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Tariffs, Quotas, and the Corrupt Purchasing of Inappropriate Technology

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Abstract

This paper develops a simple model where a manager of a firm in a Less-Developed Country (LDC) has the choice of whether or not to purchase an inappropriate technology in return for a bribe (kick-back) from the supplier of the technology. Provided that the manager achieves some minimum level of profit, the manager has a positive probability of not getting caught taking the bribe. The actual size of the bribe is determined by Nash axiomatic bargaining between the manager and the supplier. An interesting and not immediately obvious result is that, under certain circumstances, if the protective instrument is changed from a quota to an equivalent tariff the manager will switch from not acting corruptly to acting corruptly.

Key words: kick-backs; corruption; managerial discretion; border protection

JEL classification: F13; F23; L21

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1. Introduction

A well-known general conclusion from the international trade literature is that a tariff is preferable to the equivalent import quota. For a book-length treatment of the relative inefficiency of quotas see Anderson (1988). One of the least attractive aspects of quotas is the link with corruption. In her famous article Krueger (1974) discusses the rent-seeking activities associated with the quota rents. She makes it clear that rent-seeking can include illegal activities involving corruption. From this it would be natural to conclude that a shift from quotas to tariffs would necessarily result in a reduction in corruption. In this paper I argue that simply switching to tariffs, rather than reducing overall protection, may not necessarily be helpful in reducing all forms of corruption.

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The definition of corruption used here includes the private sector as well as the public sector. The more commonly discussed corruption in the public sector is generally taken to refer to both theft of public assets by public officials and public officials accepting bribes in return for taking, or not taking, certain actions. Private sector corrupt behaviour is taken to refer to a situation where a decision maker within a firm makes a particular choice as a result of being bribed that is not in the interest of the owner(s). The situation considered here is that of a manager of an import-competing firm located in a Less-Developed Country (LDC). The manager has to choose whether or not to purchase an inappropriate technology in return for a bribe (kick-back) from the foreign supplier of the technology.

While the economics of corruption literature has grown substantially over the last decade or so, see Jain (2001), it has not focused heavily on the corrupt purchasing of technology. One exception to this is contained in the masterly discussion of corruption issues by Shleifer and Vishny (1993). They give the example of a bottle-making factory in Mozambique. The issue was the replacement of three archaic bottle-labelling machines with one modern bottle-labelling machine. The sensible choice would have been a machine that cost about $10,000. This type of machine could have been purchased from any one of a large number of foreign suppliers using foreign aid money. However, the manager of the factory wanted to buy a sophisticated $100,000 machine that was only available from a single foreign supplier. Shleifer and Vishny (1993) explain this perverse choice in terms of the greater opportunity for corruption when the machine is unique rather than generic. That is, the "honest price" of the unique sophisticated machine is more or less what the supplier says it is because there are not direct competitors. Thus, the supplier could charge a price of $103,000 and then secretly pay the manager $3,000 as a reward for having chosen to purchase this machine. Shleifer and Vishny use this example to make the point that the desire for secrecy associated with corruption can lead to dramatic misallocations of resources. This bottle factory story provides us with a possible neat explanation for the "folk" belief that a substantial problem for LDCs is the use of "inappropriate" technologies, see Stiglitz (1988, p. 149).

A number of authors affiliated with the IMF have empirically investigated the idea that resources are misallocated so as to allow the decision maker to indulge in corrupt behaviour. Specifically they consider whether in relatively corrupt societies government expenditure decisions are distorted towards items like military aircraft and consequently away from items like education. Mauro (1998) performed a cross-sectional multi-country study where corruption was measured by a corruption index devised by a private firm called *Political Risk Services, Inc.* Both "government expenditure on education as a proportion of GDP" and "government expenditure on education as a proportion of total government expenditure" were tried as dependent variables. In both cases corruption was shown to be a significant explanatory variable with a negative relationship to government expenditure on education. Mauro (1998) explains this result in terms of government ministers and officials having limited opportunities to obtain kick-backs from the suppliers of education sector inputs. This is said to be because typically this sector does not require inputs that are high-technology and supplied by oligopolists. While personal computers may be regarded as high-technology, there is not the same opportunity to secretly inflate the price as there is with some customised high-technology weapons system. Also with regard to computers in schools the reference year for this study was 1991, presumably when there were limited purchasing opportunities for computers in schools in LDCs. In a similar study, Gupta et al. (2001) use cross-sectional and panel regression techniques to show a positive association between corruption and military expenditure.

