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The multiplier effect of globalization

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Abstract

This study uses a three-stage common agency model to explore the linkages between trade policy, corruption and environmental policy in an imperfect market setting. We show that the effect of trade liberalization on the stringency of environmental policy depends critically on the level of corruption—in relatively corrupt countries, trade openness leads to more stringent environmental policy. In such countries, this interaction, therefore, lends trade liberalization a type of "multiplier effect," raising both economic growth and environmental policy stringency.

Keywords: Corruption; Political economy; Trade liberalization; Trade and the environment

JEL classification: F18; D78; Q28

In many countries, corruption has been found to be a major source of policy distortions. However, despite a rapidly growing literature on the economic consequences of corruption, the linkages between trade policy, corruption, and environmental policy remain poorly understood.[1] This study uses a three-stage common agency model to provide a theoretical structure that focuses on these relationships in sectors

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[1] Related work includes Bhagwati (1982), who studies the effects of lobbying on trade policy. Notable contributions in an environmental context are López and Mitra (2000), who investigate the effect of corruption and rent-seeking on the relationship between income and pollution levels, and Fredriksson and Svensson (2003), who explore the effects of corruption and political instability on environmental policy. They do not explicitly study trade and environmental policies, however. Damania et al. (2003) explore the issue using a perfectly competitive framework.

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with imperfect competition. The model provides insights into several issues: (i) the influence of trade liberalization on the stringency of environmental policies; (ii) whether government corruption is associated with weak environmental policies in sectors with imperfect competition (related work includes Mauro, 1995; Ades and Di Tella, 1999); and (iii) whether these two effects have a joint influence on environmental policymaking. Although this literature is expanding rapidly, the interaction between trade, governmental corruption, and environmental policies has yet to be explored in an imperfect market setting.

Our three-stage common agency model allows for strategic firm interactions and thus represents an extension of Bernheim and Whinston (1986) and Grossman and Helpman (1994).[2,3] Aidt (1998) and Damania (2001) have adopted this model to environmental policy formation in sectors with perfect competition. Our attention focuses on the political economy effects of trade liberalization; for example, whether bribery incentives on environmental issues shift as a result of trade reform. Besides providing intuition into the determination of a pollution tax in a protected sector within a framework incorporating political corruption, the model yields two main predictions. First, the effect of trade liberalization depends on the level of corruption, and whether the polluting sector is import-competing or exporting. Given that trade policy is protective (i.e., an import tariff or export subsidy is used), trade liberalization leads to an increase (decrease) in the pollution tax if the level of government corruption is high (low). If, on the other hand, trade policy is anti-protective (i.e., an import subsidy or export tax is used), trade liberalization results in an increase (decrease) in the pollution tax when the degree of corruption is low (high).

The intuition for this finding is that in more corrupt regimes the government places a greater weight on bribes relative to social welfare. For example, when trade policy is protective and the level of corruption is high (low), trade liberalization induces a decline in bribery that dominates (is dominated by) second-best welfare considerations. Thus, in relatively corrupt societies, further globalization (trade integration) can be expected to increase the stringency of environmental policies. It is well known that openness to trade is a necessary condition for countries to develop (Ades and Glaeser, 1999). Hence, trade integration may confer dual benefits, raising incomes and policy efficiency, a form of multiplier effect. To our knowledge, this result is new and has not been previously identified in the literature. A second prediction is that a reduction in corruption unambiguously leads to an increase in the pollution tax. Less corruption implies a greater weight on social welfare and thus the pollution tax will deviate to a lesser degree from the Piguovian tax.

1. The model

We consider a small open economy with two sectors. There are three types of agents in the economy: consumers, producers (factor owners) and the government. Following Brander and Spencer (1992), we denote utility of the representative consumer as

$$U = z + u(Q) - \theta X, \tag{1}$$

where z is consumption of a competitively produced (exported) numeraire good with price equal to unity and Q is consumption of good x with price P produced by a domestic duopoly, assumed to be competing

[2] Following Schulze and Ursprung (2001), we take the view that the model by Grossman and Helpman (1994) closely characterizes a form of high-level corruption. Building on the same model, Coate and Morris (1999) also refer to the political contribution offered by a lobbying firm as a "bribe."

