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HABITUAL AND OCCASIONAL LOBBYERS IN THE US STEEL INDUSTRY: AN EM ALGORITHM POOLING APPROACH

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Abstract:

Using firm level data from the U.S. steel industry, we find that lobbying for import protection is habit forming, as suggested in the rent-seeking literature. Controlling for firm performance and other factors, past lobbying increases the likelihood of current lobbying in our full sample. Because addicted firms should behave differently from other firms, we let an EM algorithm to sort our firms into groups with differing propensity to lobby. A two pools model consisting of occasional and habitual rent-seekers emerges. Occasional rent-seekers' lobbying depends on their market performance. Habitual rent-seekers' lobbying is unrelated to the market performance of the firm, and only depends on previous lobbying. The evidence is consistent with political rent seeking having dynamic economies of scale: rent-seeking makes further rent-seeking easier and more lucrative.

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Introduction

The theoretical rent-seeking literature (e.g. Krueger, 1974; Magee, Brock, and Young, 1989; Baumol, 1990; and Murphy, Vishny, Shleifer, 1991and 1993) suggests political rent-seeking activities have dynamic economies to scale. Past rent-seeking experience reduces the cost of further rent-seeking and increases its return. Thus rent-seekers may, over time, become more prone to further rent-seeking. Like opium, rent-seeking can be additive. Given the social inefficiency of rent-seeking, empirical verification of the self-sustaining nature of rent-seeking is of fundamental importance.

Lobbying for protection from import competition is a form of political rent-seeking behavior. This paper uses data on lobbying for protection by firms in the steel industry in the 1970 s and 1980s to show that an addictive effect does exist. A straightforward empirical investigation is to pool all firm level data and determine whether past lobbying increases the current tendency to lobby. We find that it does.

However, not all firms need be addicted to the same degree. There may be heterogeneity amongst firms' dependence on past lobbying. We therefore apply an EM algorithm approach (Dempster, Laird, and Rubin, 1977) to a lagged-dummy model (Heckman,1982a; 1982b) and let our firms sort themselves into groups according to the determinants of their lobbying activity. We find that an acceptable explanation of our data is a division into two groups: infrequentlobbyers, whose lobbying depends on the firm's business situation; and persistentlobbyers, whose lobbying is essentially unrelated to the firm's business situation but depends mainly on past lobbying. Firms that never lobby for protection end up in the first group. Greater firm size and greater focus in steel production increase the probability of lobbying in both groups, but the influence is stronger for occasional lobbyers. Past sales growth and spending on modern equipment curtail lobbying by occasional rent-seekers, but have no effect on lobbying by persistent rent-seekers. Changes in cashflow have no influence in either. Generally, persistent lobbyers have invested less in physical assets and R&D and account for the lion share of lobbying. These results are consistent with that rent-seeking is habit-forming and that habitual rent-seekers invest less in productivity while specializing in rent-seeking.

In the next section, we describe the intensive lobbying for protection in the U.S. steel industry in the 1970s and 1980s. We justify our contention that lobbying for protection by steel firms in our sample period may be habit-forming and the need to consider groups of firms with dissimilar propensities to lobby for protection. In section three, we present our EM algorithm approach. We explain our data in the fourth section and report our results in section five.

II Habitual Lobbyers and Occasional Lobbyers -- Lobbying in the US Steel Industry

In the U.S., domestic firms under import competition pressure often complain to the government about "unfair" foreign practice. These complaints usually allege either unfair foreign government subsidies or dumping. The U.S. government then investigates the veracity of these claims and decides whether or not material injury has occurred. Sometimes, complainants invoke the "escape clause" (Section 201 of the 1974 Trade Act) which allows temporary protection if imports are causing material injury to a U.S. industry. Foreign firms must actively participate in these investigations to try to prevent biased readings of the data and the subsequent erection of trade barriers. The process is commonly regarded as biased and as a form of administered trade protection (Finger, Hall, and Nelson, 1982, p. 452-466) that coerces foreign firms to curtail their penetration of the US market (e.g. see Hartigan, Perry, and Kamma, 1986 [p. 610-617] and Staiger and Wolak [1994]).

