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Foreign direct investment and lobbying for environmental policies

Abstract

Under a Cournot oligopolistic setting, foreign firms located in a host country compete when pollution quota as environmental policy is implemented. We develop a theoretical economic policy model where pollution promotes competitive disadvantage for the foreign firms. However, these firms offer political contribution/bribe to the government in order to induce a convenient pollution quota. The government will maximize its objective function. Objective function consists of the national welfare (the benefit in consumer and producer surplus and the harm caused by pollution on the society) plus contribution/bribe received from the foreign firms. A strict pollution quota will reduce the impact of pollution on the health of the people but will reduce the consumer and producer surplus and the amount of contribution/bribe received by the foreign firms. The optimal pollution quota is going to depend on the level of corruption, the marginal pollution disutility and the marginal cost of the foreign firms for abating pollution. With a small level of corruption, if the marginal pollution disutility is larger than the marginal cost for abating pollution, the optimal pollution quota will be zero. When the marginal pollution disutility is smaller than the cost for abating pollution, the optimal pollution quota will be positive. On the other hand, with a large level of corruption, the marginal pollution disutility must be too large in order to have a strict pollution policy; otherwise the optimal pollution quota will be positive.

Keywords: pollution quota, foreign direct investment, corruption.
JEL Classifications: F21, H2.

Introduction

Pollution is blamed for many natural disturbances such as greenhouse effect, acid rain, and climate change. In this sense, pollution is related to the social and economic costs caused by natural disasters like hurricanes, twisters and floods. For instance, the cost of air pollution to the world's most advanced economies plus India and China is around US$3.5 trillion per year in lives lost and ill health; the monetary impact of death and illness due to outdoor air pollution in 2010 in the OECD countries is estimated to be around US$1.7 trillion. According to the World Health Organization (WHO), around 7 million premature deaths resulted from air pollution in 2012 (United Nations Environment Program, 2014).

Use of natural resources and intense production processes are important causes of pollution. However, governments do not easily accept implementing policies to reduce pollution since these policies may increase the industrial costs and undermine the international competitiveness. Specifically, in developing economies the severe pollution policies may have a negative impact on the flows of Foreign Direct Investment (FDI). The emerging of FDI is a crucial source of development for many emerging economies as it is an opportunity to boost the economy[1]. The perceived benefit of attracting FDI into their economies is the main reason why emerging economies are reluctant to set strict pollution policies. However, the social and economic costs produced by pollution and the international pressures are strong enough to implement certain measures to control pollution.

Nevertheless, in many emerging economies the institutional setting is rather weak and the foreign firms may be able to lobby the government in order to benefit from less severe pollution policies. A corrupted action by foreign firms is linked with a corrupted government that is in favor of some economic benefits created by low level of pollution control policies. The foreign firm may bribe the local government to pursue a relaxed pollution policy. Uncountable examples on these facts are around emerging economies from Mexico to China (a good analysis is presented in Zhang, 2013). In this regard, political contribution may play an important role in favoring a relaxed pollution policy because of not only the potential positive effects that FDI may provide on the economy but also due to existing corruption on local governments.

Based on this fact, we develop a partial equilibrium model in which a good is produced by FDI and consumed in a country. The aim of this theoretical model is to offer an explanation about how corruption and FDI may coexist to determine an optimal pollution policy. Political contribution of special interest groups to governments in order to lobby for desired policies is quite common in many countries at different degrees. One may call it bribery, and that is how we intend to use our political economy model setting. Hence, we consider bribery as a common practice that the firms should take into account in their managerial decisions.

Although the literature on environmental regulations is vast[2], the existing literature on the relationship

[1] As an important element of global economic activity, FDI has received enormous attention from scholars worldwide. See, for example, Brander and Spencer (1987), Ethier (1986), Haufler and Wooton (1999), Helpman (1984), Horstman and Markusen (1987), Motta (1992), and Smith (1987).

[2] An extensive survey is given in Cropper and Oates (1992).

between environmental regulations and foreign investment has not been explored enough. In this paper, we try to analyze the welfare effects of pollution regulation in the presence of a lobbying foreign direct investment and corrupt local government. We will set the model in the first section. In section two, we set the optimal pollution policy. The final section conclude the study.