[3] Note, however, that, whereas Grossman and Helpman (1994) deal with multiple interest groups and policy dimensions, the current paper has only one interest group and the policy space is uni-dimensional.

with one foreign producer.[4] Producers of the non-numeraire good face competition from imports of this commodity and are protected by an import tariff $\tau \in T \subset R_+$, determined by multilateral negotiations over which this small country's government has no influence.[5] We make the standard assumption that the domestic and foreign firms sell only in the home market.[6] $u(Q)$ is a concave, twice differentiable sub-utility function. Since this utility function implies that the marginal utility of income is unity, inverse demand is defined by the condition $\partial u(Q)/\partial Q = P$. Let X be the domestic firms' output of the non-numeraire good and y be imports of this good. Thus, total domestic consumption is $Q = X + y$. Domestic production of the good results in θ damage from pollution per unit of output, and the total damage (disutility) from pollution is θX. Because production of good X results in local pollution, the government controls emissions by levying an emissions tax, $t \in T \subset R_+$, per unit of pollution.

The analysis is based on the following sequence of events. In the first stage, domestic producers optimally determine the bribe function $S(t)$ offered to the government (the sum of individual bribes of each firm $S^i(t)$ and $S^j(t)$). In the second stage, given knowledge of the contributions, the government optimally determines environmental policy. Finally, output levels are set to maximize profits.

Output of domestic firm $i = 1,2$, $i \neq j$, is denoted x^i. Thus, total output of the non-numeraire good is given by $Q = X + y$, where $X = x^1 + x^2$. The payoff function of domestic firm i is

$$\pi^i = (P(Q) - c^i - t\theta)x^i - S^i(t), \tag{2}$$

where $P(Q)$ is inverse demand, c^i is production costs, $t\theta$ is the pollution tax levied on firm i's emissions which equal $E^i = \theta x^i$. For simplicity, we ignore the use of a pollution abatement technology. Our results are robust to the introduction of an abatement technology with convex costs. The foreign firm's payoffs are

$$\pi^y = (P(Q) - c^y - \tau)y, \tag{3}$$

where c^y represents costs of the foreign rival and τ is the tariff. By backward induction, we begin by solving the third stage of the game. The output levels that maximize profits satisfy the first-order conditions

$$\pi^i_i = P'(Q)x^i + P(Q) - c^i - t\theta = 0, \ i = 1,2; \ i \neq j;$$

$$\pi^y_y = P'(Q)y + P(Q) - c^y - \tau = 0. \tag{4}$$

Letting subscripts denote derivatives, the SOCs require $\pi^i_{ii} < 0$, $\pi^y_{yy} < 0$ and $|\pi^i_{ii}| > |\pi^i_{ij}|$, $i = 1,2$, $i \neq j$. Stability is ensured by the requirement $\pi^i_j < 0$, $\pi^y_{yi} < 0$, $i = 1,2$, $i \neq j$ (see Shapiro, 1990). Moreover,

[4] Our results extend to the more general case of an oligopoly in both the domestic and foreign economies.

[5] Grossman and Helpman (2001) study the case in which the domestic industry may influence both the import tariff and the pollution tax, and show that the interest group will focus on gaining a favorable pollution tax only, and not asking for any trade protection. Most governments (even large economies) are constrained in their trade policy agenda by WTO agreements, however. For example, as a member of the European Union (EU), France is not free to set trade policy: any external trade policy changes must first be negotiated within the EU, then with EU's negotiation partners (even if the EU would be able to set trade policy unilaterally, France's influence would be hampered by the other members' agendas). Prior to EU formation, the Treaty of Rome from 1957 created a customs union where import duties were removed internally, and the external barriers were unified in stages. Finally, as discussed by Ederington (2000), the success of GATT negotiations in reducing worldwide tariff barriers has resulted in a shift of attention to domestic policy instruments as secondary trade barriers.

[6] The results hold for the case of competition in both domestic and foreign markets by all firms provided demand in the domestic market is sufficiently large. The introduction of an additional market complicates the analysis without adding further insights; hence, we ignore this aspect of the problem.

observe that by symmetry of domestic firms i and j, $\pi^i_{ij}=\pi^j_{ji}$, $\pi^y_{yi}=\pi^y_{yj}$ and $\pi^i_{iy}=\pi^j_{jy}$. Totally differentiating the FOCs yields the system:

$$\begin{bmatrix} \pi^i_{ii} & \pi^i_{ij} & \pi^i_{iy} \\ \pi^j_{ji} & \pi^j_{jj} & \pi^j_{jy} \\ \pi^y_{yi} & \pi^y_{yj} & \pi^y_{yy} \end{bmatrix} \begin{bmatrix} \mathrm{d}x^i \\ \mathrm{d}x^j \\ \mathrm{d}y \end{bmatrix} = \begin{bmatrix} -\pi^i_{it} \\ -\pi^j_{jt} \\ 0 \end{bmatrix} \mathrm{d}t + \begin{bmatrix} 0 \\ 0 \\ -\pi^y_{y\tau} \end{bmatrix} \mathrm{d}\tau. \tag{5}$$

