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CORRUPTION IN JAPANESE DEFENSE PROCUREMENT
A GAME-THEORETIC ANALYSIS

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Abstract
The Japanese defense market is an oligopoly. Firms in the defense industry also produce civilian goods, and the revenues they obtain from defense contracts are quite small relative to the revenues coming from the production of private goods. Because the Japanese constitution prohibits arms export, the defense industry in Japan essentially serves an internal market. Furthermore, defense contracts are not awarded on a competitive basis. The procurement procedures rely on cost-plus contracts, most of which are carried out at the discretion of the bureaucrats in charge. Information on prices and contracts thus become extremely opaque, which makes it easier for misuse and corruption to flourish. The paper presents a game that incorporates these features of the defense procurement process. The results of the analysis suggest that the government pay for low-quality defense goods at inflated prices. Furthermore, because Japanese firms are shielded from competition and because of the lack of a large foreign market, the Japanese defense industry has no incentive to engage in R&D to improve the quality of its defense goods.

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The Japanese defense market is an oligopoly. Firms in the defense industry also produce civilian goods, and the revenues they obtain from defense contracts are quite small relative to the revenues coming from the production of private goods. Because the Japanese constitution prohibits arms export, the defense industry in Japan essentially serves an internal market. Furthermore, defense contracts are not awarded on a competitive basis. The procurement procedures rely on cost-plus contracts, most of which are carried out at the discretion of the bureaucrats in charge. Information on prices and contracts thus become extremely opaque, which makes it easier for misuse and corruption to flourish. The paper presents a game that incorporates these features of the defense procurement process. The results of the analysis suggest that the government pay for low-quality defenses goods at inflated prices. Furthermore, because Japanese firms are shielded from competition and because of the lack of a large foreign market, the Japanese defense industry has no incentive to engage in R&D to improve the quality of its defense goods.

KEYWORDS: Defense procurement, corruption
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1. INTRODUCTION

CORRUPTION HAS MANY FORMS. It ranges from the petty bureaucratic variety that is connected with issuing licenses or franchising rights to corruption in the police, the judiciary, and the legislature, and grand corruption that occurs at the highest office. But no form of corruption is more pervasive than that related to government procurement. Government procurement of goods and services typically accounts for 10-15% of GDP for developed countries, and up to as much as 20% of GDP for developing countries. The amounts involved in individual procurement contracts are often huge, and this offers great opportunities for bribes, kickbacks, and other forms of payoffs. In this paper, we present an analysis of corruption in defense procurement, or more precisely the corruption

The most basic rule governing the relationship between the government and the defense industry is Article 9 of the Japanese constitution, in which Japan renounces wars and recourse to armed force to resolve conflicts. Based on this national philosophy is a prohibition-in-principle, which is known as Three Principles on the Prohibition of Arms Export, a doctrine promulgated by former Prime Minister Sato in 1967. In 1976, the Miki Cabinet updated the weapon embargo list of countries to include practically all countries except the US. Also, because the defense of the Japan is guaranteed by the bilateral security alliance with the US, Japan is not under pressure to develop a weapon

1 Readers interested in the research of corruption can consult Rose-Ackerman (1999) who presents a good reference of this subject.
2 Article 9 says “Aspiring sincerely to an international peace based on justice and order, the Japanese people forever renounce war as a sovereign right of the nations and the threat or use of force as means of setting international disputes.”
technology for its own national security. As a consequence of these guidelines and the rigidity of the security relationship with the US, the Japanese defense industry has lost the opportunity to compete in an outside market, and it exists essentially to serve an internal market. Because of these reasons, the Japanese government has a strong incentive to protect the relatively weak defense industry. The protection given by the government shields Japanese defense companies from foreign competition and creates no incentive for these firms to develop low-cost and high-quality products.

According to the government procurement system in Japan, each ministry can procure from both private and public corporations\(^3\) under the Account Law (Law No. 35 of 1947),\(^4\) Cabinet Order related to the budget, Settlement of Account and Accounting (Imperial Ordinance No. 165 of 1947), the Local Autonomy Law (Law No.67 of 1947) and also international rule on procurement procedures (effective January 1, 1996 concluded by WTO)\(^5\). According to these laws and international agreements, the Japanese procurement system is implemented on the principle of non-discrimination, open, and transparent tendering procedures. In particular, in the Japanese defense industry there are some exceptional features and customs in the procurement systems. To obtain a better idea of the Japanese defense procurement system, let us first present some salient facts about the Japanese defense industry.