The methodology used in this paper is reasonably standard; see Ades and Di Tella (1997). The size of the bribe is determined by axiomatic Nash bargaining between the payer of the bribe (the foreign supplier) and the accepter of the bribe (the manager of the domestic firm). If the manager decides to act corruptly and accept the bribe then there is a probability that the manager will be caught and incur the associated cost. The new technology will reduce the domestic firm's marginal cost but not sufficiently to ever offset the cost of the investment. Thus the decision to make the investment is synonymous with deciding to act corruptly. While, in the example of the Mozambique bottle factory there is a profit-improving new technology available to adopt, including a "good" new technology would not add anything to this analysis. The reason the manager stands a chance of getting away with corruption is because his performance is imperfectly monitored by the owners.

The type of situation being considered is the traditional story from the managerial theories of the firm literature; see Williamson (1964). In this literature the owners do not have the ability and/or the incentive to actively monitor the various individual actions of the manager. Rather, the owners only take action against the manager if profit falls below some minimum level. This minimum profit limit would presumably be determined by some rough comparison to the profitability of some imperfectly comparable firms. In this literature the standard explanation for this substantial separation between ownership and control is that the owners are numerous and only have a small proportion of their total wealth invested in one particular firm. However, in the context of a LDC this ownership structure is not particularly plausible. A more appealing third world explanation for imperfect monitoring of the manager would be state ownership of the firm. State ownership of the firm fits in comfortably with the use of the standard assumption, used in the literature on public sector corruption, that both the cost of being caught and the probability of being caught are exogenous. With state ownership there is typically little concern by public officials and politicians about returns and managerial decisions unless disastrous results occur that become a political issue. Hence the cost and probability of being caught are the result of arbitrary circumstances rather than some sophisticated incentive scheme. The literature on state-owned firms emphasises the soft nature of the budget constraint; see Megginson and Netter (2001, p. 331). There is a minimum profit constraint being used but this is very much to be thought of as "soft" because before it bites there can be substantial scope for the manager to pursue his own agenda.

If the manager does decide that the firm will buy the new technology, he will want the firm to pay as high a price as possible so that the supplier's surplus, from which the bribe comes, is as large as possible. The highest price the manager can set is the difference between the firm's profit, gross of the price (the investment cost), and the minimum profit constraint. Obviously a price that was any higher than this would break the minimum profit constraint. So the model this paper develops makes clear that the size of the potential bribe is dependent upon the size of the profit gross of investment cost. Given that there is a probability of being caught and there is a cost associated with this, the higher the size of the profit gross of investment cost, the stronger is the tendency for the manager to act corruptly. So just as protection can encourage rent-seeking behaviour, it can also encourage managers to corruptly purchase inappropriate new technology.

Once the basic framework has been set out in Section 2, it is used to show in Section 3 that merely changing from quotas to equivalent tariffs will not deter the manager from choosing to accept bribes. That is, in Section 3, it is shown that, for certain values of the cost of being caught, the manager will choose not to accept the bribe if the firm is protected by a quota but will accept the bribe if the firm is protected by a tariff. Thus changing from a quota to the equivalent tariff will never induce the manager to switch away from taking the bribe.

2. The Basic Model

Consider an industry where there is a single domestic firm. This firm competes (Cournot fashion) with imports from a single foreign firm. The inverse demand function which both of these firms face is $p = \alpha - \beta(x + y)$, where x and y refer respectively to the domestically produced and foreign produced quantities sold. Both the domestic and foreign firms have constant unit costs which are respectively denoted c_0 and c^*.

Now there is a foreign supplier that can provide the domestic firm with a piece of capital equipment that will reduce its marginal cost from c_0 to c_1. The cost the supplier incurs in producing this equipment is denoted C_S. The price paid by the domestic firm for this equipment is denoted *I*. We are interested in the case where making this investment will never represent profit-maximising behaviour and will only occur because of corrupt behaviour on the part of the manager. Thus we assume that even if the domestic firm only paid C_S for the piece of equipment it would not be worth it.

The manager of the domestic firm is paid a fixed wage that is normalised to zero. The manager has discretion how he behaves provided the firm's profit does not fall below $\pi_{\min}$. If the manager is caught taking a bribe *b*, instead of receiving the bribe, the manager incurs the cost *m*. The probability of being caught is denoted θ. The bribe under consideration is a kick-back from the supplier of the capital equipment. The bribe is paid so as to reward the manager for having the firm purchase the piece of capital equipment at a high price. The constraint on how high this price can be set is, effectively, the domestic firm's minimum profit constraint.