1. The model

Our focus is on a country that hosts n identical foreign firms in the form of FDI competing in an oligopolistic industry. These firms produce a homogeneous good x, which is consumed entirely in the host country where there are not domestic producers[1]. The marginal cost of each firm is k, which is taken to be constant, and therefore equal the average variable cost[2]. The parameter k will be defined later on.

We use the following demand function:

$$p = a - b \text{ x } Q, \tag{1}$$

where $Q = nx$ is the total demand, p is the price of the good x, and a and b are positive parameters[3]. Each foreign firm n has the following profit function:

$$\pi = (p - k)x. \tag{2}$$

Since it is a Cournot setting, each firm takes the output of rivals as fixed in order to maximize profits. Under the above specification we get the following:

$$x = \frac{a-k}{b(n+1)}, \tag{3}$$

and hence, the profits are:

$$\pi = (p - k)x = bx^2. \tag{4}$$

Pollution occurs as a by-product during the production of x. The host government regulates emission. Firms incur two kinds of costs: the usual technological and market conditions cost (which is assumed to be constant), c, and the unit policy-induced cost of pollution abatement, T. That is,

$$k = c + T, \tag{5}$$

In order to define the policy-induced cost, we will consider the original Lahiri and Ono (2000) cost structure. From (5) we have:

$$T = \gamma(\theta - z). \tag{6}$$

Each firm incurs a constant marginal cost of abatement per unit of pollution, γ[4]. The constant amount of gross pollution per unit of output generated by each firm in the host country is θ. The maximum quantity of pollution per unit of output produced that firms in host country are allowed to emit into the atmosphere is denoted by z, such that $0 < z < \theta$. That is, the higher (lower) the z, the less (more) severe the environmental regulation, the higher (lower) will be the pollution emission and yet the lower (higher) will be the cost to the firms.

The specific interest of the foreign firms is to influence the government so that they could obtain some benefit derived from a reduction in the cost. Given this motivation, foreign firms offer political contributions (e.g., contribution for the next election or bribe as an extreme case) to the government that are subject to government's choice of policy. The government, apperantly not a benovelant one by assumption, implements a policy to maximise a weighted sum of total contributions and aggregate social welfare. The foreign firms form a lobby group whose political contribution schedule (or bribe) is defined by $C(z)$. Therefore each firm has the following indirect utility function,

$$V^f = \pi - C. \tag{7}$$

Consumers are assumed to have identical quasi-linear preferences with an exogenous level of income, $\bar{Y}$. Consumption of the non-numeriare good is denoted by Q, and function u is increasing and strictly concave in Q. With income $\bar{Y}$ each individual consumes $Q = g(p)$ of the non-numeriare good and m = $\bar{Y} - pg(p)$ of the other goods. The consumers' indirect utility is the following:

$$V^C = CS + \bar{Y} - \varphi Z. \tag{8}$$

Where the first term, CS, is the consumer surplus $\left(CS = \int_{p=0}^{p=p^*} u\left(g(p) - pg(p)\right) \right)$. Hence, one could easily derive,

$$dCS = bQdQ. \tag{9}$$

The third term in (8), Z, is the total amount of pollution in the host country, defined as $Z = nzx$. Finally, φ is the marginal disutility of pollution. We assume, as in Lahiri and Ono (2000) and Markusen et al (1993) and (1995), that marginal disutility of pollution is constant[5]. The environmental parameter

[1] The assumption that there are only foreign firms is made for simplicity.

[2] We assume that there is a numeraire good produced in the background competitively and there is also a factor of production and its price is determined under competitive environment.

[3] Utility function here is derived from $U = u(x) + m$ where x is the good under consideration and m is the expenditure on the numeraire good. Thus, we can ignore the income effect.

[4] Abatement does not require any labor force.