The American steel industry has been subject to intensifying import competition over the past two decades. Deardorff and Stern (1988) report the U.S. trade deficit in steel almost tripled, from $2 billion to $5.9 billion between 1973 and 1983. Crandall (1987, p. 275) documents steel imports to the U.S. increasing from an annual average of

16.49 million tons in the 1973-1979 period to an annual average of 20.06 million tons in the 1980-1986 period, a 22% rise. In contrast, domestic steel output dropped 23% from an annual average of 93.83 million tons between 1973 and 1979 to an annual average of 72.16 million tons between 1980 and 1986. This heightened import competition, along with a declining demand, led to combined losses of $9.5 billion in the 1983-1986 period for the seven major U.S. integrated producers studied by DeAngelo and DeAngelo (1991, p. 4).

In response, some steel companies aggressively sought trade protection. After 1979, when authority over trade complaints was transferred from the Treasury Department to the International Trade Administration (I.T.A.) of the Department of Commerce[1], their lobbying intensified and focused on provisions in Trade Act 1974. In the early 1980's, more than 60% of all petitions for protection submitted to the U.S. government were filed by steel companies. According to Deardorff and Stern (1988, table 2.5), steel companies filed 75% of all "countervailing" complaints and 59% of all "antidumping" complaints in the period from 1980 to 1984.[2]

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[1] The latter was widely perceived as more sympathetic to protectionist arguments. Table 2.5 in Deardorff and Stern (1988) shows that the number of investigations related to trade complaints jumped from one on two per year in the late 1970's to 8 in 1980, 8 in 1981, and 159 in 1982.

[2] Following the filing of an anti-dumping case, the Department of Commerce (or, prior to 1979, the Treasury Department) was to decide within 20 days if the case merited investigation. If the preliminary ruling was affirmative, the International Trade Commission was to decide within 45 days if there was material injury. If the ITC found injury, the Department of Commerce had 110 days to complete its investigation for dumping complaints and 40 days for unfair subsidy complaints. If the Commerce Department found dumping or unfair subsidies, importers of the product were required to post a bond equal to an estimate of the value of the unfair subsidies or dumping margin. The Department of Commerce was to conduct on-site verifications within 75 days. If these verifications showed unfair trade practices, the International Trade Commission was to arrive at an injury determination within 45 days. See Eichengreen and van der Yen, 1984 (p. 72) for further details.

Faced with this onslaught of lobbying, the U.S. government implemented a series of protectionist policies. Trigger price mechanism were established in 1977 and 1980, and “voluntary” export restraints in 1982 and 1984. Trigger prices were floor prices for various steel imports. Imports at prices below these floors were *prima facie* considered to be dumping. The 1977 trigger prices were based on Japanese steel mills' production cost converted to U.S. dollars at historical dollar yen exchange rates. The prices became ineffective barriers as US inflation surged. The 1980 trigger prices were set low to avoid rankling US allies, and were widely viewed as ineffective from the outset. To derail further US protectionist measures, the EC agreed to “voluntary” export restraints in 1982. Protected by these restraints, non-EC steel firms rapidly penetrated the U.S. market. The Reagan administration promised comprehensive multiple bilateral voluntary export restraints in 1984 as U.S. steel firms filed a flurry of petitions for protection, including protection against imports from countries like Poland and Argentina. The EC voluntary export restraints were strengthened, and similar agreements were quickly reached between the US and all major steel exporters. The effects of these protection measures are examined in Crandall (1987) and Lenway, Morck, and Yeung (1996). Their evidence suggests that trade protection of the U.S. steel industry was the fruit of political rent-seeking; it benefited managers and steel workers with tenure-seniority, but did little to improve the competitiveness of American steel firms.

There are dynamic economies of scale in lobbying. This is because lobbying requires large up-front investments in intangible assets like political connections, professional lobbyers, lawyers, and knowledge of political and legal procedures and channels. Once these investments are made, the marginal cost of further lobbying is relatively low. In addition, firms may learn by doing; practice lobbying now leads to more effective lobbying in the future.