Hence we can write the price as $I = \delta - \pi_{\min}$, where δ is the domestic firm's profit gross of investment costs. The total surplus which the supplier would have prior to paying the bribe is $Z = I - C_S$. How much of this is paid to the manager of the domestic firm in the form of a bribe is determined by Nash bargaining between the manager and the supplier. The Nash bargaining problem can be written as

$$\max_b \ [(1-\theta)b - \theta m][I - C_S - b]$$

or

$$\max_b \ [(1-\theta)b - \theta m][\delta - \pi_{\min} - C_S - b] \ .$$

Rearranging the first-order condition gives us an expression for the bribe:

$$b^* = \frac{(1-\theta)(\delta - \pi_{\min} - C_S) + \theta m}{2(1-\theta)} \ . \tag{1}$$

Clearly we are interested in what the conditions are for the manager not being corrupt. Obviously if *m* is sufficiently high, the expected cost of being caught offsets the expected benefit from the bribe. It is simple to find m_d , the level of *m* that leaves the manager indifferent between making the investment (corruption) and not making the investment (non-corruption):

$$(1-\theta)b^* - \theta m_d = 0$$

$$\Rightarrow \ m_d = \frac{(1-\theta)}{\theta}(\delta - \pi_{\min} - C_S) = \frac{(1-\theta)}{\theta}(I - C_S) \ . \tag{2}$$

Here *m* is large enough to offset the expected value of being paid a bribe equal to the supplier's total surplus. Thus, if *m* is larger than m_d , the manager will definitely not make the investment even if the supplier is prepared to pay a bribe equal to its total surplus.

3. The Quota versus Tariff Issue

We now use our framework to show that, if a quota rather than a tariff is used to assist the domestic firm, this can affect whether the manager engages in corrupt behaviour. To compare these two alternative instruments, the tariff is set so that the domestic firm's level of output would be equal to *Q*, the maximum volume of imports allowed if a quota is used. That is, the tariff and quota are equivalent if no cost-reducing investment is made. They are equivalent in the sense that the quantities sold, the market price, and the profits are the same no-matter which instrument is used. If the cost-reducing investment is made, then the profit associated with the tariff case will be higher. This result is looked at in more detail in Campbell (1998). To show it we begin by considering the domestic firm's problem when there is a quota in place:

$$\max_{x} \ \delta_0^Q = x[\alpha - \beta(x + Q)] - c_0 x \ .$$

We are assuming that the quota is binding and hence the foreign firm's best response is to set $y = Q$. Rearranging the first-order condition we get the following expression for output in terms of the parameters:

$$x_0^Q = \frac{\alpha - \beta Q - c_0}{2\beta} \ . \tag{3}$$

If a tariff is used we can obtain the expression for output and profit by simply solving the standard Cournot problem (see the appendix) to obtain:

$$x_0^t = \frac{\alpha - 2c_0 + c^* + t}{3\beta} \tag{4}$$

$$\delta_0^t = \frac{(\alpha - 2c_0 + c^* + t)^2}{9\beta} \ . \tag{5}$$

Here t refers to the tariff levied on each unit imported. We equate (3) and (4) so as to obtain an expression for the tariff which results in a quota-equivalent output:

$$t = \frac{\alpha - 3\beta Q + c_0 - 2c^*}{2} \ . \tag{6}$$

Substituting (6) into (5) gives the profit associated with this tariff level:

$$\delta_0^Q = \frac{(\alpha - \beta Q - c_0)^2}{4\beta} \ . \tag{7}$$

Now we go on to show that if the piece of capital equipment is purchased, then $\delta_I^t > \delta_I^Q$ assuming neither Q nor t were changed. Let us start with

$$\delta_I^t = \frac{(\alpha - 2c_I + c^* + t)^2}{9\beta} \ . \tag{8}$$

Here we need to remember t stays at the amount shown in expression (6). So we substitute (6) into (8):

$$\delta_I^t = \frac{(3\alpha - 4c_I + c_0 - 3\beta Q)^2}{36\beta} \ . \tag{9}$$

To compare δ_I^Q with this we write it in the following manner:

$$\delta_I^Q = \frac{(3\alpha - 3c_I - 3\beta Q)^2}{36\beta}. \qquad (10)$$

Now $-4c_I + c_0 > -3c_I$ since $c_0 > c_I$. Therefore we can say that $\delta_I^t > \delta_I^Q$. If we look back at (2) it is easy to see that *m* could be at a level such that:

$$m_d^Q < m < m_d^t,$$

where

$$m_d^Q = \frac{(1-\theta)}{\theta}(\delta_I^Q - \pi_{\min} - C_S)$$
$$m_d^t = \frac{(1-\theta)}{\theta}(\delta_I^t - \pi_{\min} - C_S).$$

