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Lobbying for Protection under Uncertainty: A Real Option Approach

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Abstract

In this paper we explore the effect of protection lobbying by solving a firm's dynamic optimisation problem where there is uncertainty about future demand, the success of lobbying and non-zero entry/exit costs. We find out that the firms in declining industries tend to lobbying in economic downturn to prevent shutting down factories. On the contrary, the firms in growing industries tend to lobby for preventing other firms from entering the market. The degree of this effect depends on the ratio of exit costs to entry costs. It is shown that the higher the ratio, the stronger the effect is.

Keywords: Protection; Lobbying; Uncertainty; Employment, Real Options.

JEL-Classification: D72, D81, F13

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I. Introduction

The literature on political economy and trade has offered several explanations for the persistence of protection in terms of the interaction between declining industry, lobby, protection and self-interested politicians. Much of the earlier literature modelled the lobbying activities in a "political market" and small open economy, in which the domestic producers in import-competing industries would invest resources in lobbying for the protection until the marginal return on the last unit of contribution was equal to its probable return producing the transfer (see Tullock, 1967; Kemp, 1976; Bhagwati, 1980). The classical analysis of political and economic activities has focused on the rent- or revenue-seeking activities and their associated costs of distortions (see Krueger, 1974; Brock and Magee, 1978; Bhagwati and Srinivasan, 1980; Bhagwati, 1980).

A variety of models have been developed to extend research on the determination of domestic and international policies. One line of research has focused on domestic regulatory policy and trade policy formation. For example, Hillman (1982) adopts the Stigler-Peltzman assumption and uses a Ricardo-Viner framework in which government maximizes a political-support function by balancing the changes of the welfare of two competiting interest groups. Political support thus depends on the regulated domestic price level (see Stigler, 1971; Peltzman, 1976).[1]

A second line of research has emphasized the endogenous determination of trade policies through a political process. If voters in democratic societies are fully informed, the determination of trade policy would depend on the interests of the median voter (see Mayer, 1984). On the other hand, in a representative democracy

[1] See Hillman (1989) for a comprehensive survey of this approach. See also Long and Vousden (1991), and Choi (2001).

framework, interest groups can probably enforce the lobbying pressure on bureaucrats or legislators to influence economic policies in favour of themselves.[2] The approach recently developed in Grossman and Helpman (1994) combines elements of these two lines, in which profit-maximizing lobby groups make political contributions to influence government policies, while the self-interested politicians maximize the objective function that is linear in social welfare and total contributions collected.

The endogenous nature of trade policies is abundantly analyzed in a large number of contributions in previous literature. When attention is turned to determine the path of industry adjustment and lobbying over a long period, in earlier literature the industry and politicians are assumed to engage in the political activities of a simplified repeated timing structure. From the standpoint of a single firm or an import-competing industry within a country, the benefits of protection can be significant and hence firms will have strong incentives to invest effort and money into the political process to secure benefits or defer collapses.[3] Under this framework, there exists no uncertainty throughout the whole political process, i.e. the more the interest groups contribute, the more protection they can obtain.[4]

Clearly, the self-interest assumption looks much less adequate in contemporary interational political economy where trade policies are presumably determined by complex interactions between the counterpart interest groups and politicians within domestic politics. In this paper, we will therefore adopt a quite

[2] Hillman (1989) and Riezman and Wilson (1995) review the literature. See also Brock and Magee (1978), Findlay and Wellisz (1982), Rodrik (1986), Young and Magee (1986), and Magee et al. (1989) for the political economy models.

[3] Hillman (1982), Cassing and Hillman (1986), and Choi (2001) adopt the political-support function to analyze the protectionist responses to declining industries. Using the Grossman-Helpman framework, Brainard and Verdier (1994, 1997) investigate the industry's optimal adjustment path under lobbying. Brainard and Verdier (1997) is also concerned with the political process for growing industries.

[4] Exceptions to this include Bhagwati and Srinivasan (1980), Moore and Suranovic (1992), whose models are consistent with the political model.

plausible assumption that domestic industry of the import-competing good is uncertain about the tendency of future prices and tariffs, and therefore its revenues.[5] The uncertainty of firm's revenues is introduced in Baldwin and Robert-Nicoud (2002) by considering that a firm has two different values when it is facing high vs low demand. By using that, they demonstrate that the only-losers-lobby equilibrium is a Markov perfect equilibrium and also a dominant strategy. We will re-examine firm's decision to lobby or not with a lobbying model of the *real options* type. By doing so, we then are allowed to consider the impact of uncertainty and real options on the decision of industry lobbying.

Real option theory considers the benefit to a firm of delaying irreversible investment decisions when facing an uncertain economic future (see Dixit and Pindyck 1994 for a comprehensive analysis of real option theory). In widely cited paper, McDonald and Siegel (1986) use real option theory to show that the required rate of return on investment in many large industries can be more than doubled by moderate amounts of uncertainty when the investment is at least, in part, irreversible. Pindyck and Solimano (1993) examine the empirical relationship between uncertainty and investment. They use measures of economic and political instability to proxy for uncertainty about the marginal profitability of capital and inflation to proxy economic uncertainty. They find that inflation is invers ely correlated with investment.

