exclude a bidder. In other words, if debarment was the only tool available (which indeed is the case in some contexts), there is a limit to the gains from competitive bidding precisely because corruption cannot be deterred with too many firms in the market. To limit any anti-competitive effect a debarment regime might have, it should be combined with initiatives to bring back excluded suppliers so that they can contribute to competition as soon as they regain the trust of procurement agencies (by help of for example external monitoring and compliance reform).[42]

Our technical analysis of debarment as a policy tool is useful for understanding its potential effects in a market context. Those effects, however, will depend on the government system that manages the tool. Yet the arrangement makes it seem like if those who developed the debarment rules totally ignored the fact that corruption in procurement has two sides. The causes of corruption, and other forms of crime that call for disqualification of some suppliers, are not to be found in the private sector alone. Corruption will not take place if governments and their public procurement agents are all honest, since under such conditions a bribe will be declined and there will be no need for debarment of suppliers as a means of securing integrity. When procurement agents are dishonest, on the other hand, the exclusion of some suppliers will not be sufficient to deal with the problem, especially when politically connected local firms are involved.[43] If government officials can take bribes with few or no consequences if the case is detected, debarment will not make procurement any better. Unless the tool is combined with anti-corruption strategies on the side of those who procure the goods and services, the debarment rules can easily come to define corruption as a problem that resides outside the procurement agencies' sphere of control.

The problem is that in countries where corruption runs high, elite actors are often involved, and they will discourage the enforcement of a two-sided anticorruption legislation. While most countries - rich and poor - have integrity mechanisms in place to promote good governance, the performance of these mechanisms varies substantially. For development partners that offer aid and cheap loans, debarment in public procurement is seen as one of the few pragmatic solutions that still exist when other integrity mechanisms

[42] Hjelmeng and Søreide (2014), Majtan (2013).

[43] The most serious corruption problem, involving capture of political decision-makers, calls for legal harmonization and an expansion of the market that is regulated by the same rules (Auriol 2006). Foreign bribery legislation and global debarment are attempts of moving in such a direction. The tool is targeted at the suppliers and will not reach government representatives. Internationally, there is very asymmetric enforcement of these rules and this fact distorts competition (See Bjorvatn and Søreide 2013 for analysis and Søreide 2016 Ch 3 for a review of enforcement practices).

fail, and in order to enhance its impact, they operate with cross-debarment, as discussed above. There are circumstances where this initiative will make a difference. Large international contractors seeking to secure on a regular basis projects financed by the World Bank might become more reluctant to bribe public officials if the threat of cross-debarment is perceived as real.[44] The effect of debarment might be substantial also for small suppliers who operate on World Bank financed projects in one market only, especially those that have specialized on such markets and have no alternative customers. By contrast, debarment threats from international organizations will carry little weight for local contractors applying on a one-shot basis. Also the anticompetitive effect of debarring these contractors is limited as they do not intend to compete elsewhere.

In developed countries, normally associated with more reliable integrity mechanisms, collusion and other forms of profit-motivated crime requires a more holistic law enforcement approach than what we observe today. For the sake of securing specialized competence, many countries have separated different law enforcement functions in different government institutions, such as a competition authority, financial oversight, tax system, criminal justice system, and more. Even if each institution properly administers its own mandate and tools, the various regulations introduced for the sake of securing integrity in markets can function contradictory. For example, if a bribery case is settled under criminal law, it may render debarment rules irrelevant because the settlement requires the firm has accepted the facts and promised to improve, and thus it is "self-cleaned". If "self-cleaned" as part of a criminal law reaction, there is legitimate basis for keeping it out of the market, hence the debarment tool is pacified. As another example, a bribe paid for the sake of facilitating a cartel may well be ignored by competition authorities even if these are the only authorities in position to detect the offence. Not only is corruption beyond their mandate; an investigation may undermine their leniency tool as (in most countries) the competition authority can offer leniency "only" for violation of competition law, and not for criminal law offences. As a further example of conflicting law enforcement initiatives, a criminal court may decide to reduce what might have been a deterrent punishment for corruption if the firm is likely to be debarred as the result of such a verdict.[45] These examples illustrate the need for a law enforcement approach that spans across the borders between administrative and criminal law so that markets can be protected with policy tools that combined serve to prevent crime, instead of undermining each other's impact on the problem.