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3. Public corporations are the public entities whose objective is to implement government laws and policies. In that sense, they have part of the characteristics of both government and private corporations. In our paper, we do not study the behavior of public corporations although their role in government procurement is quite significant. The reader who is interested in the detailed operation of public corporation, can consult Colignon and Usui (2003, Chapter 4).

4. The Account Law specifies that competition will be conducted under open-bid procedures. It also permits the selective or limited tendering procedures in some cases.

5. See the detailed report of ADB/OECD Anti-Corruption Initiative for Asia and the Pacific (2004).
In the defense market, the 20 leading companies always acquires the approximately 95% of the budget of Japan Defense Agency. Since the mid of 1980s, domestic defense industry occupies 90% of the total production and the rest from foreign procurement, especially from the United States. As a result, the Japanese defense industry forms an oligopoly market. These firms also produce civilian goods, and the revenues they obtain from defense contracts are quite small relative to the revenues coming from the production of private industrial goods. Furthermore, defense contracts are not awarded on a competitive basis. In many cases, these companies cooperatively work together and share the pies routinely according to government policy implementation and administrative guidelines. The procurement procedures rely on cost-plus contracts, most of which are carried out at the discretion of the bureaucrats in charge. Information on prices and contracts thus become extremely opaque, which makes it easier for misuse and corruption to flourish. In practice, it is enough opportunities to change the result of the tenders and to limit the number of the bidders in the defense procurement. Sometimes companies in the defense industries might be bid-rigging in order to share their pies (in Japanese Dango). According to the Central Procurement Office (CPO) at Japan’s Self-Defense Agency, in 1999, the monetary share of discretionary contracts was 85% of all contracts; the share of contracts by tender was 11%; and the share of general competitive contracts was only 4%. These statistics suggested an extraordinary degree of discretion given to bureaucrats in awarding procurement contracts. Thus it was not surprising to

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6 The details on the twelve leading Japanese defense companies can be found at http://www.bis.doc.gov/DefenseIndustrialBasePrograms/OSIES/ExportMarketGuides/PacRimMktGuideIndex.html.
7 Dango is defined as “an institutionalized system of bid-rigging.” (Woodall (1996)). In Japan, there are many scandals in the case of Dango in the construction industry. Mamiya (1995) and Woodall (1996) contain good examples of Dango cases in the construction industry.
learn that scandals and corruption have plagued the defense industry for many years. As an example of corruption, we might mention two cases: One case occurred in 1998. The defense agency's procurement division allowed Toyo Communications Equipment, a subsidiary of NEC, one of the largest electronics company in Japan, to slash from $19.2 million to $6.6 million the amount it was to pay back to the agency after an investigation revealed Toyo had overcharged it for supplies. In exchange, Toyo allegedly agreed to hire these officials as ‘advisors’ after they retired (Amakudari). Second case happened in 2007. Former vice minister of the Defense Ministry was arrested on the suspicion of taking bribes from the equipment trading company, Yamada Corp. In order to beat Yamada Corp’s rival, it offered 3.9 million yen including several entertainments such as golf tour etc. Summing up these two cases, we may observe that Defense companies thus have a strong incentive to pay bureaucrats for favorable treatment on policy and administrative guidelines. For a government official, there is also a strong incentive to secure a post-retirement job. As a consequence of the confluence of self-interests, both defense agency and private companies tend to form the informal and vague network related to the procurement process that exists between them.

This paper presents a game that incorporates these features of the defense procurement process. The results of the analysis suggest that the government pay for low-quality defenses goods at inflated prices. Furthermore, because Japanese firms are shielded from

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10 Translated into English, Amakudari means “descend from heaven,” which is used to describe the reemployment of elite government officials in the private or quasi-private sector after the termination of their public service. For these government officials, this is the time they begin their second life as an executive in these sectors. See Colignon and Usui (2003).
competition and because of the lack of a large foreign market, the Japanese defense industry has no incentive to engage in R&D to improve the quality of its defense goods.