The use of real option theory to analyze investment under uncertainty has become increasingly popular (see Dixit and Pindyck, 1998; Coy, 1999). The real option approach argues that firms may benefit from waiting for more information

[5] Recently viewing agents' interactions in game theoretical terms has also proved helpful in understanding certain features of international political economy (See Bagwell and Staiger, 1997; Levy, 1999).

concerning the economic environment before making investment decisions. This benefit (or real option) is lost once the decision is made. Consequently, the firm requires the NPV to be considerably greater than zero to compensate for the lost benefit before deciding to invest.

Real option theory is relevant to any investment decision where adjustment costs are irreversible and there is uncertainty. For examples, firms may exercise real options in relation to changing production, taking over a rival, diversifying markets, closing factories (see McDonald and Siegel, 1986), hiring new employees, and firing employees (see Bentolila and Bertola, 1990; Chen and Zoega, 1999; Booth et al, 2002).

Our analysis shows the relationship between protection lobbying and industry decision can be explained within the approach of real options. Furthermore, we show that in an uncertain environment combined with high ratio of exit costs to entry costs, firms in declining industry lobby for protection in economic downturns and firms in growing industry lobby for preventing poential entry from other firms in strong demand. The high ratio of exit costs to entry costs implies that entry options play crucial role in firms' decisions of lobbying, entry, and exit in facing an uncertain demand.

The remainder of this paper is structured as follows. Section II develops a theoretical model which describes how demand uncertainty might influence firm's entry and exit decisions and protection lobbying. Section III discusses the calibration results. Finally, section IV exlpores on some of the policy implications of our findings and suggests avenues for future research.

II. The Theory of the Firm

For simplicity, the production function of the representative firm is denoted by a Cobb-Douglas production function

$$Y = \theta N^{\alpha} K^{1-\alpha}, \ 0<\alpha<1, \tag{1}$$

where N is the number of employees engaged in production, K capital stock, and θ he efficiency parameter. The capital stock K is taken as given at any point in time and normalised to one, which gives the following strict concavity of the production function.

$$Y = \theta N^{\alpha}, \tag{2}$$

It is assumed that the firm is in an import-competing industry of imperfect competition. The firm faces an isoelastic demand function where p and Y denote the price and the output, respectively (See Abel and Eberly, 1994).

$$p = Y^{(1-\psi)/\psi} Z, \quad \psi \geq 1, \tag{3}$$

where Z represented the source of the demand shock, by stochastic process and/or jump processes by protection lobbying, ψ is an elasticity parameter with minimum value of 1 under perfect competition. If the firm is lobbying, then the current profits become

$$\Pi = \theta^{1/\psi} Z N^{\alpha/\psi} - wN - \gamma H - c, \tag{4}$$

where w and γ denote the wages for employees and lobbyists hired by the firm respectively, c represents fixed cost of employment and physical capital to spread these costs over adjustment, and H is the total number of the lobbyists. Note that the wage for the lobbyists, γ is higher than employees' wages, w, and H is assumed less than N. The lobbyists are assumed not to participate in production, but to be related to the possible jump in demand by lobbying for protection.

The risk-neutral firm has two-stage optimal choices. First it chooses employment to maximise its expected discounted value of profits. After optimisation of employment, the employment level becomes a function of demand. In the second stage, the firm considers its entry/exit problem according to the fluctuations of demand. The firm's expected discounted value of profits is:

$$V = \max_{N} \int_{0}^{\infty} \left[\theta^{1/\psi} Z N^{\alpha/\psi} - wN - \gamma H - c \right] e^{-rs} ds \,, \qquad (5)$$

where r is the required rate of return for the industry.

Under increasing globalization and a rise around the world of steps toward special regional trading agreements, fluctuations of demand faced by the firm realistically come from two sources of uncertainty: the economic and non-economic activities. One on hand, real world investment and profit of the firm can be sensitive to volatility and uncertainty over the economic environment. One the other hand, under the World Trade Organization (WTO) auspices, it is anticipated that the WTO contracting parties would undertake a series of negotiating rounds in which each country would make concessions to its trading partners in order to gain something in the trading system. Thus, the non-economic activities such as the political decisions of lobbying to influence industry and trade policy outcomes undoubtedly contribute to the uncertainty of firm's revenue. To consider this, we assume that firm's demand follows a combined geometric Brownian motion and jump processes as follows:

$$dZ = \eta Z dt + \sigma Z d\varpi + dq_1 - dq_2 \,, \qquad (6)$$

where ϖ is a Wiener process; $d\varpi = \varepsilon\sqrt{dt}$ (since ε is a normally distributed random variable with mean zero and a standard deviation of unity), η is the drift parameter, σ the variance parameter, dq_1 and dq_2 are the increments of Poisson processes (with mean arrival rates λ_1 and λ_2). It is assumed that if an “event 1” (or “event 2”) occurs, Z increases (or falls) by ϕ_1 (or ϕ_2) percents with probability 1. Over each time interval dt, there is a probability $\lambda_1 dt$ (or $\lambda_2 dt$) that it will rise up (or drop down) by $\phi_1 Z$ (or $\phi_2 Z$) and Z fluctuates until next event occurs. In this model, if the firm succeeds in expending resources to influence government policy in its favour, the demand for its goods is supposed to rise up, i.e. event 1. The occurring jump by political lobbying would be partially offset by drops in the demand, i.e. event 2. We assume that the probability of jump is higher than the one of drop. Note that it is assumed that (dq_1, dq_2) and $d\varpi$ are independent to each other. Thus, $E(d\varpi dq_1) = 0$, $E(d\varpi dq_2) = 0$, and $E(dq_1 dq_2) = 0$.