For the sake of securing the intended effects of debarment in public procurement, governments should consider whether procurement agents are the ones who should hold the authority to debar and re-include corrupt suppliers. These officials organize auctions, control whether pre-qualification criteria for a tender

[44]This requires the involvement of civil society (such as Transparency International) to increase firms' exposure (see Auriol, Flochel, and Straub 2016). Indeed in countries where the elite benefits from corrupt deals the probability of corruption being uncovered and prosecuted is very low and this problem neutralizes the potential benefit of debarment.

[45]For details, see Auriol, Hjelmeng and Søreide (2017).

are met, and with debarment rules, they also decide whether a supplier is to be considered trustworthy. These different roles leave them with substantial authority and opportunity to manipulate bids, while they are also the main targets for suppliers that seek to secure contracts through bribery. By separating some of these functions, the procurement system not only becomes less vulnerable to the very problems that have motivated debarment rules in the first place. It is also a necessary step in the process of securing a more holistic policy approach against profit-motivated crime like corruption and collusion. Therefore, we recommend that the authority to exclude and re-include bidders is placed with a different law enforcement institutions than procurement agencies, most logically competition authorities, when they exist and function well. Competition authorities are already tasked with the role of protecting competition in markets and securing deterrent effects – while also considering how law enforcement reactions can distort competition.

# 6 References

# References


[1] ADB/OECD 2006. Curbing Corruption in Public Procurement in Asia and the Pacific: Progress and Challenges in 25 Countries. Asian Development Bank and OECD.

[2] Ades, A., and R. Di Tella. 1999. Rents, Competition and Corruption. *The American Economic Review* 89 (4): 982–93.

[3] Arnáiz, T. M. 2009. EU Directives as Anticorruption Measures: Excluding Corruption-Convicted Tenderers from Public Procurement Contracts. *International Handbook of Public Procurement,* 106.

[4] Athey, S. and K. Bagwell. 2001. Optimal collusion with private information. *Rand Journal of Economics.* 32 (3): 428-65.

Auriol, E. and J.J. Laffont. 1992. Regulation by duopoly. *Journal of Economics and Management Strategy,* 1(3), 507-533.

[5] Auriol, E. 2006. Corruption in procurement and public purchase. *International Journal of Industrial Organization 2*4 (5): 867-885.

[6] Auriol, E., S. Straub and T. Flochel. 2016. Public Procurement and Rent-Seeking in Paraguay, *World Development* 77: 395-407.

[7] Auriol, E., E. Hjelmeng, and T. Søreide. 2017. Deterring Corruption and Cartels: In Search of a Coherent Approach. Concurrences (forthcoming January 2017).

[8] Auriol, E., and J. Lassebie 2015. Capture for the rich, extortion for the poor. mimeo Toulouse School of Economics.

[9] Bjorvatn, K. and T. Søreide. 2013. Corruption and competition for resources. *International Tax and Public Finance*. 21: 997-1011.

[10] Chong, E., Klien, M., & Saussier, S. (2013). The quality of governance and the use of negotiated procurement procedures: Some (un)surprising evidence from the European Union. MIMEO.

[11] De Silva, D. G., T. Dunne and G. Kosmopoulou. 2003. An empirical analysis of entrant and incumbent bidding in road construction auctions. *The Journal of Industrial Economics,* 51(3), 295-316.

[12] Della Porta, D. and Vannucci. 1999. *Corrupt Exchanges: Actors, Resources, and Mechanisms of Political Corruption.* Aldine de Gruyter.

[13] Della Porta, D., & Rose-Ackerman, S. (Eds.) (2002). Corrupt exchanges: Empirical themes in the politics and political economy of corruption. Nomos Verlagsgesellschaft.

[14] Estache, A. and L. Wren-Lewis. 2009. Toward a theory of regulation for developing countries: Following jean-jacques laffont's lead. *Journal of Economic Literature*, 47(3).

[15] Estache, A. and A. Iimi. 2012. Quality or Price? Evidenced from ODA-Financed Public Procurement. *Public Finance Review*. 40(4):435-69.

[16] European Commission. 2001. Public procurement in Europe, Cost and effectiveness, A study on procurement regulation, Prepared for the European Commission, March 2011, $http : //ec.europa.eu/internal_market/publicprocurement/docs/modernising_rules/cost - effectiveness_en.pdf$

[17] Fariello F. A. and C.C Daly. 2013. Coordinating the Fight against Corruption among MDBS: The Past, Present, and Future of Sanctions. *George Washington International Law Review*, 45, 253.