Until recently, the research on the relationship between corruption and government procurement is rather scarce. An exception is the pioneering work of Rose-Ackerman (1975), who first shed light on the relationship between the market structure and the contracting process of bribery between private firms and public officials. In the paper, the author concentrates on the situation in which a private firm or individual attempts to bribe a government bureaucrat in order to acquire a government contract. Rose-Ackerman describes the situations in which bribery tends to occur, and considers the methods in which incentives for corrupt behavior may be controlled under the proper assumptions. Her results show that the existence of corruption affects the structure of government programs. Burguet and Che (2004) model the competitive bidding process in procurement under the charge of a third party, a bureaucrat, who has the discretion power to manipulate the result of the tendering in exchange for bribes. If the third agent is corrupt and has considerable discretion power, the bribery that he exacts is a heavy burden on the efficient firm. As a result, the existence of bribe competition undermines the efficient allocation of bidding result. Compte et al. (2005) analyze the effect of corruption on the competitive bidding process in procurement. Their model allows for the opportunity of readjustment of bidding by a firm in exchange for a bribe. These researchers demonstrate that the existence of bribery facilitates the collusion in price bidding between firms and results in the bidding price being too high. Our paper represents an attempt along the lines of Burguet and Che, op cit., and Compte et al., op
cit., to analyze the corruption that exists in the procurement process in the Japanese defense industry.

The main contributions of the paper are as follows. First, as stated in Proposition 1, when the bureaucrat in charge of the procurement contract is corrupted, he can increase his income by using the discretion allowed by the public office to extract bribes from the bidding of the government procurement contract of which he is responsible. Under the uncertainty of the cost structures of the firms, the corrupted bureaucrat can manipulate the assessment of bidding in exchange for a bribe. We show that under the perfect Bayesian Nash equilibrium the collusion between the corrupted bureaucrat and the bidding firms ensures that all the bids propose a low-quality project at the maximum price that the government is willing to pay for the project. Second, we show that when trade liberalization of arms exports takes place, the lure of foreign profits and the imperative to be competitive in international markets induce the firms to propose that the procurement be realized at high quality. In contrast with the case when the firms can only serve the internal market, export liberalization leads to an ex post efficient outcome. However, the collusion between the corrupted bureaucrat and the bidding firms still ensures that the government pays the reservation price for the project, and the corrupted bureaucrat still obtains the lion’s share of the surplus. It is also worth pointing out that the scenario of exports liberalization is much more pleasant for the bidding firms because now their net payoffs are positive instead of being zero as suggested by the perfect Bayesian equilibrium in the case the firms can only serve the internal market.
This paper is organized as follows. The model of government procurement with corruption is presented in Section 2. In the model of Section 2, the firms serve only the internal market. In Section 3, the model of Section 2 is extended to allow for arms exports. That is, the weapon system developed under the procurement contract can be sold in foreign countries. Section 4 contains some concluding remarks and possible future research avenues.12

2. A MODEL OF GOVERNMENT PROCUREMENT WITH CORRUPTION

2.1. The Extensive Form of the Game

Here, we establish the model of government procurement with corruption. We shall assume that the corrupted bureaucrat – as a civil servant – is paid a regular salary by the state, his employer. Furthermore, he can increase his income by using the discretion permitted by the public office to extract bribes from the firms that bid for the procurement contract of which he is in charge. In abusing his power, the corrupted bureaucrat – through his expertise in evaluating bids – can inflate the quality of a bid, by declaring that the project to be realized by a bid is of high quality when in reality it is of low quality. However, the bureaucrat cannot declare that the quality of a proposed project is low when it is of high quality. There is thus asymmetry in the ability of the bureaucrat to “interpret” the quality of the project proposed in a bid: discretion can be biased upward, not downward. Another action that the model allows the corrupted bureaucrat to take is to inform the firm it favors about the bid of the other firm and allows the former to revise its