By using Itô’s Lemma, the Bellman equation for the case of lobbying for the value V at time zero in the continuation region is:

$$\begin{aligned} rV = \theta^{1/\psi} Z N^{\alpha/\psi} - wN - \gamma H - c + \eta Z V_Z + \frac{1}{2}\sigma^2 Z^2 V_{ZZ} \\ + \lambda_1 \{V(Z(1+\phi_1)) - V\} - \lambda_2 \{V - V((1-\phi_2)Z)\} \end{aligned} \quad . \tag{7}$$

The first term on the right-hand side is revenue, wN is the total wage bill, and γH is the total wage bill for the lobbyists. $\eta Z V_Z$ is the gain due to demand growth, $\frac{1}{2}\sigma^2 Z^2 V_{ZZ}$ denotes the changes caused by stochastic changes in demand, and the last two terms are the change in the value of the firm caused by changes in lobbying. The firm always optimises its labour employment level to maximise the discounted profit before making its entry and exit decision. The first-order conditions for L gives[6]:

[6] Here we assume that there are no sunk costs for hiring and firing. For the impact of irreversible labour-related sunk cost investment, see Bentolila and Bertola (1990) and Booth et al (2002).

$$\frac{\alpha\theta^{1/\psi}}{\psi} ZN^{\alpha/\psi-1} = w. \tag{8}$$

When the demand is changed by its trend growth, wiener process, and/or lobbying, the firm chooses its optimal employment level N^*, determined by equation (8). Rearranging the terms gives the optimal employment level N^*, given the demand level:

$$N^* = \left(\frac{\alpha\theta^{1/\psi}}{\psi w} Z\right)^{1\Big/\left(1-\frac{\alpha}{\psi}\right)}. \tag{9}$$

Plugging the variable N^* into Equation (7) then gives:

$$\begin{aligned} rV = \theta^{1/\psi} Z(N^*)^{\alpha/\psi} - wN^* - \gamma H - c + \eta Z V_Z + \frac{1}{2}\sigma^2 Z^2 V_{ZZ} \\ + \lambda_1\{V(Z(1+\phi_1)) - V\} - \lambda_2\{V - V((1-\phi_2)Z)\} \end{aligned}. \tag{10}$$

To find the impact of protection lobbying on the entry/exit of the firms we need to find out the optimal condition after the optimisation of employment. Since the decisions for entry/exit involve sunk-cost investment, the firm needs to compare the marginal costs and benefits of entry and exit. The solutions for $V(Z)$ of equation (10) consist of the particular solution and complementary solution. We first deal with identification of uncertainty effects in the very special case where there exist no sunk costs for entry and exit. This special case turns out to be useful as a starting point and for comparisons. Then we turn to the general case with sunk costs of entry and exit.

The particular solutions of equation (10) can be written as the following integral:

$$V^P(Z) = E\left[\int_0^\infty \left[\theta^{1/\psi} Z(N^*)^{\alpha/\psi} - wN^* - \gamma H - c\right] e^{-rs} ds\right]. \tag{11}$$

We then have the following particular integral:

$$V^P(Z)=\frac{\theta^{1/\psi}Z(N^*)^{\alpha/\psi}}{r-\eta-\lambda_1\phi_1+\lambda_2\phi_2}-\frac{wN^*}{r}-\frac{\gamma H}{r}-\frac{c}{r}. \quad (12)$$

The firm's option values of entry and exit in the future are represented and measured by the complementary function:

$$rV=\eta ZV_Z+\frac{1}{2}\sigma^2 Z^2 V_{ZZ}+\lambda_1\{V(Z(1+\phi_1))-V\}-\lambda_2\{V-V(Z(1-\phi_2))\}. \quad (13)$$

Letting v^G be the value of the option, the general solutions have the following forms[7] [See the Appendix A]:

$$V_I^G(Z)=A_1 Z^{\beta_1}, \quad (14)$$

$$V_E^G(Z)=A_2 Z^{\beta_2}, \quad (15)$$

where β_1 and β_2 are the positive roots of the following characteristic equation:

$$\frac{1}{2}\sigma^2\beta(\beta-1)+\eta\beta+\lambda_1\left[(1+\phi_1)^\beta-1\right]-\lambda_2\left[1-(1-\phi_2)^\beta\right]-r=0. \quad (16)$$

Following the standard approach of real options (e.g., see Dixit and Pindyck; 1994), the value-matching conditions for the entry and exit demand thresholds $[Z_I \text{ and } Z_E]$ are denoted by

$$\frac{\theta^{1/\psi}Z_I(N_I^*)^{\alpha/\psi}}{r-\eta-\lambda_1\phi_1+\lambda_2\phi_2}-\frac{wN^*}{r}-\frac{\gamma H}{r}-\frac{c}{r}+A_2 Z_I^{\beta_2}=I+A_1 Z_I^{\beta_1}, \quad (17)$$

$$-\left[\frac{\theta^{1/\psi}Z_E(N_E^*)^{\alpha/\psi}}{r-\eta-\lambda_1\phi_1+\lambda_2\phi_2}-\frac{wN^*}{r}-\frac{\gamma H}{r}-\frac{c}{r}\right]+A_1 Z_E^{\beta_1}=E+A_2 Z_E^{\beta_2}, \quad (18)$$

where N_I and N_E are optimal values for *N* computed via equation (9) for the entry and exit demand thresholds Z_I and Z_E. When the representative firm decides to set