[18] Goldman, E., Rocholl, J., and So, J. (2013). Politically connected boards of directors and the allocation of procurement contracts. Review of Finance, 17(5), 1617–1648.

[19] Gordon, S.D. and R. O. Duvall. 2013. United states: It's time to rethink the suspension and debarment process. Holland & Knight 3 July 2013.

[20] Gupta, S. 2002. Competition and collusion in a government procurement auction market. *Atlantic Economic Journal*, 30(1), 13-25.

[21] Guasch, J. L. 2004. *Granting and Renegotiating Infrastructure Concessions: Doing it Right.* Washington DC.: World Bank Publications.

[22] Hjelmeng, E., and T. Søreide. 2014. Debarment in Public Procurement: Rationales and Realization. In *Integrity and Efficiency in Sustainable Public Contracts,* In G. M. Racca and C. R. Yukins (Eds). Brussels: Bruylant.

[23] Hjelmeng, E. and T. Søreide. 2016. Bribes, crimes and law enforcement. *European Business Law Review*, forthcoming.

[24] Iimi, A. 2006. Auction Reforms for Effective Official Development Assistance, *Review of Industrial Organization* 28: 109–128.

[25] Iimi, A. 2011. Public Procurement: Learning from the Experience of Developing Countries. In Estache (Ed.): *Emerging Issues in Competition, Collusion, and Regulation of Network Industries.* London: Center for Economic Policy Research.

[26] Klemperer, P. 2004. Auctions: Theory and Practice, *Princeton University Press*

[27] Laffont, J. J. and J. Tirole. 1993. *A theory of incentives in procurement and regulation.* MIT press.

[28] Lambert-Mogliansky, A. 2011. Corruption and collusion: strategic complements in procurement. In S. Rose-Ackerman and T. Søreide (eds.) *International Handbook on the Economics of Corruption, Volume Two.* Edward Elgar Publishing.

[29] Levenstein, M. C. and V. Y. Suslow. 2006. What determines cartel success? *Journal of Economic Literature*, 44(1), 43-95.

[30] Leroy, A. M. and F. Fariello. 2012. The World Bank Group Sanctions Process and Its Recent Reforms. Washington, DC: World Bank.

[31] Majtan, R. 2013. The Self-Cleaning Dilemma: Reconciling Competing Objectives of Procurement Processes. *George Washington International Law Review.* 46(2): 291-347.

[32] Martyniszyn, M. 2012. Export cartels: Is it legal to target your neighbour? Analysis in light of recent case law. *Journal of International Economic Law*, 1-42.

[33] Marvao, C. 2016. The EU Leniency Programme and Recidivism. *Review of Industrial Organization*, Volume 48, Issue 1, pp 1–27.

[34] Myerson, R. B. 1981. Optimal auction design. *Mathematics of Operations Research*, 6(1), 58-73.

[35] OECD. 2014. OECD Foreign Bribery Report: An Analysis of the Crime of Bribery of Foreign Public Officials. Paris: The Organisation for Economic Co-operation and Development.

[36] OSD, 2014. Report on Functions Data and Lessons 2007-2013. The World Bank Office of Suspension and Debarment (OSD). Washington DC: World Bank.

[37] Piga, G. 2011. A fighting chance against corruption in public procurement. In S. Rose-Ackerman and T. Søreide (eds.) *International Handbook on the Economics of Corruption, Volume Two.* Edward Elgar Publishing: 141-184.

[38] Piselli, E. 2000. The scope for excluding providers who have committed criminal offences under the E.U. Procurement Directives, in *Public Procurement Law Review:* 267-286;

Pittman, R. 2011. Blame the Switchman? Russian Railways Restructuring After Ten Years. EAG Discussions Papers 201103, The United States Department of Justice, Antitrust Division.

[39] Rose-Ackerman, S. and B. J. Palifka. 2016. *Corruption and Government: Causes, Consequences and Reform.* Cambridge: Cambridge University Press.

[40] Seiler, N. and J. Madir. 2012. 'Fight Against Corruption: Sanctions Regimes of Multilateral Development Banks.' *Journal of International Economic Law* 15 (1):5-28.