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12 We omitted the analysis of the model of government procurement without corruption. We also derive the mechanism of procurement auction without corruption in order to compare the case with corruption. For interest readers, see the first chapter of Mizoguchi (2008).
bid. Because crime and punishment are not our focus in this paper, we shall assume the bureaucrat can abuse his power with impunity. Also, because the objective of the corrupted bureaucrat is to maximize his income, he will favor the firm that offers the higher bribe. The discretion thus allows the corrupted bureaucrat to extract bribes from the bidding firms. Under the scenario we envision, a bid of a firm, say firm $i$, is a list $(p_i, q_i, b_i)$, where $p_i$ is the price it charges for realizing the project; $q_i$ is the quality of the realized project the bid proposes; and $b_i$ is the bribe (monetary payoff) the firm offers the corrupted bureaucrat if its bid is chosen. For the purpose of simplification, we only consider two firms – called firm 1 and firm 2 – compete for a procurement contract at a price not exceeding $p_{\max}$. Here $p_{\max}$ represents the government’s reservation price, i.e., the highest price that the government is willing to pay for the project. A bid for the procurement contract is evaluated in terms of the price and the quality it proposes. For simplicity, assume that the quality proposed in a bid can be $q$ (low quality) or $\bar{q}$ (high quality), with $0 \leq q < \bar{q}$. The costs of realizing the project at low quality are assumed to be the same for both firms and will be normalized to be 0. Realizing the project at high quality requires more effort from each firm, and the cost of realizing the project at high quality for firm $i$ it will be denoted by $\theta_i$, $i = 1, 2$. We shall assume that $\theta_1$ and $\theta_2$ are independently drawn from the uniform distribution on the interval $[0,1]$, and that they are private information. In this section, it is assumed that the public official (the bureaucrat) in charge of evaluating the bids is honest. Under this assumption, the firms have no incentive to curry favor by offering bribes to the bureaucrat. A bid of a firm, say firm $i$, in this case is a list $(p_i, q_i)$, where $p_i$ is the price it charges for realizing the project and
$q_i$ is the quality of the realized project. The government’s valuation of the bid is assumed to be given by

(1) \[ \varphi(p_i, q_i) = q_i - p_i. \]

Also, $q_i$ refers to the quality of the contract that firm $i$ is required to provide under the allocation rule. Note that $q_i$ becomes superfluous if the contract is not awarded to firm $i$. Under these settings, next we consider the extensive game structure of our model.

The game of government procurement is a four-staged game, and its extensive form is as follows. In the first stage, the costs – for the two firms – of realizing the project at high quality are independently drawn from the uniform distribution on the unit interval, and the cost of each firm is its own private information. In the second stage, each firm $i, i = 1, 2,$ submits a bid $(p_i, q_i, b_i)$, based on $\theta_i$, the cost it must incur to realize the project at high quality. In the third stage, the corrupted bureaucrat evaluates the bids. Let $\hat{q}_i$ be the quality – declared by the corrupted bureaucrat – of the realized project proposed by firm $i$. The firm with the higher valuation $\hat{q}_i - p_i$ will obtain the contract. Note that a firm, say firm $j$, might not obtain the contract, even with the help of a bribe, if $q_i - p_i > \bar{q} - p_j$, i.e., the price it charges for the realization of the project is much higher than that of the other firm. Of course, the corrupted bureaucrat will use his discretion to manipulate the qualities associated the projects proposed by the two firms to favor the firm that offers the higher bribe, if this action is possible. We shall assume that a firm only pays the bribe it proposes in its bid if it is awarded the contract. In the fourth stage,
the firm that wins the contract pays the promised bribe and realizes the project at the quality level specified in its bid.

2.2. The Perfect Bayesian Equilibrium

The following lemma follows from the behavior – allowed by the model – of the corrupted bureaucrat. The lemma asserts that the behavior of the corrupted bureaucrat induces the bidding firms to submit bids that propose to realize the project at low quality.

LEMMA: It is not optimal for a firm to submit a bid that promises to realize the procurement project at high quality.

PROOF: See Appendix 1.

The following proposition presents a perfect Bayesian equilibrium for the procurement auction game when the bureaucrat in charge of the procurement contract is corrupted and the firms can only serve the internal market.

PROPOSITION 1: For each $i = 1,2$, let $(p_i^*, q_i^*, b_i^*) = (p_{i\text{max}}^*, q, p_{i\text{max}}^*)$ be the bid submitted by firm $i$. Then the combination of strategies $(p_i^*, q_i^*, b_i^*), i = 1,2$, constitutes a perfect Bayesian equilibrium for the game of corruption in government procurement.