[7] Since there are no sunk costs for the adjustment of employment level, the firm adjust the employment continuously until *Z* fluctuates to hit either investment or dis-investment thresholds. This implies that the firm faces a two-stage decision-making problem and thus takes the first-stage optimal value of *N* as given when making the entry/exit decisions. This indicates that the general solutions only contain the component of *Z*, not *N*.

up a new factory, it gains V^P and the option to discontinue its operations in the future, V_E^G, while pays the entry costs I and sacrifices an option to enter later, V_I^G. When, during an economic downturn, the firm then decides to close down its operations and shut down the factory, it gains $-V^P$ (since V^P is then a negative number) and an option to re-enter V_I^G, while pays the exit costs E, and sacrifices an option to go out of business later, V_E^G. Finally, the smooth-pasting conditions follow:

$$\frac{\theta^{1/\psi}(N^*)^{\alpha/\psi}}{r-\eta-\lambda_1\phi_1+\lambda_2\phi_2}+A_2\beta_2 Z_I^{\beta_2-1}=A_1\beta_1 Z_I^{\beta_1-1}, \tag{19}$$

$$-\frac{\theta^{1/\psi}(N^*)^{\alpha/\psi}}{r-\eta-\lambda_1\phi_1+\lambda_2\phi_2}+A_1\beta_1 Z_E^{\beta_1-1}=A_2\beta_2 Z_E^{\beta_2-1}. \tag{20}$$

Equations (17), (18), (19) and (20) form a non-linear system of equations with four unknown parameters, Z_I, Z_E, A_1 and A_2, and can be solved for numerically once the solutions for β_1 and β_2 are obtained from (16) and the optimal values for N_I and N_E via equation (9).

Note that the entry and exit policy of the optimising firm is discontinuous. In some periods the optimal strategy of the firm will be determined to adjust the number of employees. Under other demand fluctuation conditions, the firm will enter or exit from the market. More specifically, the inaction will always be chosen when deviations of the expected marginal product of the firm from the optimal level do not justify the costs of entry/exit adjustment. In such situations, the firm prefers to adjust the actual level of employment. Notice that adjustments to entry/exit will only be observed when deviations in the expected marginal revenue product of labour from the optimal level are large enough to compensate for the entry and exit costs and net value of relevant options. In other words, entry and exit costs generate a corridor of inaction. This region is identified by the upper, Z_I, and lower, Z_E, control barriers. In next section, we discuss the results of numerical simulations.

III. Numerical Simulations

Most of the structure of the simulated model was shown and explained in the previous section. To have a feel on the quantitative importance of the various factors discussed above, we present some numerical examples. Unless otherwise noted, in what follows we keep some of the numerical values of the parameters fixed throughout the calculations, and others will be varied over a range to examine the comparative effects. The fixed parameters include the wages for employees and lobbyists hired by the firm, $w = 1.0$, $\gamma = 1.2\ w$; when the total number of professional lobbyists is relatively less than that of workers the quantities are fixed at $H = 0.02$.[8] Parameters of the production function are also fixed, the constant $\theta = 2.0$ and the exponent $\alpha = 0.5$; while the adjustment cost is fixed at $c = 0.5$. The discount factor which reflects the *required* rate of return for the firm is set to be $r = 0.15$. The price elasticity of demand parameter is set at $\Psi = 1.5$ as in Bovenberg et al. (1998). Without loss of generality, the parameters denoting for the tendency of demand growth are initially fixed at $\eta = 0$ and $\sigma = 0.12$. Finally, throughout the exercise the unit time length corresponds to one year.

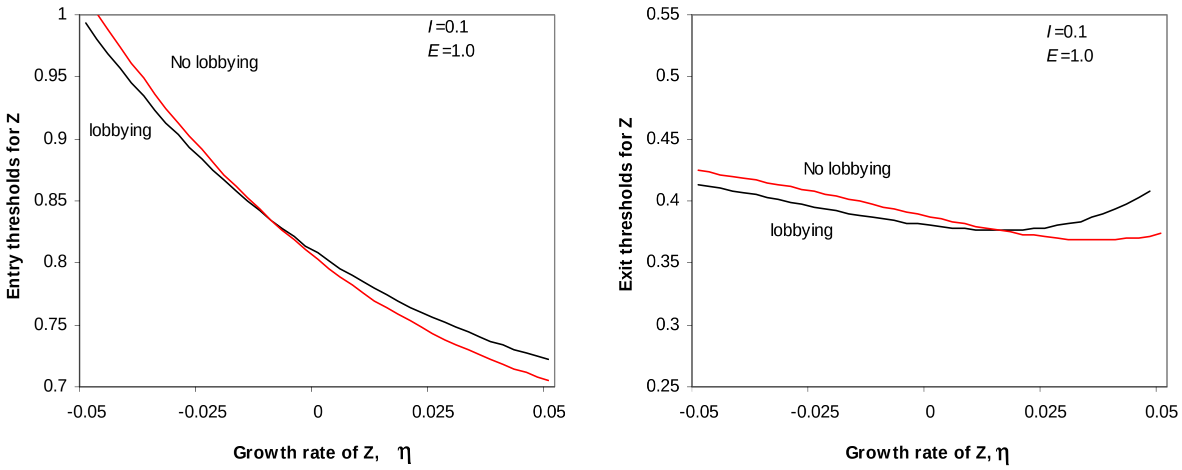
Turning to the parameters that are the focus of our study, we consider first two events in the rules for the firm pursuing protection lobbying (See the descriptions following equation 6). To match the figures of real worlds, we assume that λ_1 is greater than λ_2, i.e. the probability of the demand for the firm's goods to rise up is greater than that to drop down. The parameters are fixed at $\lambda_1 dt = 0.3\ dt$ and $\lambda_2\ dt =$

[8] Note that the optimal value of N is roughly equal to 1.0 if there are no sunk costs for entry and exit.