Thus we have a result that at first glance may seem counterintuitive. That is, when a quota is used, a lower *m* (cost of being caught) is required to deter corrupt behaviour by the manager. When thought about carefully it is clear enough how this result comes about. The corrupt behaviour being considered is the manager being induced to spend a large amount on an unprofitable investment that nevertheless reduces marginal cost. If this investment is made, the firm's profit (gross of the investment cost *I*) will be lower if the protective instrument used is a quota rather than a tariff. Thus with the quota, the amount paid to the supplier (the investment cost *I*) will be lower. Remember the constraint on *I* is the requirement that the manager satisfies the firm's minimum profit constraint $\pi_{\min}$. The lower *I* associated with the quota means that the supplier's surplus $Z = I - C_S$ will be smaller. Therefore the maximum amount the supplier is prepared to bribe the manager is smaller, and hence the cost of being caught, necessary to deter corrupt behaviour, is also smaller. This result is, of course, dependent on the assumption of a non-changing tariff and quota. This is a standard assumption used when demonstrating the dynamic non-equivalence of tariffs and quotas; see Vousden (1990, pp. 64-65). It is certainly a non-controversial assumption since it seems highly unlikely that a policy maker would have the information and sophistication to adjust a tariff or a quota in response to the firm making an investment.

4. Concluding Comments

We can see from this paper that formalising the idea of a manager taking kick-backs provides us with useful insights. It shows clearly the link between the size of the supplier's surplus $Z = I - C_S$, where $I = \delta - \pi_{\min}$, and the corruption-deterring cost of being caught m_d. Obviously a reduction in protection would result in a lower supplier's surplus and hence the m_d would be lower. So, potentially, a reduction in protection could cause a switch from corrupt to non-corrupt behaviour. The result that has been attained comparing equivalent tariffs and quotas is certainly not obvious. A policy implication that follows from this result is that, while a switch from a regime of quotas to a regime of tariffs may diminish rent-seeking activities, it will not discourage managers from accepting kick-backs in return for investing in inappropriate technology. It should be strongly emphasised that this is in no way an argument for quotas to be preferred over tariffs. Rather it is a result that emphasises that merely swapping between protective instruments is no substitute for actually reducing the level of protection.

Appendix

To derive expressions (4) and (5), suppose the domestic firm chooses its output to maximise

$$\delta_0^Q = x[\alpha - \beta(x+y)] - c_0 x .$$

The first-order condition is

$$\alpha - 2\beta x - \beta y - c_0 = 0 .$$

We rearrange this to get the domestic firm's reaction function

$$x = \frac{\alpha - \beta y - c_0}{2\beta} \text{ or } y = \frac{\alpha - 2\beta x - c_0}{\beta} .$$

The foreign firm chooses its output to maximise

$$\delta_0^{*t} = y[\alpha - \beta(x+y)] - c^* y - ty .$$

The first-order condition is

$$\alpha - \beta x - 2\beta y - c^* - t = 0 .$$

We rearrange this to get the foreign firm's reaction function

$$y = \frac{\alpha - \beta x - (c^* + t)}{2\beta} .$$

Now we equate the reaction functions and solve for x to get

$$x_0^t = \frac{\alpha - 2c_0 + c^* + t}{3\beta} ,$$

which is Equation (4).

To obtain y_0^t we substitute the above expression for x_0^t into the reaction function for the foreign firm

$$y_0^t = \frac{\alpha + c_0 - 2(c^* + t)}{3\beta}.$$

Price is simply obtained using the inverse demand function

$$p_0^t = \frac{\alpha + c_0 + (c^* + t)}{3\beta}.$$

Finally we can use our expressions for price and quantity to obtain an expression for the domestic firm's profit

$$\delta_0^t = \frac{(\alpha - 2c_0 + c^* + t)^2}{9\beta},$$

which is Equation (5).

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