[5] Other authors, like Asako (1979), consider that marginal disutility is an increasing function of output. However, we will see that this assumption will not change our results, as the concavity condition of the government objective function holds.

z is a policy instrument for the government and is determined by a political equilibrium. The above political equilibrium is in parallel with that of Dixit et al. (1997). It is fair to keep the consumer side out of lobbying activities. The government's objective can be written as:

$$G = pnC\,(V^C + nV^f). \tag{10}$$

The degree of corruption is denoted by p and it is a constant parameter where $p > 1$. The first term on the right hand side (RHS) of (10) is the political contribution impact of the n firms on government objective function[1]. The last two terms on the RHS of (10), represent the total social welfare.

The rest of the equilibrium follows a two-stage game and is in line with Kayalica and Lahiri (2007). First, the foreign firms choose their contribution schedule; and second, the government sets its environmental policy. Given the stages of the game we get the following political equilibrium: (1) A political contribution function $C^*(z)$, such that it maximizes the welfare of all the foreign firms given the anticipated political optimisation by the government, and; (2) A policy variable, z^*, that maximises the government's objective function given by (10), given the contribution schedule. The model can have multiple sub-game equilibria, some of which may be inefficient. Dixit et al (1997) develop a refinement that selects truthful equilibria that result in Pareto-efficient outcomes[2]. Stated formally, let $(C^\circ(z^\circ V^{f\circ}), z^\circ)$ be a truthful equilibrium in which $V^{f\circ}$ is the equilibrium utility level of each firm. Then, $(C^\circ(z^\circ V^{f\circ}), z^\circ V^{f\circ})$ is characterized by:

$$C(z^\circ V^{f\circ}) = \text{Max}\,(0, A), \tag{11}$$

$$z^\circ = Argmax_z \left\{ pC\left(zV^{f^\circ}\right)n + V^C(z) + nV^{f^\circ} \right\}, \tag{12}$$

$$V^C(z_1) + nV^f(z_1) = pC\left(z^\circ, V^{f\circ}\right)n + V^C\left(z^\circ\right) + nV^{f\circ}\left(z^\circ\right), \tag{13}$$

where A is defined in

$$V^{f\circ} = \pi - A, \tag{14}$$

and

$$z_1 = Argmax_z \left\{ V^C(z) + V^f(z)n \right\}. \tag{15}$$

Equation (11) and (14) state that the truthful contribution schedule is set to the level of compensating variation relative to the equilibrium utility level of the foreign firms. The definition of A is the basic concept of the compensating variations. Under a truthful equilibrium payment function, for any change in z, the change in the contribution received by the government will exactly equal the change in the benefit of the foreign firms, provided that the payment both before and after the change is strictly positive. Equation (12) is self-explanatory: the government takes the utility level of the foreign firms as given and chooses the environmental policy level so as to maximize its objective function. Equation (13) and (15) complete the characterization of the truthful equilibrium and tie down the equilibrium utility level of the foreign firms, which is derived from the premise that the foreign firms would pay the lowest possible contribution to induce the government to pursue the equilibrium policy given in (12). For this to be the case, the government must be indifferent between (1) implementing the equilibrium policy and receiving contributions from the foreign firms, and (2) implementing a policy by accepting no contribution. Equation (13) states precisely that[3] in the second case, contribution would be zero and the government would maximize its objective function as if the foreign firms were politically unorganized[4].

2. Optimal environmental policy

Having described the properties of the political equilibrium, in this section we shall analyze the optimal environmental policy and its effect on welfare. From (3), (5) and (6) we have:

$$\frac{dx}{dz} = \frac{\gamma}{b(n+1)} > 0. \tag{16}$$

An increase in the pollution quota will reduce the cost for the foreign firms and the output produced by each firm will increase. When the government allows more pollution, the cost for abatement pollution is reduced increasing the optimal output. Once this cost is reduced, the benefit of each foreign firm increases as well. From (4) and (16) we get:

$$\frac{d\pi}{dz} = \frac{2x\gamma}{n+1} > 0. \tag{17}$$

The larger amount of output produced increases the benefit of each foreign firm. Besides foreign firms' benefits, an increase in the pollution quota will increase the amount of output produced in the economy by the n firms and consequently the consumer

[1] Using equations (6) and (7) government's objective function can also be written as $= pnC(V^C \pi n - nC)$. Reorganizing the equation, we get $= (p-1)nC + (V^C + n\pi)$. Hence, government attaches a positive weight to contributions provided that $p > 1$. In other words, there is no political relationship between the government and the foreign firms when $p > 1$. The weight that the government attaches to social welfare is normalized to one.