0.15 dt, while the amounts of demand changes in the two events are fixed at $\phi_1 = 0.1$ and $\phi_2 = 0.1$. In the last part of the simulations, we will plot the 3-D graphs in which both ϕ_1 and ϕ_2 are allowed to change over the range [0, 0.1] to enrich our analysis.

Figure 1 presents results of the impact of demand growth on the entry and exit thresholds with/without lobbying for the case where the entry cost is relatively lower than the exit cost, e.g. $I = 0.1$ and $E = 1.0$.[9] With a fixed cost of adjustment, as illustrated in Figure 1, in the presence of option effect, higher growth in demand growth rate will lead to lower thresholds for entry, which implies that firms wait less to enter the market. The figure also shows that lobbying would lead to lower thresholds for entry in economic downturn, i.e. the senescent industry chooses to lobby for protection to keep on in business and avoid closure of factory. It makes sense and is supported by most of the earlier literature.

Figure 1: The Impact of Demand Growth on the Entry and Exit Thresholds for *I* = 0.1 and *E* = 1.0.



However, as shown in Figure 1 lobbying would lead to higher thresholds for entry and exit in booms. That is, for high-growth industries, firms would choose not to lobby for preventing closure of factories. If the firm does choose to lobby, it is for higher exit thresholds for preventing entry from other firms. One of what the results show is probably due to the difficulty for incumbent firms to conquer the problem that rents in expanding industries attract entrants who will preferably perform as free riders, even for a very short period. The result above echoes the findings by Brainard and Verdier (1997). However, the reason for this is quite different. The important point stressed in the model is that for the declining industry if firms choose to lobby, then in economic downturn the entry options in exit thresholds would be higher due to higher demand level. Therefore, firms would wait longer to shut down factory since the benefit of shutting down is higher. For the growing industry, the entry options are more important in entry thresholds than in the exit thresholds. Therefore, the lobbying has greater effect in preventing other firms from entering the market, not in preventing from shutting down the factory.

The analysis above is most due to the entry option in exit decision. The effect of changes in the entry cost is shown in Figures 2 and 3. As can be seen from theses figures, as the entry cost increase from 0.1 to 1.0 and 10.0, the entry thresholds denoting for lobbying option become significantly steeper, i.e. the value of the option to lobby is getting higher with higher demand growth. In contrast, the crossover in the exit threshold lines almost disappears – it is almost optimal to lobby for preventing shutting down the factory even for high growth industry. The reason is that the entry option in exit decision is getting smaller due to high entry costs/entry thresholds and the effect is smaller.

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[9] Note that in the case of no-lobbying, the values of λ_1 and λ_2 are set to zero.

Figure 2: The Impact of Demand Growth on the Entry and Exit Thresholds for *I* = 1.0 and *E* = 1.0.

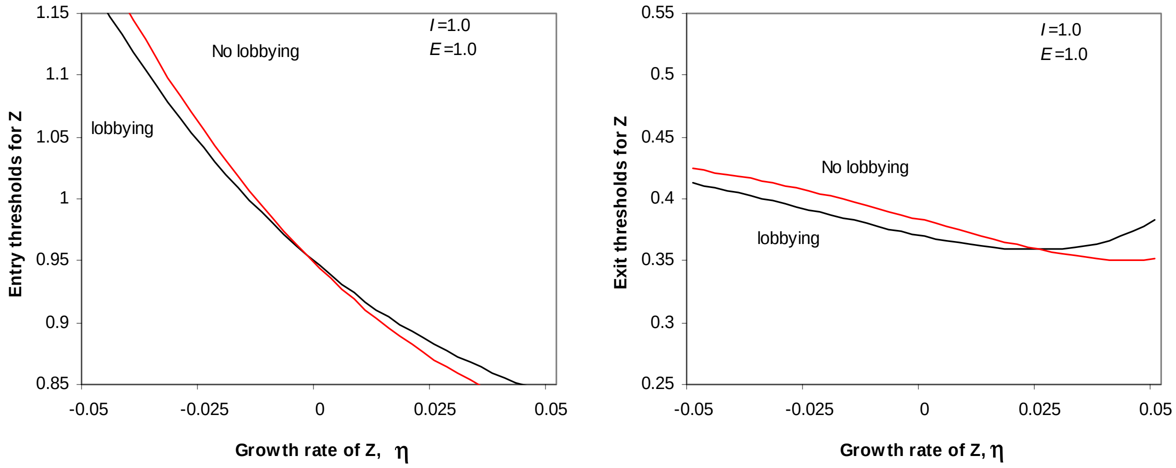
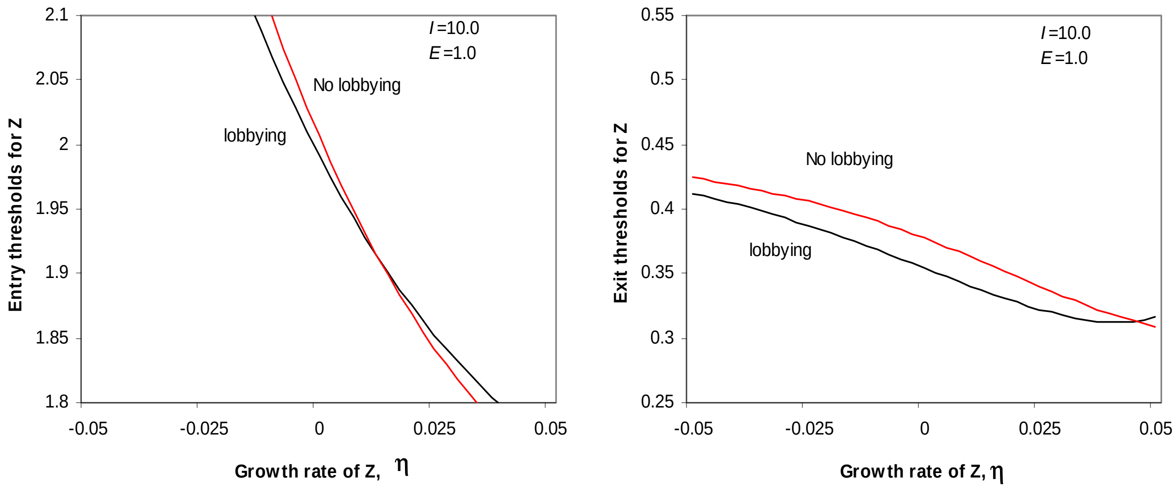