Let $|D|$ be the determinant of the system. The SOCs imply that $|D|<0$. Solving yields

$$\frac{\mathrm{d}x^i}{\mathrm{d}t} = \frac{\pi^y_{yy}(\pi^j_{jt}\pi^i_{ij} - \pi^i_{it}\pi^j_{jj})}{|D|} < 0 \quad i=1,2,\ i\neq j, \tag{6}$$

where $\pi^j_{jt}=-\theta<0$. The sign of Eq. (6) follows from the restrictions on terms from the SOC and the symmetry of firms i and j. Thus, a higher pollution tax raises costs and leads to a decline in domestic output levels. Similarly, solving Eq. (5), it follows that the impact of the tariff on domestic output levels and imports is given by

$$\frac{\mathrm{d}x^i}{\mathrm{d}\tau} = \frac{-\pi^y_{y\tau}(\pi^i_{ij}\pi^j_{jy} - \pi^j_{jj}\pi^i_{iy})}{|D|} > 0, \tag{7.1}$$

$$\frac{\mathrm{d}y}{\mathrm{d}\tau} = \frac{\pi^y_{y\tau}(\pi^i_{ij}\pi^j_{ji} - \pi^j_{jj}\pi^i_{ii})}{|D|} < 0, \tag{7.2}$$

where $\pi^y_{y\pi}=-1<0$. A higher tariff lowers imports and results in an expansion of domestic output. Since the organized producer lobby contains few individuals, it ignores consumer surplus and revenues (it receives a miniscule share), and thus has a utility function given by

$$V(t,\tau)\equiv\pi^1+\pi^2=\pi. \tag{8}$$

We assume that the government maximizes a weighed sum of the bribe received and aggregate gross-of-contributions social welfare given by

$$G(t,\tau)=S(t)+\alpha W(t,\tau), \tag{9}$$

where $S(t)=S^i(t)+S^j(t)$ is the aggregate bribe, $W(t,\tau)$ is aggregate social welfare and $\alpha>0$ is the weight given by the government to aggregate social welfare relative to the bribe. Following Schulze and Ursprung (2001), α represents the government's willingness to set policies that deviate from the welfare-maximizing level in return for bribes, and therefore is a useful measure of the level of corruption (degree of corruptibility). Following established convention in the common agency literature, we assume that tax revenues are distributed equally to all individuals, and not expropriated by the government for personal use in the same way that bribes are.[7] Domestic welfare is defined as the sum of consumer surplus, profits of domestic firms, tax and tariff revenues, less the damage from pollution:

$$W(t,\tau) = u(Q) - P(Q)Q + \pi^i + \pi^j + \tau y + t(E^i + E^j) - \theta(x^i + x^j). \tag{10}$$

Define (t^w, τ^w) as the tax and tariff combination that maximizes welfare. To ensure an interior maximum, it is assumed that $W(t,\tau)$ is jointly concave in t and τ.[8,9] The policy chosen by the government satisfies the first order condition:

$$\frac{\partial G}{\partial t} = \frac{\partial (S^i + S^j)}{\partial t} + \alpha \frac{\partial W(t,\tau)}{\partial t} = 0. \tag{11}$$

In the first stage, the firms determine their optimal bribes taking account of the government's anticipated reaction and output market responses. Thus, bribes are determined to maximize:

$$\pi^{*i} = (P(Q)^*) - c^i - t\theta)x^{*i} - S^i(t) \tag{12.1}$$

where * denotes optimal values. The equilibrium bribes satisfy the FOC

$$\frac{\partial \pi^{*i}}{\partial S^i} = \left(\frac{\partial \pi^{*i}}{\partial x^{*i}} \frac{\partial x^{*i}}{\partial t} + \frac{\partial \pi^{*i}}{\partial t} \right) \frac{\partial t}{\partial S^i} - 1 = \frac{\partial \pi^{*i}}{\partial t} \frac{\partial t}{\partial S^i} - 1 = 0. \tag{12.2}$$

Note that $(\partial \pi^{*i}/\partial t) = -\theta x^{*i} < 0$.[10] This indicates that, as domestic production (x^{*i}) falls, the marginal benefit to the firm of a reduction in the pollution tax also declines. Furthermore, since $(\partial \pi^{*i}/\partial t) < 0$, it follows that an interior solution exists iff $(\partial S^i/\partial t) < 0$. From the property of inverse functions, it follows that Eq. (12.2) can be rearranged to yield: $(\partial \pi^{*i}/\partial t) = (\partial S^i/\partial t)$. Substituting in Eq. (11) yields

$$\frac{\partial G}{\partial t} = \frac{\partial (\pi^i + \pi^j)}{\partial t} + \alpha \frac{\partial W(t,\tau)}{\partial t} = 0 \tag{12.3}$$

which suggests that, in equilibrium, the government trades off the two terms in Eq. (12.3) at a rate α.[11] The first term represents the effect of the tax t on the lobby's profits (and thus on the bribe), and the second term reflects the effect on aggregate welfare. The latter term will incorporate the second best motive of the