PROOF: First, note that according to lemma, a firm never submits a bid under which the project will be realized at high quality. Next, suppose that firm $j$ submits the bid $(p_j^*, q_j^*, b_j^*) = (p_{j\text{max}}^*, q, p_{j\text{max}}^*)$. We claim that $(p_i^*, q_i^*, b_i^*) = (p_{i\text{max}}^*, q, p_{i\text{max}}^*)$ is a best response
for firm \( i \) against \((p_j^*, q_j^*, b_j^*)\). Indeed, if firm \( i \) submits the bid \((p_i^*, q_i^*, b_i^*)\), then it has a fifty-fifty chance of obtaining the contract. Furthermore, because under the bid the bribe is equal to the price of the realized project, firm \( i \) will make zero profit. Hence firm \( i \) will make zero profit under the bid \((p_i^*, q_i^*, b_i^*)\). Next, note that if the bid \((p_i^*, q_i^*, b_i^*)\) is not best against \((p_j^*, q_j^*, b_j^*)\), then there is another bid, say \((p_i, q, b_i)\), that gives firm \( i \) a positive profit, i.e., \( p_i - b_i > 0 \). Because \( p_i \leq p_{\text{max}} \), when the preceding inequality hold, we must have \( b_i < p_{\text{max}} \). However, when \( b_i < p_{\text{max}} \), the corrupted bureaucrat will favor firm \( j \) and award the procurement contract to this firm, and this results in zero profits for firm \( i \), contradicting the hypothesis that the bid \((p_i, q, b_i)\) gives firm \( i \) positive profits. ■

Proposition 1 is reminiscent of the famous result of the Bertrand model of competition in which the prices set by the two competing firm are driven down to their common average cost, resulting in zero profit for each firm. In the current context, competition to curry favor from the corrupted bureaucrat leads each firm to give away – as bribe – the entire price of the contract: the corrupted bureaucrat extracts the entire surplus from the cooperation of the bidding firms. Furthermore, the contract is always awarded at the reservation price and the quality of the realized project is always low. In the case of Japanese defense procurement, it is often claimed that insufficient funds allocated to defense spending (one per-cent of GDP) lead to weapons of low quality. What Proposition 1 demonstrates is that the quality is low regardless of the reservation price: the corruption in the procurement process ensures that all the bids propose a low-quality project at the maximum price that the government is willing to pay for the project. We state this result formally in the following corollary:
COROLLARY: An increase in the reservation price of the procurement project does not raise its quality.

3. LIBERALIZATION OF ARMS EXPORTS

In this section, we extend the model formulated in Section 2 by allowing the firm that wins the procurement contract to export the product it develops for the government under the contract. The winning firm now can serve both the internal and foreign markets. We shall not attempt to model the explicitly the export market, but simply assuming that the profits made on the export market are equal to $\bar{\varepsilon} > 0$ if the winning firm realizes the procurement project at high quality and are equal to 0 if the realized project is low quality. Presumably, a low-quality project will not be competitive on the international market and will not bring the firm that develops the product any significant profits. The magnitude of $\bar{\varepsilon}$ depends, of course, on demand conditions on the international market. For our purpose, we shall assume that $\bar{\varepsilon}$ is sufficiently high, say $\bar{\varepsilon} \geq 1$, for a firm to justify the decision of developing a high-quality product to serve the export market. Under this assumption, the bid of a firm always proposes to realize a project of high quality. Because both firms propose to develop a high-quality product, there is no need for the corrupted bureaucrat to inflate the quality proposed by either of these firms. The only action available to the corrupted bureaucrat is to inform the firm that offers the higher bribe the price of the bid submitted by the other firm, and allows the former firm to revise its bidding price.

A bid for firm $i, i = 1,2$, is now a list $(p_i, \bar{q}, b_i)$. We shall now look for a perfect Bayesian equilibrium of the form $(p_i, \bar{q}, b_i) = (p_{i,\text{max}}, \bar{q}, -\alpha_i, -\beta_i)$, where $\alpha_i$ and $\beta_i$ are positive parameters. To this end, suppose that firm 2 submits a bid of this form, say
What is the best response of firm 1 to such a bid of firm 2? To answer this question, suppose that firm 1’s cost of realizing the project at high quality is $\theta_1$. Next, let $b_1$ be the bribe that firm 1 is contemplating to put in its bid. If $\theta_2$ is firm 2’s cost of realizing the project at high quality, then the corrupted bureaucrat will favor firm 1 if $b_1 > b_2 = -\alpha_2 \theta_2 + \beta_2$, which implies that $\theta_2 > (\beta_2 - b_1) / \alpha_2$. Given that $\theta_2$ is uniformly distributed on the unit interval $[0,1]$, the probability of such an event is $1 - (\beta_2 - b_1) / \alpha_2$. Furthermore, the net payoff of firm 1 is equal to 