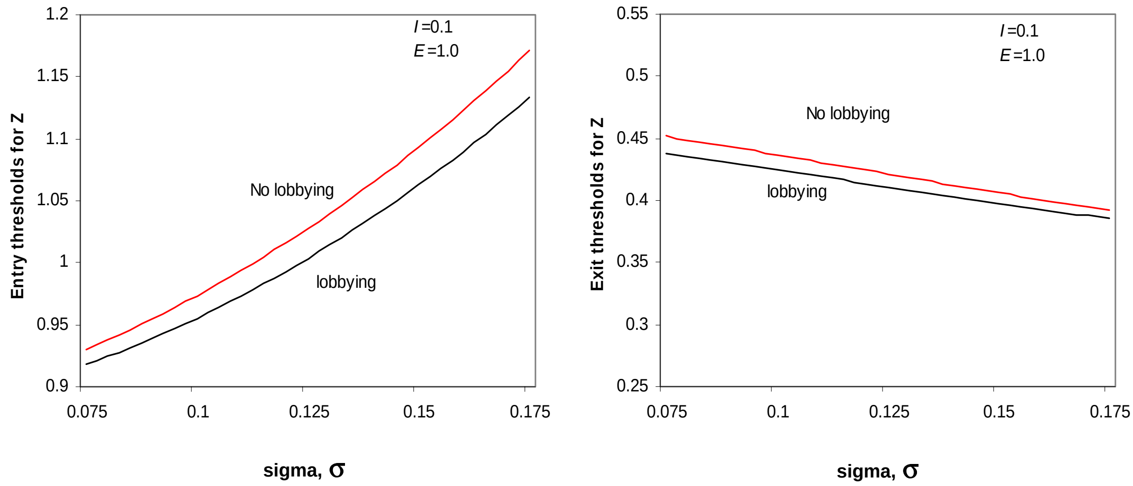
Figure 3: The Impact of Demand Growth on the Entry and Exit Thresholds for *I* = 10.0 and *E* = 1.0.



To get a better idea of factors that affect the value of the lobbying option, we next consider the effect of the volatility of the combined geometric Brownian motion representing demand uncertainty, i.e. the variance of firm's demand growth on the option (See the second term in the right hand side of equation (6)). As an illustration, Figure 4 shows the case in which $\eta = -0.05$ and all other things are set equal except that σ is allowed to change throughout the simulation. Observe that the entry thresholds indicating the lobbying and no lobbying cases increase when σ increases. Leaving aside the possibility of protective lobbying by firms in the senescent industry, as in the existing literature, here we find that the threshold value where investment takes place increases in the variance of firm's demand growth. That is, greater uncertainty increases the value of a firm's entry option, but for the same reason that reduces the firm's incentives to take action actually. As a result, in volatile economic and political environment, the best policy is to keep options open and await new information rather than commit an investment immediately. Figure 4 also demonstrates that lobbying would lead to lower thresholds for entry in economic downturn. Thus, the senescent industry always chooses to lobby for protection to stay away from closure of factory. Note as well that the difference between the entry thresholds of lobbying and no lobbying increases in σ, which implies the firm in the declining industry has more incentives of lobbying when the market or economic environment becomes more uncertain.