[41] Bjorvatn, K. and T. Søreide. 2005. Corruption and privatization. *European Journal of Political Economy* 21 (4), 903-914

[42] Søreide, T., L. Gröning and R. Wandall. 2016. An Efficient Anticorruption Sanctions Regime? The Case of the World Bank. *Chicago Journal of International Law.* 16(2): 523-552.

[43] Søreide, T. 2008. Beaten by bribery: why not blow the whistle? *Journal of Institutional and Theoretical Economics:* 407-428.

[44] Tillipman, J. 2013. The Congressional War on Contractors. *The George Washington International Law Review,* 45 (2): 235-51.

[45] Treisman, D. 2007. What have we learned about the causes of corruption from ten years of cross-national empirical research?. *Annual Review Political Science,* 10, 211-244.

[46] UNODC. 2013. Guidebook on anti-corruption in public procurement and the management of public finances. Good practices in ensuring compliance with article 9 of the United Nations Convention against Corruption. Vienna: United Nations Office on Drugs and Crime.

[47] US Department of Justice. 2012. Audit of Statutory Suspension and Debarment Activities within the Department of Justice. Office of the Inspector General. Audit Division. Audit Report 12-25, June.

[48] Williams, S. 2007. The debarment of corrupt contractors from World Bank-financed contracts. *Public Contract Law Journal* 36 (3): 277–306.

[49] World Bank. 2014. The World Bank Group Integrity Vice Presidency Annual Update: Fiscal Year 2014. Washington, DC.: World Bank Group.

# 7 Appendix

## 7.1 Expected welfare and firms' profit with competitive bidding

When the public purchaser chooses an open procedure he implements a second price auction (see Myerson 1981). In this procedure each firm submits independently a price above which it accepts to serve the market. The contract goes to the firm with the lowest bid, but the price it gets in exchange for the production is the second-lowest bid. With this form of auction it is a dominant strategy for each producer to announce its true marginal cost. Let $f^N_{[2]}(\beta)$ denote the density function of the second lowest draw of $(\beta_1, ..., \beta_N)$: $\beta_{[1]} \leq \beta_{[2]} \leq ... \leq \beta_{[N]}$. The density function of the second lowest draw of $N$ independently and uniformly distributed variables is $f^N_{[2]}(\beta) = N(N-1)(1-F(\beta))^{N-2}F(\beta)f(\beta) = N(N-1)\beta(1-\beta)^{N-2}$. The expected cost of the purchase with a second price auction is $Q_t \int_0^1 \beta f^N_{[2]}(\beta)d\beta = Q \int_0^1 \beta^2 N(N-1)(1-\beta)^{N-2}d\beta$. Integrating the expected cost by part yields $Q_t \int_0^1 \beta f^N_{[2]}(\beta)d\beta = Q_t \int_0^1 2\beta N(1-\beta)^{N-1}d\beta$. Since $f^N_{min}(\beta) = N(1-\beta)^{N-1}$ is the density function of $\beta_{[1]} = min(\beta^1, ..., \beta^N)$ the minimum of $N$ independent variable of type $\beta^i$, we deduce that expected welfare when a competitive bidding procedure is implemented is: $W(N) = S(Q_t) - Q_t \int_0^1 2\beta f^N_{min}(\beta)d\beta = S(Q_t) - \frac{2Q_t}{N+1}$.

We now turn to the firms' expected rent. Given that each bidder announces his true cost value in the second price auction, it is clear that a firm with marginal cost value $\beta$ will win the auction with probability $\big(1-\beta\big)^{N-1}$, which is just the probability that all other bidders, which are in number $N-1$, will have cost values (and bids) above $\beta$. We deduce that the ex-ante probability to win the auction is $Pr(win) = \int_0^1 (1-\beta)^{N-1}d\beta = \frac{1}{N}$. In the second price auction the winner of the procurement contract, which is the lowest bidder, is paid for his production the second lowest bid. The expected gain of a bidder, conditional on winning the auction, is therefore proportional to the difference between the second lowest bid and the lowest bid: $\big(E\beta_{[2]} - E\beta_{[1]}\big)Q_t$. The ex-ante expected profit of a firm in the auction is the product of the probability that it wins the auction, $Pr(win) = \frac{1}{N}$, multiplied by $\big(E\beta_{[2]} - E\beta_{[1]}\big)Q_t$, the expected gain conditional on wining it : $\pi(N) = Pr(win)\big(E\beta_{[2]} - E\beta_{[1]}\big)Q_t$. We know from Klemperer (2004) that the expected $k$th lowest value among $N$ values independently drawn from the uniform distribution on $[0,1]$ is $E\beta_{[k]} = \frac{k}{N+1}$. We deduce that $\pi(N) = \frac{1}{N}\big(\frac{2}{N+1} - \frac{1}{N+1}\big)Q_t$, which is equivalent to (2). QED