[2] Bernheim and Whinston (1986) develop a refinement in their menu auction problem. Following this, first Grossman and Helpman (1994) and later Dixit et al. (1997) develop a refinement (as in Bernheim and Whinston, 1986) for the political contribution approach, which selects Pareto-efficient actions.

[3] See Dixit, Grossman and Helpman (1997), pp. 756-759.

[4] Using (7) to (10) it can be seen that the government does not accept any contribution at all when $p = 1$.

price will go down and the consumer surplus will benefit. From (9) and (16) we have:

$$\frac{dCS}{dz}=\frac{nQ\gamma}{n+1}>0. \tag{18}$$

Finally, an increase in the total amount of output available in the economy implies that the amount of pollution in the economy increased as well. Since $Z = zQ$, from (16) we get:

$$\frac{dZ}{dz}=Q\frac{n\gamma}{b(n+1)}>0. \tag{19}$$

The larger amount of output produced by a reduction in the pollution quota will increase the amount of pollution emitted into the atmosphere because of two effects: a direct effect given by the reduction of the quota itself and an indirect effect given by the increase in the production. Consequently, there is a negative effect on the health of the people in the host country given by the increase in the harming pollution.

In order to determine the optimal pollution policy the first step is to obtain the first order condition for the optimization problem given in (12). From (7), (8), (9), (10) and (16) to (19) we obtain implicitly the following result:

$$G_Z=Q\left[\frac{\gamma}{n+1}(2p+n)-\varphi\right]-z(B)=0. \tag{20}$$

Such that:

$$B=\frac{n\gamma}{b(n+1)}>0.$$

From equation (20) we get:

$$z^*(B)=Q\left[\frac{\gamma}{n+1}(2p+n)-\varphi\right]. \tag{21}$$

On the other hand, the second order condition is given by

$$G_{ZZ}=\frac{B}{n+1}\left[\gamma(n+2p)-2(n+1)\varphi\right], \tag{22}$$

where concavity holds under the following conditions to consider in the analysis:

$$\frac{1}{2}\left[\frac{\gamma}{n+1}(2p+n)\right]<\varphi. \tag{23}$$

From (21) we can see that the value of z^* is ambiguous. This value will depend on the corruption parameter, the marginal cost of abatement pollution and the marginal disutility of pollution. As a first approach we can see that a larger corruption and cost of abatement pollution promote a positive pollution policy. When the cost for abating pollution is large, the foreign firms may reduce the output produced reducing the consumer and producer surplus affecting negatively the government objective function. In the same sense, a large corruption parameter encourages the setting of a larger pollution policy because of the benefit in political contribution. Intuitively, the weight attached to the political contribution made by the foreign firm is determined by the corruption parameter that measures the government's sensibility of the contribution in the political process[1].

On the other hand, when the marginal disutility is large enough, the government may have the intention of setting a strict pollution policy given by the harm produced by pollution on the people's health. The optimal pollution policy is the result of the combination of these three parameters.

In order to get cut clear results we consider two possible scenarios: first, we assume that corruption is negligible ($p = 1$). Second, we assume a much larger corruption parameter ($p \geq 0$).

In the first case ($p = 1$), there is not corruption and the government is not considering any political contribution. The government is maximizing the social welfare. We can rewrite (20) as:

$$z^*(B)=Q\left[\frac{n+2}{n+1}\gamma-\varphi\right], \tag{24}$$

where from any value of n we will have that:

$$1<\frac{n+2}{n+1}\leq 1.5.$$

In this case the concavity condition can be written as:

$$\frac{1}{2}\frac{n+2}{n+1}\gamma<\varphi. \tag{25}$$

In this case, the government is willing to set the strictest pollution quota ($z^*=0$) when the marginal pollution disutility is larger than one and a half time the value of the marginal cost of abatement pollution ($\varphi>1.5\gamma$) for any number of foreign firms located in the host country. Without loss of generality we can say that the optimal pollution policy is zero with a sufficiently large marginal pollution disutility. A large marginal pollution disutility implies that the damage for polluting on the health of the people is larger than the benefit in consumer and producer surplus.