Investment theory says firms evaluate investments according to their expected returns. As a firm acquires a history of rent seeking, further investments in rent-seeking offer increasingly attractive returns compared to investments in productive assets. In short, lobbying can induce further lobbying, and firms can become "habitual" lobbyers, who essentially supply lobbying inelastically.

Protection can generate negative externalities. Lenway, Morck, and Yeung (1996) find that protection seeking US steel firms appeared to politically engineer protection that benefited their stakeholders; but that harmed more profitable and innovative US steel firms that were not explicitly seeking protection. (See also Crandall, 1987).

Understandably, therefore, attitudes towards protection may vary among firms in the same industry. While many steel firms actively and repeatedly sought protection, many other firms did so rarely. Some might be free-riding on other firms' lobbying. Some may be in the process of developing a lobbying habit. However, a small minority of steel firms clearly stated their objection to protection during various congressional hearings in the nineteen-eighties. For example, more innovative and profitable steel firms like Nucor explicitly lobbied against trade barriers. Much previous research on lobbying uses industry level data, and so misses such intra-industry differences. Firm level studies, like Lenway, Morck, and Yeung (1996) point to such differences being potentially important.

In summary, there appear to be different types of firms with different tendencies to lobby. Occasional lobbyers lobby in response to negative changes in firm performance and to reductions in competitiveness. They may eventually become habitual lobbyers. Habitual lobbyers supply lobbying inelastically, and their tendency to lobby depends on past lobbying rather than firm performance or characteristics[3]. To investigate this hypothesis, we need to let our sample of US steel firms sort themselves

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[3] It would be desirable to explore also the determinants of stance against trade protection. Unfortunately, we do not have enough data points of such nature to do so.

statistically into groups based on the determinants of their lobbying. To do this, we use an EM algorithm (Dempster, Laird, and Rubin, 1977) approach to a lagged-dummy model of the Heckman (1982 a, b) type. The next section provides technical details.

III An EM Algorithm Pooling Approach

Let i = 1, ... , I, be an index of firms, t = 1, ... T_i, denote the time periods and x_{it} be the vector of explanatory variables describing the ith firm at time period t. Consider the Heckman (1982 a,b) lagged-dummy variable model

$$y^*_{it} = \alpha y_{i,t-1} + x_{it}\beta + \varepsilon_{it},$$

where α and β are unknown parameters, and the errors ε_{it} are independently and identically distributed (iid) and have a standard normal distribution. Suppose the firm lobbies (y_{it} = 1) when $y^*_{it} > 0$, but refrains from lobbying (y_{it} = 0) if $y^*_{it} \leq 0$. The probability of a firm lobbying is therefore $P(y_{it} = 1) = P(y^*_{it} > 0)$. The variable y^*_{it} can be thought of as firm i's "utility" of lobbying in period t.

We conjecture that α is positive. That is, a firm that lobbied in the previous period has a higher probability of lobbying again in the current period than does a firm that did not lobby in the previous period[4].

Let $Y_{it} = (y_{i1}, y_{i2}, \ldots, y_{it})'$, and $X_{it} = (x'_{i1}, x'_{i2}, \ldots, x'_{it})'$, t = 1,2, ..., T_i. Then, the probability of firm i lobbying at time t is

$$P\left(y_{it} = 1 \middle| y_{i0}, x_{i0}, Y_{i,t-1}, X_{it}\right) = P\left(\alpha y_{i,t-1} + x_{it}\beta + \varepsilon_{it} > 0\right) = \Phi\left(\alpha y_{i,t-1} + x_{it}\beta\right)$$

where Φ is the cumulative normal distribution function. Therefore, the contribution to the likelihood function of the ith firm is

$$f\left(Y_{iT_i} \middle| X_{iT_i}, y_{i0}, x_{i0}, \beta\right)$$

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4 Our intention is to test for serial dependence in lobbying by a subset of firms. We are not restricting ourselves to testing a specific model of addictive behavior, such as in Becker, Grossman, and Murphy (1994).