[7] This reflects the notion that politicians face fewer constraints in the way that bribes can be dispersed. The focus of the analysis is, therefore, on situations where bribes are used by special interest groups to gain more favorable policies, rather than on cases where corrupt politicians seize tax revenues.

[8] This is a standard utilitarian welfare function; hence, taxes paid by one domestic agent that are distributed lump sum to other agents cancel each other.

[9] For instance, the welfare function will be jointly concave in t and τ if the sub-utility function takes the following quadratic form described in Singh and Vives (1984): $u(x) = \alpha^i X + \alpha_i y - \beta^i X^2 - \beta^j y^2 - 2\gamma Xy$, where α^i, $\beta^i \gamma^i > 0$ are parameters. With perfect substitutes, $\alpha^i = \alpha^j$, $\beta^i = \beta^j = \gamma$.

[10] $\partial \pi^* / \partial x^{*i} = 0$ by the FOC in Eq. (4).

[11] Grossman and Helpman (1994) show that, with one lobby, the bribe must perfectly compensate the government for the utility loss associated with the distorted equilibrium policy (compared to the welfare-maximizing policy).

government, raising the pollution tax in the presence of a positive tariff (since the tariff stimulates output and thus pollution). A unique maximum requires $\partial^2 G/\partial t^2 < 0$.

2. Results

Proposition 1. *In the political equilibrium, trade liberalization*

(i) unambiguously increases the pollution tax if the level of corruption is sufficiently high;
(ii) reduces the pollution tax if the level of corruption is sufficiently low and $(\partial^2 W(t,\tau)/\partial t\partial\tau)>0$.

Proof. Totally differentiating Eq. (9) yields $\mathrm{d}t/\mathrm{d}\tau = -(\partial^2 G/\partial t\partial\tau)/(\partial^2 G/\partial t^2)$, where the denominator is required to be negative. The numerator equals

$$\frac{\partial^2 G}{\partial t \partial \tau} = -\theta \frac{\partial (x^i + x^j)}{\partial \tau} + \alpha \frac{\partial^2 W(t,\tau)}{\partial t \partial \tau}. \tag{13}$$

The sign of $\partial^2 W(t,\tau)/\partial t\partial\tau$ is ambiguous, and hence the sign of Eq. (13) is ambiguous. However, from Eq. (7.1), $\partial X/\partial\tau = (\partial(x^i + x^j)/\partial\tau > 0$. Thus, $\mathrm{Lim}_{\alpha\to 0}(\partial^2 \mathrm{G})/(\partial t\partial\tau) = -\theta(\partial(x^i + x^j))/\partial\tau < 0$. It follows that, as $\alpha \to 0$, $(\mathrm{d}t/\mathrm{d}\tau) < 0$. For $(\partial^2 W(t,\tau))/(\partial t\partial\tau)>0, \mathrm{Lim}_{\alpha\to\infty} = (\partial^2 G)/(\partial t\partial\tau) > 0$ And, it follows that, as $\alpha \to \infty$, $(\mathrm{d}t/\mathrm{d}\tau)>0$. □

The intuition is as follows: a reduction of the import tariff has two main effects, reflected by the two terms in Eq. (13). First, trade liberalization reduces output in the polluting sector. As the marginal profits from bribery fall (since less is at stake when production declines), the bribe offer declines (first term in Eq. (13)). Hence, the pollution tax *rises* through this channel.

Alternatively, the second-best welfare motive for increasing the pollution tax declines as the tariff is reduced. That is, as the tariff declines domestic output and pollution levels fall, thereby vitiating the need for a higher pollution tax. Provided this effect is sufficiently strong such that $\partial^2 W(t,\tau)/\partial t\partial\tau>0$, this channel causes a *reduction* in the pollution tax. A sufficient condition (expression available upon request) for this to occur is that $|\partial y/\partial\tau|$ be sufficiently large. When this condition holds, imports are highly responsive to the tariff. Hence, a reduction in the tariff induces a relatively large increase in imports, so that domestic production and pollution levels decline substantially. This mitigates the need to curb pollution levels through an emissions tax.