On the other hand, by (24) we can see that the government is going to set a more relaxed pollution

[1] This sensibility may change according to many factors like election times and political scandals.

quota ($z^* > 0$), when the marginal cost of abatement pollution is at least as the value of the marginal pollution disutility ($\gamma \geq \varphi$). But according to the concavity condition, the cost of abatement pollution should not be larger than 4/3 the value of the marginal pollution disutility $\left(\frac{4}{3}\varphi \geq \gamma\right)$ for any number of foreign firms located in the host country. Therefore, in order to guarantee the concavity condition, the government will set a positive pollution quota when the marginal cost of abatement is between one and 4/3 of the value of the marginal disutility $\left(\frac{4}{3}\varphi > \gamma \geq \varphi\right)$ for any number of foreign firms located in the host country. Without loss of generality, we can say that the optimal pollution policy is positive when the marginal cost for abating pollution is at least as larger than the marginal pollution disutility holding the concavity condition.

In the second case, with a large level of corruption ($p \geq 1$), the government has incentives to set a more relaxed pollution policy because of the value of the political contribution. A large level of corruption means that government is more sensible to any political contribution and it is included in the government's objective function. Even in this case, the optimal policy could be setting a strict pollution policy ($z^* = 0$) if the marginal pollution disutility is sufficiently large $(\varphi \geq 0)$. Different to the previous case, the corruption in the government reduces the impact of the marginal pollution disutility in the optimal policy decision because, besides the cost of abatement pollution and its effect on consumer and producer surplus, the government receives an income given by a political contribution. The level of marginal pollution disutility should be much larger than in the previous case in order to set the strictest pollution policy.

On the other hand, the government is willing to set a relaxed pollution policy ($z^* > 0$) when marginal pollution disutility is sufficiently smaller than the combined value of the marginal cost for abatement and the level of corruption. This is an ambiguous case since the large level of corruption may be enough to set a positive pollution policy independent of the cost of abatement pollution (which can be larger or smaller than the marginal pollution disutility but positive in any case) or the number of foreign firms.

Certainly, the positive pollution policy may be the result of a combination of these two variables (cost of abatement pollution and corruption level) over the marginal pollution disutility, but without loss of generality we can always have a sufficiently large corruption parameter in order to set a relaxed pollution policy taking into account that the marginal pollution disutility is small and the cost for abating pollution is positive.

However, this result is related to the concavity condition. From (21) and (23) we can write:

$$\left[\frac{2p+n}{n+1}\right]\gamma > \varphi\frac{1}{2}\left[\frac{2p+n}{n+1}\right]\gamma.$$

The first term above should be larger than the marginal pollution disutility to have a positive pollution policy; and the third term, which is exactly the half of the first term, should be smaller than the marginal pollution disutility in order the concavity condition to hold. Therefore, with a level of corruption sufficiently large, the optimal pollution quota will be positive holding the concavity condition. We can write the following:

Proposition. *In a partial equilibrium model, a country hosts competing foreign firms in an oligopolistic industry; these firms produce pollution and offer political contribution in order to influence a pollution policy set by the host government. When the government pursues a pollution quota, the optimal pollution quota will be:*

$$if\ p = 1 \begin{cases} and\ \varphi > 1.5\gamma, & then\ z^* = 0, \\ and\ \varphi \leq \gamma, & then\ z^* > 0. \end{cases}$$

$$if\ p \geq 1 \begin{cases} and\ \varphi \geq 0, & then\ z^* = 0, \\ otherwise & then\ z^* > 0. \end{cases}$$

Intuitively, the weight attached to the political contribution made by the foreign firm is relevant for the following analysis. When the level of corruption is small, the weight of the political contribution is limited and the government is willing to maximize the benefit of the society in terms of consumer and producer surplus as well as to minimize the pollution impact on the health of the people as a result of the production process of foreign firms.