$$= P\left(y_{i1} \middle| y_{i0}, x_{i0}\right) P\left(y_{i2} \middle| y_{i0}, x_{i0}, y_{i1}, x_{i1}\right) \dots P\left(y_{iT_i} \middle| y_{i0}, x_{i0}, Y_{i,T_i-1}, X_{i,T_i-1}\right)$$

$$= \Pi_{t=1}^{T_i} \left\{\Phi\left(\alpha y_{i,t-1} + x_{it}\beta\right)\right\}^{y_{it}} \left\{1 - \Phi\left(\alpha y_{i,t-1} + x_{it}\beta\right)\right\}^{1-y_{it}} ,$$

Note that given y_{i0}, x_{i0}, $Y_{i,t-1}$, and $X_{i,t}$, the indicator y_{it} depends only on $y_{i,t-1}$ and x_{it}. The log-likelihood function for the sample is

$$\sum_{i=1}^{I} \sum_{t=1}^{T_i} \left[y_{it} \ln\left\{\Phi\left(\alpha y_{i,t-1} + x_{it}\beta\right)\right\} + \left(1 - y_{it}\right) \ln\left\{1 - \Phi\left(\alpha y_{i,t-1} + x_{it}\beta\right)\right\}\right] \tag{1}$$

Aggregate-level regression estimation of common parameters α and β for all firms can be solved by usual probit regression procedure.

To capture the possibility that our firms might belong to groups with different parameters α and β, we assume that there are K pools of firms in our data, and each pool is associated with a regression coefficient vector (α_k, β_k), k = 1, ..., K. The difficulty here is that we do not know *a priori* which pool a firm belongs to. We use an approach based on a similar problem in linear estimation in Ramaswamy, DeSarbo, Reibstein, and Robison (1992), and use an EM algorithm to form multiple pools for the lagged-dummy variable model.

Define the unobserved variable $Z_i = (z_{i1}, ..., z_{iK})$, with

$$z_{ik} = 1 \quad \text{if the ith firm belongs to pool k}$$
$$= 0 \quad \text{otherwise.}$$

Assume Z_i are iid and have a multinomial distribution with probability $q = (q_1, \dots , q_K)$. The joint likelihood function of $\left(Y_{iT_i}, Z_i\right)$ is

$$f\left\{\left(Y_{iT_i}, Z_i\right) \middle| X_{iT_i}, y_{i0}, x_{i0}\right\} = \Pi_{k=1}^{K} \left\{q_k f\left(Y_{iT_i} \middle| X_{iT_i}, y_{i0}, x_{i0}, \beta_k\right)\right\}^{z_{ik}} \tag{2}$$

The log likelihood function of the sample is therefore

$$\log L = \sum_{i=1}^{I}\sum_{k=1}^{K} z_{ik} \ln\left\{f\left(Y_{iT_i}\middle|X_{iT_i}, y_{i0}, x_{i0}, \beta_k\right)\right\} + \sum_{i=1}^{I}\sum_{k=1}^{K} z_{ik} \ln(q_k) \tag{3}$$

The EM algorithm is employed with Z_i as missing data. Note that by Bayes' rule and expression (2),

$$p_{ik} = E\left(z_{ik}\middle|Y_{iT_i}, X_{iT_i}, y_{io}, x_{io}\right)$$

$$= q_k f\left(Y_{iT_i}\middle|X_{iT_i}, y_{i0}, x_{i0}, \beta_k\right) \Big/ \sum_{k=1}^{K} q_k f\left(Y_{iT_i}\middle|X_{iT_i}, y_{i0}, x_{i0}, \beta_k\right). \tag{4}$$

Let $\alpha = (\alpha_1, \ldots, \alpha_k)'$, $\beta = (\beta_1, \ldots, \beta_k)'$ and $\theta = (\alpha', \beta')'$. For simplicity, let $\Phi(\cdot) = \Phi(\alpha_k y_{i,t-1} + x_{it}\beta_k)$. Note that from (1) and (3), the first derivatives of log L with respect to θ are

$$\frac{\partial \log L}{\partial \alpha_k} = \sum_{i=1}^{I}\sum_{t=1}^{T_i} z_{ik} \frac{\{y_{it} - \Phi(\cdot)\}\phi(\cdot) y_{i,t-1}}{\Phi(\cdot)\{1 - \Phi(\cdot)\}}$$

$$\frac{\partial \log L}{\partial \beta_k} = \sum_{i=1}^{I}\sum_{t=1}^{Ti} z_{ik} \frac{\{y_{it} - \Phi(\cdot)\}\phi(\cdot) x'_{it}}{\Phi(\cdot)\{1 - \Phi(\cdot)\}},$$

where ϕ is the normal probability distribution function.