## 7.2 Delegate information acquisition process and capture risk

Figure 1 represents the possibilities of capture in function of $k(N)$. "Limited tender" and "open tender" are corruption free zones. When $\overline{Q}k(N) \leq \underline{K}$ the optimal acquisition policy is always limited tendering (i.e., the market is too small to organize an auction), and when $\underline{Q}k(N) \geq \overline{K}$ it is open tendering (i.e., the market is too big to organize a direct purchase). In both cases there is no risk of corruption (as defined in this analysis) because the purchasing procedure is fixed by law, and the delegate has no authority to favor any of the suppliers. "Capture free" is a zone where the only corruption that could occur is extortion.[46] We rule out this possibility here to focus on the more relevant case of capture. In what follow we focus on the "capture risk" zone: $\frac{\underline{K}}{\overline{Q}} \leq k(N) \leq \frac{EK}{EQ}$.

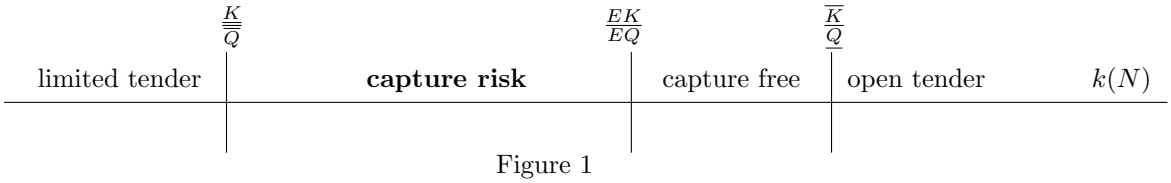


Figure 1

The job of the delegate is to collect information on the appropriateness of implementing an open tender. Following Laffont and Tirole (1993) we assume that the information acquisition process is exogenous. The delegate holds information, denoted $\sigma$, on the subset, $C = [\frac{\underline{K}}{\overline{Q}}, k(N)]$ or $M = (k(N), \frac{EK}{EQ}]$, in which $K_t/Q_t$ is drawn from. With positive probability $\xi > 0$ the delegate information is pertinent: $\sigma = S$, where $S = M$ if $\frac{K_t}{Q_t} \in M$ and $S = C$ if $\frac{K_t}{Q_t} \in C$. And with complementary positive probability $1 - \xi > 0$ it is uninformative: $\sigma = \emptyset$, so that $\sigma \in \{S, \emptyset\}$ with $\xi = Prob(\sigma = S) \in (0, 1)$. The information received by the delegate is hard evidence. When she is informed that implementing competitive bidding is optimal (i.e., when $\sigma = C$) she can prove it in court. However she can always hide her information and pretend that $\hat{\sigma} = \emptyset$. This claim is impossible (or extremely costly) to verify. We assume that the probability that $K_t/Q_t$ belongs to $C$ is $\mu > 0$ and the probability that it belongs to $M$ is $1 - \mu > 0$. We deduce that the probability that $\sigma = C$ is $Prob(\sigma = C) = \xi\mu = \nu$.

This model of information acquisition can be enriched in several directions. On the one hand, the probability of the delegate finding out the true state of the world could depend on the effort produced by the latter. The incentives to produce effort would then depend on the expected bribe, which increases with $N$ the number of potential bidders in the case the acquisition procedure is the fair competitive one. On the other hand, the exogenous probability $\mu$ that $K_t/Q_t$ falls into $C = [\frac{\underline{K}}{\overline{Q}}, k(N)]$ could also varies with $N$ as $k(N) \in [\frac{1}{3}, 1)$ when $N \in [2, +\infty)$. For instance if we assume that $K_t/Q_t$ is uniformly distributed

[46] When $\frac{EK}{EQ} \leq k(N) \leq \frac{\overline{K}}{\underline{Q}}$ in the absence of information the optimal acquisition strategy is open tendering. If the delegate has the proof that the optimal policy entails limited tendering she could extort a firm to pay a bribe by threatening to claim $\hat{\sigma} = \emptyset$. Extortion occurs when the optimal acquisition strategy is the fixed-price purchase and the delegate threatens to implement competitive bidding instead. For analyses of extortion see Rose-Ackerman (1978), Auriol (1996) and Auriol and Lassebie (2015).