$$[1 - (\beta_2 - b_1) / \alpha_2] p_{\max} - \theta_1 + \bar{v} - b_1$$

if the bribe it offers is sufficient to obtain the favorite treatment by the corrupted bureaucrat. On the other hand if firm 1 does not obtain the procurement contract, then its payoff is 0. Thus the expected payoff of firm 1 if it offers the bribe $b_1$ is given by 

$$[1 - (\beta_2 - b_1) / \alpha_2] p_{\max} - \theta_1 + \bar{v} - b_1$$

and the optimal bribe for firm 1 is the solution of the following simple maximization problem:

\[
\max_{b_1} \frac{1}{\alpha_2} \left[ \alpha_2 - \beta_2 + b_1 \right] p_{\max} - \theta_1 + \bar{v} - b_1
\]

The solution of the maximization problem (2) is

\[b_1 = -\alpha_1 \theta_1 + \beta_1,\]

where we have let

\[\alpha_1 = \frac{1}{2}; \quad \beta_1 = \frac{1}{2} \left[ \beta_2 - \alpha_2 + p_{\max} + \bar{v} \right]\]

For a symmetric perfect Bayesian equilibrium, we have
(5) \[ \alpha_1 = \alpha_2 = \frac{1}{2}, \]

and

(6) \[ \beta_1 = \beta_2 = \frac{1}{2} \left[ \beta_2 - \alpha_2 + p_{\text{max}} + \bar{e} \right]. \]

Using (5) in (6), we obtain

(7) \[ \beta_1 = \beta_2 = -\frac{1}{2} + p_{\text{max}} + \bar{e}. \]

We have just established the following proposition:

PROPOSITION 2: For each \( i = 1,2, \) let

(8) \[ b_i(\theta_i) = -\frac{1}{2} \theta_i - \frac{1}{2} + p_{\text{max}} + \bar{e}. \]

Then the combination of strategies \((p_i, q_i, b_i(\theta_i)) = (p_{\text{max}}, \bar{q}, b_i(\theta_i)), i = 1,2,\) constitutes a perfect Bayesian equilibrium for the game of government procurement with export liberalization. Under this perfect Bayesian equilibrium, the bribe offered by firm \( i \) is given by (8), and its net payoff is given by

(9) \[ p_{\text{max}} - \theta_i + \bar{e} - b_i(\theta_i) = \frac{1}{2} (1 - \theta_i). \]

Without considering the morality of arms exports, Proposition 2 offers a much more positive result for all the players – the government, the corrupted bureaucrat, and the
bidding firms – in the procurement auction game. The lure of profits in foreign markets
and the imperative to be competitive in international markets have induced the bidding
firms to propose that the procurement project be realized at high quality, in contrast with
the low quality proposed by the bids when the firms can only serve the internal market.
Furthermore, as can be seen from (8), the bribe offered by the firm with a lower cost is
higher than that offered by the firm with a higher cost, allowing the former firm to win
the contract. The perfect Bayesian equilibrium described in Proposition 2 is thus ex post
efficient: the introduction of an export market has changed an inefficient outcome into an
efficient one. Also, as can be seen from (9), the profit of the firm that obtains the contract
is positive, but decreasing in $\theta_i$ for $0 \leq \theta_i < 1$, and this result stands in contrast with the
result – asserted by Proposition 2 – that the corrupted bureaucrat extracts the entire
surplus generated by the co-operation of the bidding firms when they can only serve the
internal market. Also, observe from (8) that the higher is the cost of the firm that obtains
the contract, the lower is the bribe received by the corrupted bureaucrat.
4. CONCLUSION

Under the special conditions that characterize the current Japanese political system, the Japanese defense industry is an oligopoly, and most of the defense contracts are awarded on a discretion base. In many cases, the defense companies routinely work together – in accordance with government implementation policy and administrative guidelines – to share the procurement pies. In this paper, we have constructed a game-theoretic model to study the Japanese defense market. The main result that emerges from our analysis is that it is the collusion between the corrupted bureaucrat, who is charged with evaluating the bids and award the contract, and the bidding firms and the constraint that these firms can only serve the internal market that is the source of low-quality and high-cost defense goods paid for by the Japanese government. This inefficient state of affair can be removed by liberalizing the exports of arms. The liberalization of arms exports present Japanese defense firms with opportunities for good profits, which are only possible if the quality of their products is sufficiently high to make their products competitive on international markets.