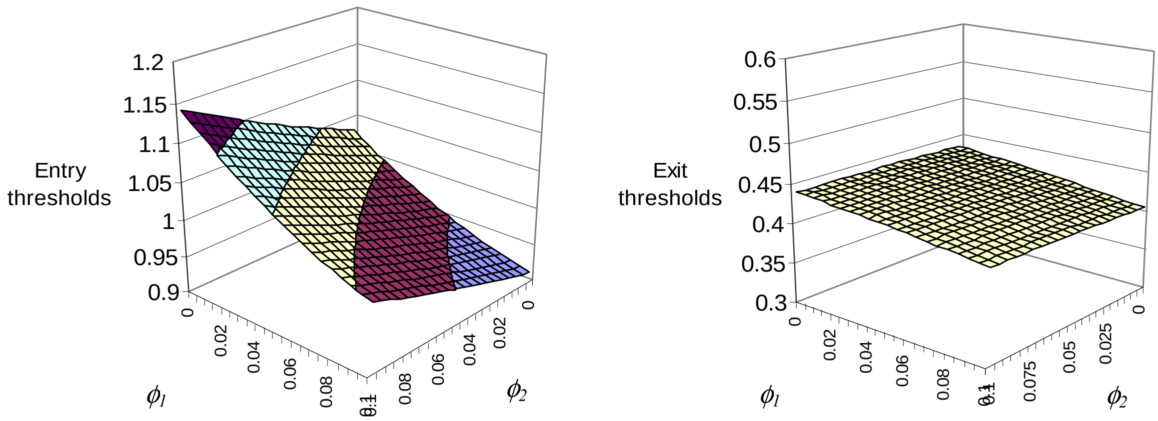
The dependence of the exit thresholds on the variance of firm's demand growth is also shown in the right hand side of Figure 4. Observe that the exit thresholds indicating the lobbying and no lobbying cases decrease when σ increases. Also, note that the difference between the exit thresholds of lobbying and no lobbying cases decreases in σ. Thus, for given large values of σ, the zone of lobbying thresholds shrinks considerably in contrast that of no lobbying thresholds. As one would expect, the uncertainty of demand growth has a greater effect on the firm's investment decision, and for the very reason that induces the firm's incentives to lobby. That is, by doing that, the declining industry under a highly unpredictable economic and political environment is able to capture some certain information to enjoy profits from protection at the expense of lobbying commitments to politicians.

Figure 4: The Impact of the Variance of Demand Growth on the Entry and Exit Thresholds for I = 0.1, E = 1.0 and $\eta = -0.05$.



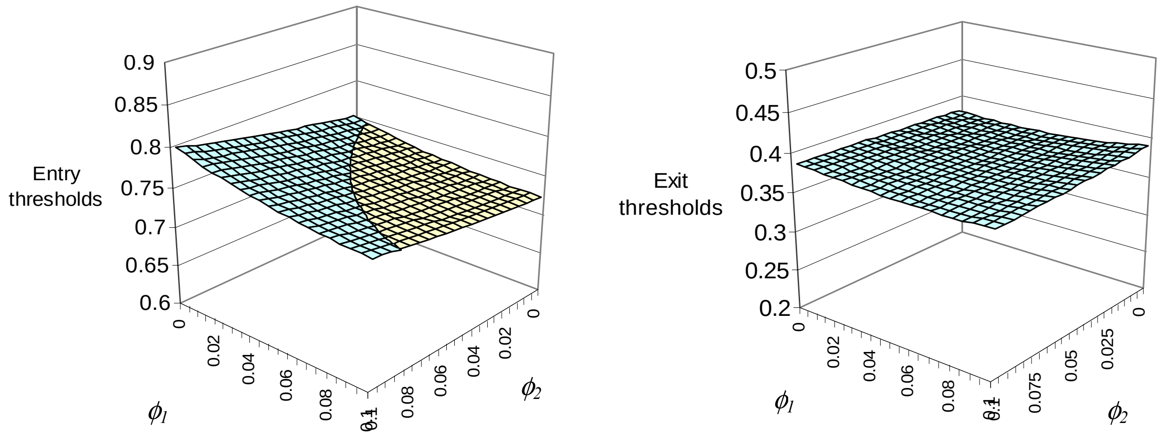
Thus far, the analysis mainly discusses the effects of demand growth rate on the simulations. Recall that we allow for the possibility that the demand for the firm's goods to take a Poisson jump upward is greater than that to take a jump downward once the firm successfully shapes government policy in its favour. The jump process is anticipated, however its arrival date is assumed stochastic. To gain more insight into the effects of protection lobbying pursued by the declining firm on its investment option, let us next turn to investigate the effects of the last two terms in equation (6). The 3-D graphs in Figure 5 show a sensitivity analysis of the entry and exit thresholds, both as functions of ϕ_1 and ϕ_2. These graphs clearly demonstrate the entirely possible lobby-action areas. Note that $\phi_1 = \phi_2 = 0.1$ and $\phi_1 = \phi_2 = 0$ are the benchmark and no-lobbying cases respectively, while that in between would be the impact of success and failure of protection lobbying.

Figure 5: The Threshold Values as Function of ϕ_1 and ϕ_2 for *I* = 0.01, *E* = 1.0 and $\eta = -0.05$.