With a small or null corruption level, the government is willing to set a strict pollution policy when the marginal pollution disutility is larger (one and a half times) than the cost of abatement pollution, since the impact of pollution on the health of the people is larger than the benefit in consumer and producer surplus of having more production. The government will set the strictest policy ($z^* = 0$) in order to reduce the amount of pollution *via* the reduction in the amount of output produced.

However, when the cost for abating pollution is larger than the marginal disutility, the government is willing to set a lax pollution policy ($z^* > 0$) in order to encourage the production and benefit from a larger consumer and producer surplus despite the damage given by pollution. The consumer and producer surplus together are larger than the effect of pollution caused by increased production.

With a large corruption level, the contribution is a valuable objective for the government. The setting of a positive pollution quota is encouraged not only for the benefit in consumer and producer surplus but also the benefit granted by the political contribution.

However, with a sufficiently large marginal pollution disutility the government is willing to set the strictest pollution policy despite the loss in consumer and producer surplus and the political contribution. This large marginal pollution disutility can be seen as a manifestation of social groups in order to press government due to a weak political position against pollution control. This pressure faced by the government could be so strong that there is not enough political contribution to overcome the social reaction.

However, when the social body is not sensible to environmental concerns, a large political contribution could be enough to set the laxest pollution policy. A passive society in environmental issues may produce some disgraces in the sustainability of their society.

Conclusions

Underestimating the power of corruption in government and firms may affect the society's welfare through environmental distortions such as pollution. In this sense, the impact of corruption on the competitive advantage and disadvantage of competing foreign firms may produce strong implications on environment.

Corruption is a very complicated issue. Historically, in many developing countries corruption may have seen as an institutional way in which the society looks for compensation to the inefficiencies of the formal institutions. On the other hand, corruption is also inherent to culture, idiosyncrasies and even religion (bribery, for example, has not only been a way to compensate the low wage rates, but also has part of a tradition involving social values). Nowadays, corruption is a survival strategy that represents a source of income for people and government of these countries.

On the other hand, the same government may have a political interest in supporting the illegal structures since these structures provide monetary resources. The political competition between political parties implies the need to get contributions to secure the continuity in the power. These contributions come from corrupted lobbies and dishonest people who try to influence the political decision.

This paper attempts to explain the relationship between FDI and corruption in the presence of foreign firms and government in the setting of environmental policies to control pollution. The corruption in the government and the benefit obtained by foreign firms can inhibit any action to set a clear and healthy environmental policy. Bribes are the origin and the result of corruption; the foreign firms make payments to the party in the power to guarantee the setting of a lax environmental policy according to their needs. Likewise, the government has to consider the benefits of its citizens and a part of the benefits come from bribes from foreign firms. The foreign firms lobby the government taking into account their interests, and the government takes into account both the interests of its nationals and those of the foreign firms.

We model lobbying following the common agency problem. In this framework the government accepts political contributions from the lobbyists and the level of contribution depends on the policy that the government pursues. We analyze two cases: in the first case the level of corruption is small, so the weight of the political contribution is limited and the government is willing to maximize the benefit of the society in terms of consumer and producer surplus as well as to minimize the pollution impact on the health of the people as a result of the production process of foreign firms.

In the first case the government will set the strictest pollution policy when the marginal pollution disutility is larger than the cost of abatement pollution. However, when the cost for abating pollution is larger than the marginal disutility, the government is willing to allow some level of pollution in order to encourage the production and benefit from a larger consumer and producer surplus despite the damage given by pollution.

In the second case, with a large corruption level, the contribution is a valuable objective for the government. The setting of a positive pollution quota is encouraged not only for the benefit in consumer and producer surplus but also the benefit granted by the political contribution. Only in the case in which the pollution disutility is too large the government is willing to set the strictest pollution policy despite the loss in consumer and producer surplus and the political contribution. But when the marginal disutility is not too large, the government will grant a more weight to the political contribution made by foreign firms and the benefit in consumer and producer surplus. Environmental concerns are left far away from the social interest.

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