It is often claimed that the low level of defense spending in Japan is responsible for the low quality of the weapons produced in Japan. This is obviously true if the cost of developing a good weapon system exceeds the funds allocated for its development. This feature of the Japanese defense industry can easily incorporated in our model by allowing the cost of realizing the project at high quality to be bounded below, not by 0, but by a minimum cost level that is significant. Our analysis demonstrates that it is the corruption caused by the lack of transparency in the procurement process – not the low budget of
defense spending – that is responsible for the current sorry state of affair. Furthermore, while the liberalization of arms exports presents the firms with an opportunity for greater profits, it also forces the firms to produce high-quality products to be competitive on international markets. From the perspective of economic efficiency, liberalizing arms exports is certainly welfare improving, although considerations of ethics and morality might render this policy questionable.

The models we formulated can be extended in several directions. First, we can reduce the discretion at the disposal of the corrupted bureaucrat. In the model of Burguet and Che, op cit., the corrupted bureaucrat is only allowed to exaggerate the quality proposed by a firm. Compte et al., op cit., model the prices, not the quality, proposed by the bidding firms, and allow the corrupted bureaucrat to communicate to the firm he favors the lowest bid price then letting the favorite firm revise its bid. In our model of corruption, the corrupted bureaucrat can both inflate quality and communicate the lowest bid to the firm that offers the highest bribe. Compared to works of these researchers, our model accords the corrupted bureaucrat considerable discretion. Second, our model can be enriched by modeling the export market in more detail and by allowing the firms to bribe foreign officials. Because relative to the Japanese internal market the foreign arms market is large and very competitive, the research in this direction should explain how the uncertainty in the cost structures of the firms affects exports and foreign competition. Third, a component that characterizes bilateral co-operation in R&D can also be added. Finally, our model of corruption can serve as a stepping stone for formulating and
analyzing the problem of mechanism design, voiced by various world institutions, such as
the IMF and the World Bank, to fight corruption at the global level.

APPENDIX

PROOF OF LEMMA: We shall prove the lemma by reduction ad absurdum. To this end,
suppose that a firm, say firm $i$, submits a bid $(p_i, \bar{q}, b_i)$. Let $(p_j, q_j, b_j)$ be the bid
submitted by firm $j$, the other firm.

If $b_i > b_j$, then the bureaucrat will favor firm $i$. Because the quality proposed by firm $i$ is
high, there is no need for the corrupted bureaucrat to inflate the quality proposed by firm
$i$. The favorite treatment of firm $i$ takes the form of the corrupted bureaucrat informing
firm $i$ about the bid of firm $j$, and allows firm $i$ to revise its bid to $(p_i', \bar{q}, b_i)$, with $p_i'$
as the revised bidding price, such that $\bar{q} - p_i' > q_j - p_j$. This action allows the corrupted
bureaucrat to offer the procurement contract to firm $i$ officially. The net payoff for firm
$i$ is then given by $p_i' - \theta_i - b_i$. Now note that if firm $i$ submits the bid $(p_i, q, b_i)$ instead
of $(p_i, \bar{q}, b_i)$, then it still wins the contract. In this case, besides informing firm $i$ about
the bid of firm $j$, the corrupted also has to inflate the quality of the project proposed by
firm $i$. The net payoff obtained by firm $i$ under the bid $(p_i, q, b_i)$ is then given by
$p_i' - b_i > p_i' - \theta_i - b_i$.

On the other hand, if $b_i < b_j$, then firm $i$ will not obtain the procurement contract
because the corrupted bureaucrat will favor firm $j$ under this scenario. By submitting the
bid \((p_i, q, b_i)\), instead of the bid \((p_i, q, b_j)\), firm \(i\) still does not obtain the contract, and thus cannot make it worse-off. In the case \(b_i = b_j\), there is no reason for the bureaucrat to favor one firm over the other. For simplicity, we shall assume that the corrupted bureaucrat will award the contract to firm 1. Thus, submitting a bid that proposes to realize the procurement project at high quality is not optimal for a firm.

REFERENCES


Economics, 4, 187-203.