The degree of corruption determines the relative influence of the two terms in Eq. (13). When the level of corruption is high (low), the effect of reduced bribery dominates (is dominated by) the effect of a reduced tariff distortion. When corruption has a strong impact on environmental policy, trade policy reform has a relatively large effect on the bribery effort, and trade liberalization is more likely to raise the pollution tax rate. When the government is honest, on the other hand, welfare considerations may counter this upward pressure on the pollution tax. This upward force on the tax declines proportionally more as protection is dismantled when the government is honest.

Proposition 2. *In the political equilibrium, corruption reduces the pollution tax.*

Proof. Totally differentiating Eq. (11) yields $\mathrm{d}t/\mathrm{d}\alpha = -(\partial^2 G/\partial t\partial\alpha)/(\partial^2 G/\partial t^2)$, where $(\partial^2 G)/(\partial t\partial\alpha) = (\partial W(t,\tau))/\partial t$. In the political equilibrium $t < t^w$, which combined with concavity of $W(t,\tau)$ implies $\partial W(t,\tau)/\partial t > 0$, $\forall 0 < t < t^w$. By assumption $\partial^2 G/\partial t^2 < 0$, hence $\mathrm{d}t/\mathrm{d}\alpha > 0$, $\forall 0 < t < t^w$. □

An increase in corruption implies that the government places a greater relative weight on bribes, and thus on firm profits. The pollution tax consequently falls as corruption increases, deviating further from the welfare-maximizing tax rate.

3. Epilogue

In this note, we provide a theoretical relationship between corruption levels, openness of markets, and environmental policy formation in an imperfect market setting. We have shown that trade liberalization may have additional beneficial "multiplier effects" that have been largely ignored in the public policy debate. While our analysis has focused upon the determinants of environmental policy, the results may apply more generally to other issues—such as the provision of public goods, competition policy and perhaps even macroeconomic policies. The analysis suggests that trade openness provides a potentially useful tool to combat the distorting influence of special interest groups in corrupt societies.

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References

Ades, A., Glaeser, E., 1999. Evidence on growth, increasing returns and the extent of the market. Quarterly Journal of Economics 114 (3), 1025–1045.

Ades, A., Di Tella, R., 1999. Rents, competition, and corruption. American Economic Review 89 (4), 982–993.

Aidt, T.S., 1998. Political internalization of economic externalities and environmental policy. Journal of Public Economics 69 (1), 1–16.

Bhagwati, J.N., 1982. Directly unproductive, profit-seeking (DUP) activities. Journal of Political Economy 90 (5), 988–1002.

Bernheim, B.D., Whinston, M.D., 1986. Menu auctions, resource allocation, and economic influence. Quarterly Journal of Economics 101, 1–31.

Brander, J., Spencer, B., 1992. Tariff protection and imperfect competition. In: Grossman, G.M. (Ed.), Imperfect Competition and International Trade. MIT Press, Cambridge, MA, pp. 107–119.

Coate, S., Morris, S., 1999. Policy persistence. American Economic Review 89 (5), 1327–1336.

Damania, R., 2001. When the weak win: the role of investment in environmental lobbying. Journal of Environmental Economics and Management 42 (1), 1–22.

Damania, R., Fredriksson, P.G., List, J.A., 2003. Trade liberalization, corruption, and environmental policy formation: theory and evidence. Journal of Environmental Economics and Management 46 (3), 490–512.

Ederington, J., 2000. International coordination of trade and domestic policies. American Economic Review 91 (5), 1580–1593.

Fredriksson, P.G., Svensson, J., 2003. Political instability, corruption and policy formation: the case of environmental policy. Journal of Public Economics 87 (7–8), 1383–1405.

Grossman, G.M., Helpman, E., 1994. Protection for sale. American Economic Review 84 (4), 833–850.

Grossman, G.M., Helpman, E., 2001. Special Interest Politics. MIT Press, Cambridge, MA.

López, R., Mitra, S., 2000. Corruption, pollution and the kuznets environment curve. Journal of Environmental Economics and Management 40 (2), 137–150.

Mauro, P., 1995. Corruption and growth. Quarterly Journal of Economics 110, 681–712.

Schulze, G., Ursprung, H., 2001. The political economy of international trade and the environment. In: Schulze, G., Ursprung, H. (Eds.), International Environmental Economics: A Survey of the Issues. Oxford Univ. Press, New York and Oxford, pp. 62–83.

Shapiro, C., 1990. Theories of oligopoly. In: Schmalansee, R., Willig, R. (Eds.), The Handbook of Industrial Organization. North-Holland, Amsterdam, pp. 329–414.

Singh, N., Vives, X., 1984. Price and quantity competition in a differentiated duopoly. Rand Journal of Economics 15, 546–554.