As seen in the graphs, in a declining industry with $\eta = -0.05$, any changes in ϕ_1 and/or ϕ_2 may lead to big changes in entry thresholds but not exit thresholds. Graphing the entry and exit thresholds against possibilities of demand jumps (ϕ_1 and ϕ_2) gives some idea of how the optimal lobbying rule develops. First, the entry threshold decreases in the differential of $\phi_1 - \phi_2$. (Thus, a higher ϕ_1 drops the value of the entry option therefore the declining industry has every intention of pursuing protection lobbying.) The impact of ϕ_1 and ϕ_2 on the entry thresholds is non-monotonic and asymmetric. This is due to the fact that there are two terms that depend upon ϕ_1 and ϕ_2. The first of these is the entry option value of waiting which is increasing in ϕ_1 (higher ϕ_1 means higher uncertainty) while the second effect is expected profitability, which lowers the entry thresholds. Note that the effect of higher expected profitability dominates as ϕ_1 increases; however effect of the dominance of ϕ_1 falls with higher ϕ_1. Similarly there are two terms depending on ϕ_2. A higher ϕ_2 leads to higher entry options (due to higher risk) and lower expected profitability. Both effects would increase the entry thresholds and firms are reluctant to invest. Both effects of risk and profitability would make entry less attractive. The higher value of ϕ_2, the stronger effects of risk and profitability are. (On the other hand, an increase in ϕ_2 increases the option value of waiting hence reduces the lobbyist's intention to take action.) Second, all other things equal as both ϕ_1 and ϕ_2 increases at the same rate, the entry threshold decreases insignificantly. This implies that the declining industry has no intention to lobby since the effect is cancelled out and that eventually there is no effect at all, no matter what the value of the Poisson jump parameter.

Figure 6: The Threshold Values as Function of ϕ_1 and ϕ_2
for I = 0.01, E = 1.0 and $\eta = 0.025$.



To end the section, we consider the case of the lobbying option of a growing industry. Intuition tells us that an incumbent firm in a growing industry may grow rapidly when it lobbies politicians to prevent new entrants and thus enjoy increasing profits. On the contrary, as pointed by Brainard and Verdier (1997), if lobby formation requires the payment of some sunk cost, an incumbent firm in a growing industry faces the greater risk that future rents will be driven away with entry and thus is possibly unwilling to lobby since it is more unlikely to overcome the free-rider problems. As we can see in the graphs of Figure 6, both the critical values of the entry and exit options change trivially with respective to ϕ_1 and ϕ_2 for the case of $\eta = 0.025$. The graphs, which can be regarded as a supplement to Figure 1, help understanding the case where the firm would be indifferent to lobbying.

IV. Summary and Conclusions

Previous literature has mainly analyzed government's choice of trade policy by assuming that lobby formation is assumed exogenous or developing models in which both government policy and lobby formation are determined endogenously. Until recently, Baldwin and Robert-Nicoud (2002) model the uncertainty of firm's revenues when it is facing high versus low demand, and remarkably demonstrate why losers "pick government policy" rather that government policy picks losers. In this paper we have focused instead on the link between lobbying and political (and/or economic) uncertainty by employing ideas and analytical techniques developed in the real options literature.

One important feature of our model is that an industry decides whether or not to contribute to a lobbying attempt based on individual expected discounted value of profits, and that the opportunity to lobby for protection is simply assigned to one firm only. We have shown that an uncertain political and economic environment exerts a non-trivial influence on industry's lobbying decision. The first result is that when the entry cost is relatively lower than the exit cost, in the presence of option effect, lobbying would lead to lower thresholds for entry in economic downturn, which means the senescent industry chooses to lobby for protection to avoid closure of factory. In contrast, lobbying would lead to higher thresholds for entry in booms. That is, for high-growth industries, firms would choose not to lobby, unless they choose to prevent new entry into market.

The second result is that greater uncertainty increases the value of a firm's entry option, but for the same reason that reduces the firm's incentives to take action actually. For a firm in volatile economic and political environment, the best policy is to keep options open and await new information rather than commit an investment immediately. Finally, our model shows that with either a higher ϕ_1 or a lower ϕ_2, the declining industry has every intention of pursuing protection lobbying. On the contrary, the firm in a growing industry is possibly unwilling to lobby.

The model developed above is certainly stylized and thus may not capture all of the details. However, the model contributes to the literature by shedding light on the inter-linkages between policy uncertainty, option value and the motivation of lobby at the firm level. The extension is also useful for identifying the conditions under which firms in a declining industry are more willing to lobby than those in a growing industry.

The Appendix:

Assume that the solution to equation (13) in the text is represented by the following functional form:

$$V = AZ^{\beta} . \tag{A1}$$

This gives the following relationships

$$\eta Z V_Z = A\eta\beta Z^{\beta} , \tag{A2}$$

$$\frac{1}{2}\sigma^2 Z^2 V_{ZZ} = \frac{1}{2} A\sigma^2 \beta(\beta - 1)Z^{\beta} \tag{A3}$$

$$\lambda\{V(Z(1+\phi_1)) - V\} = \lambda A Z^{\beta}\{(1+\phi_1)^{\beta} - 1\}, \tag{A4}$$

$$(1-\lambda)\{V - V(1-\phi_2)\} = (1-\lambda)AZ^{\beta}\{1 - (1-\phi_2)^{\beta}\}, \tag{A5}$$

Substituting (A2), (A3), (A4), and (A5) into (13) in the text gives the characteristic equation (14) in the text.

$$\frac{1}{2}\sigma^2 \beta(\beta - 1) + \eta\beta + \lambda_1\left[(1+\phi_1)^{\beta} - 1\right] - \lambda_2\left[1 - (1-\phi_2)^{\beta}\right] - r = 0 . \tag{A6}$$

Thus, we have the homogeneous solutions of (14) and (15) in the text:

$$V_I^G(Z) = A_1 Z^{\beta_1} ,$$

$$V_E^G(Z) = A_2 Z^{\beta_2} ,$$

where β_1 and β_1 are the positive and negative roots for the characteristic equation respectively.

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