in $[\frac{K}{\overline{Q}}, \frac{EK}{EQ}]$ then $\mu = \frac{k(N)-\frac{K}{\overline{Q}}}{\frac{EK}{EQ}-\frac{K}{\overline{Q}}}$. These two types of change would both make $\nu$, the probability of finding out that the relevant purchasing procedure is $C$, increases with $N$. The model would be technically more difficult to solve (in particular there would be no closed form solutions), but the qualitative results would be the same. The main difference would be that corruption would stop sooner, as $\nu$ would be smaller as $N$ would decrease. This would only reinforced our results.

## 7.3 The forever-honest strategy is subgame perfect

We need to show that under (12) the firm - starting from a baseline of honest behavior - does not want to deviate for $T \geq 1$ periods and take the corrupt deal, before returning to the honest behavior. If such a deviation was profitable then the forever-honest strategy would not be subgame perfect. The payoff of a deviation of $T \geq 1$ periods at any time $\tau \geq 0$ from the honest strategy to the corrupt strategy is

$$\begin{aligned}
&\sum_{t=0}^{T} \left\{ \tfrac{(1-b)\nu E_c Q}{2} + \tfrac{E_{\sigma \neq C} Q}{2N} \right\} \big(1-\nu(1-p)\big)^t \delta^t + \big(1-\nu(1-p)\big)^{T+1} \delta^{T+1} \sum_{t=0}^{+\infty} \left\{ \tfrac{\nu E_c Q}{N(N+1)} + \tfrac{E_{\sigma \neq C} Q}{2N} \right\} \delta^t \\
= \quad & \left\{ \tfrac{(1-b)\nu E_c Q}{2} + \tfrac{E_{\sigma \neq C} Q}{2N} \right\} \tfrac{1-((1-\nu(1-p))\delta)^{T+1}}{1-(1-\nu(1-p))\delta} + \tfrac{(1-\nu(1-p))^{T+1}\delta^{T+1}}{1-\delta} \left\{ \tfrac{\nu E_c Q}{N(N+1)} + \tfrac{E_{\sigma \neq C} Q}{2N} \right\}.
\end{aligned}$$

A firm will never find it profitable to deviate from honest behavior and be corrupt for any $T \geq 1$ periods if

$$\begin{aligned}
&\left\{ \tfrac{(1-b)\nu E_c Q}{2} + \tfrac{E_{\sigma \neq C} Q}{2N} \right\} \tfrac{1-((1-\nu(1-p))\delta)^{T+1}}{1-(1-\nu(1-p))\delta} + \tfrac{(1-\nu(1-p))^{T+1}\delta^{T+1}}{1-\delta} \left\{ \tfrac{\nu E_c Q}{N(N+1)} + \tfrac{E_{\sigma \neq C} Q}{2N} \right\} \\
\leq \quad & \tfrac{1}{1-\delta} \left\{ \tfrac{\nu E_c Q}{N(N+1)} + \tfrac{E_{\sigma \neq C} Q}{2N} \right\}
\end{aligned} \tag{20}$$

One can easily check that condition (20) is equivalent to condition (12).QED

## 7.4 Proof of Proposition 2

Firms might be willing to enter into a corrupt deal if the bribe demanded by the public official is low enough (i.e., if $b < \overline{b}$). Debarment will deter corruption if there is no positive bribe rate $b$ that can be lower than $\overline{b}$ defined in condition (13). That is, if $\overline{b} \leq 0$. The critical value of $\delta$ so that $\overline{b} = 0$ is (14). We deduce the result. QED

## 7.5 Proof of Proposition 4

We first compute the expected payoff of a firm $i = 1, ..., N$ when it participates in an infinite sequence of competitive auctions.

$$\Pi(N) = \frac{EQ}{N(N+1)} \sum_{t=0}^{+\infty} \delta^t = \frac{EQ}{N(N+1)(1-\delta)} \tag{21}$$

Second, we compute firm's expected profit when it colludes with other firms to bid the monopoly price. If the winning firm cannot or is not willing to compensate the other losing firms for not bidding (perhaps because of concern about detection), the best collusive mechanism involves rotating the winning bid among the cartel members so that the winner changes in each round (see Athey and Bagwell 2001).

To ease on notation we also denote by $d = 1-p \geq 0$ the probability that the winning firm is discovered as a cartel member (i.e., $1-p \geq 0$ is a generic notation for a firm being found guilty of a crime) and debarred permanently from this market. From the firm's point of view it does not matter whether all the cartel members are debarred or not. The only relevant payoff for the firm is its own. The expected profit of a firm $i = 1, ..., N$ in the cartel is:

$$\Pi^{cart}(N) = \frac{EQ}{2N} \sum_{t=0}^{+\infty} \Big(\delta p\Big)^t + 0 \sum_{t=0}^{+\infty} \Big(\delta(1-p)\Big)^t = \frac{EQ}{2N(1-\delta p)} \tag{22}$$

Comparing (21) and (22), being a member of the collusive cartel is profitable for firm $i = 1, ..., N$ if and only if $\Pi^{cart}(N) > \Pi(N)$, which is equivalent to:

$$N > \frac{2(1-p\delta)}{1-\delta} - 1. \tag{23}$$

Moreover the cartel is stable if deviating at any period $t \geq 0$ from the collusive equilibrium is not profitable. We assume that the cartel uses a grim trigger strategy. This strategy works as follows. Firm $i = 1, ..., N$ starts by choosing the action that maximizes cartel profits. Firm $i = 1, ..., N$ keeps on choosing this action as long as all firms have done so in all previous periods. This corresponds to a cooperation phase. If one firm deviates, deviation "triggers" the start of the punishment phase. Firms choose the action that corresponds to the competitive equilibrium of the static game forever. The firms do not discover their cost unless they prepare a real bid. In a collusive equilibrium, the firms that are not chosen to win do not pay the cost of discovering their true cost for this market. They do not submit a bid.

In this context a "losing" firm under the veil of ignorance - in the sense that it does not know the exact value of its marginal cost - will be tempted to deviate from the collusive equilibrium at date $t \geq 0$ for an expected profit $\frac{EQ}{2}$ at period $t$ and $\frac{EQ}{N(N+1)}$ forever after that. We deduce that at date $t \geq 0$ deviation is ex-ante unprofitable if:

$$\frac{EQ}{2} + \frac{EQ}{N(N+1)} \sum_{\tau=1}^{+\infty} \delta^\tau = \frac{EQ}{2} + \frac{EQ}{N(N+1)} \sum_{\tau=0}^{+\infty} \delta^\tau - \frac{EQ}{N(N+1)} < \frac{EQ}{2N(1-\delta p)}.$$

This yields:

$$\frac{EQ}{2} + \frac{EQ}{N(N+1)(1-\delta)} - \frac{EQ}{N(N+1)} < \frac{EQ}{2N(1-\delta p)}.$$

Reducing it to the same denominator this equation becomes

$$\frac{EQ}{2} + \frac{\delta EQ}{N(N+1)(1-\delta)} < \frac{EQ}{2N(1-\delta p)}. \tag{24}$$

Equation (24) is equivalent to:

$$p > \frac{1}{\delta} \frac{2\delta + (N-1)(N+1)(1-\delta)}{2\delta + N(N+1)(1-\delta)}. \tag{25}$$

Depending on the value of $\delta$, the right hand side ($RHS$) is not always lower than 1, in which case there is no way for the cartel to sustain collusion. In particular, if the firms are very impatient collusion is unstable and the firms will compete for the market. A necessary condition for collusion to be a threat is thus that in (25) the $RHS < 1$, which is equivalent to

$$\delta > \frac{(N-1)(N+1)}{N(N+1)-2}. \tag{26}$$

In other words, firms must be patient for a collusive equilibrium to emerge. Condition (26) is a necessary condition for collusion to be stable, but it is not sufficient. In addition, condition (25) must hold.

To illustrate how these conditions come to effect, let us assume that $N = 5$. We deduce that condition (25) is equivalent to $p > \frac{1}{\delta} \frac{\delta+12(1-\delta)}{\delta+15(1-\delta)}$ and condition (26) is equivalent to $\delta > \frac{6}{7} \simeq 0.857$. Let assume that $\delta = 0.9$. It implies that $p > \frac{35}{36} \simeq 0.972$. In other words if $N = 5$ the firms have to be patient and the probability of detection low (i.e., lower than 2.7 percent) for collusion to emerge and be stable. QED