Define $B'(\theta) = \left[\partial \log L \big/ \partial\alpha', \partial \log L \big/ \partial\beta'\right]$ and $C(\theta) = -E\left[\frac{\partial^2 \log L}{\partial\theta\partial\theta'}\right]$. The updated estimates $\hat{\theta}$ can be obtained by using the Newton-Raphson algorithm:

$$\hat{\theta} = \theta^* + C^{-1}(\theta^*)B(\theta^*). \tag{5}$$

Define H = log L - $\lambda\left(\sum_{k=1}^{K} q_k - 1\right)$, where λ is a Langrange multiplier. Then

$\partial H \big/ \partial q_k = \sum_{i=1}^{I} \sum_{k=1}^{K} z_{ik}/q_k - \lambda = 0$, which implies that

$$\hat{q}_k = \sum_{i=1}^{I} \sum_{k=1}^{K} z_{ik}/I, \tag{6}$$

where I is the number of firms. Note that $\hat{q}_k$ is the sample proportion.

The EM algorithm starts with an initial value (θ_o, q_o) of (θ, q), and proceeds as follows:

E-step: Compute $\hat{p}^*_{ik}$, the expected value of z_{ik} given the data, using equation (4).

M-Step: Obtain an updated maximum likelihood estimates of (θ, q) based on equations (5) and (6), with z_{ik} replaced by $\hat{p}^*_{ik}$ computed in the E-step.

Repeat the E and M steps until the algorithm meets a specified convergence criterion. We use the criterion that the sum of absolute differences between the updated estimates and those obtained at the previous step must be less than 10^{-6}, which is a standard practice. Note that if we set K to 1 (i.e. a one-pool model), then log $(q_k) = 0$ and $p_{ik} = 1$, and the EM algorithm is equivalent to the usual probit procedure.

IV Data and Variables

Our sample period, 1977 to 1988, was one of intense lobbying by steel firms. Our sample of steel firms consists of all companies listed in the *Standard and Poor's Corporate Register* between 1977 to 1988 under S.I.C. codes 3312 (steel works), 3315 (blast furnaces), 3316 (rolling mills), and 3317 (finishing mills).[5] These are an exhaustive list of S.I.C. codes for steel production. Firms not included on the *Compustat*

[5] SIC code 3313 is 'electro-metallurgical products except steel'; SIC code 3314 is not assigned.

tapes are dropped.[6] The resulting sample is a panel of 890 firm-year observations spanning 121 firms. Our sample includes a fairly complete cross section of the steel industry. It contains all the integrated steel companies and 14 of the 42 mini-mills in Barnett and Crandall (1985). The mini-mills we omitted are relatively small, with capacities under 400,000 tons in 1985. Because of exit from the industry, the panel is not balanced across years.

We collected publicly available information on firms' participation in protection-seeking activities, which include petitioning for escape clause protection, petitioning for the imposition of a countervailing duty or antidumping measures, or filing a complaint about foreign government practices. We also included testifying in support of trade protection in congressional hearings as a kind of protection seeking activity. The names of firms undertaking the above activities were compiled from the *Federal Register* and the *CIS Congressional Abstract Index.*[7] Protection-seeking activity by a subsidiary was considered protection-seeking by the parent firm. The parent companies of subsidiaries were found by searching the *Standard and* Poor's *Corporate Register, Moody's Industrial Manuals, Capital Adjustments,* the *Value Line Investment Survey* and the *Directory of Corporate Affiliates.* We used this information to construct a dummy variable y_{it} equal to one if firm i lobbied for protection year t.

Our premise is that there may be habitual lobbyers and occasional lobbyers. Habitual lobbyers are influenced by the dynamic economies of scale in lobbying and thus are prone to petition for more trade protection. Occasional lobbyers have not reached such a point. They may become habitual lobbyers in the future, or they may choose to free ride on other firms' lobbying effort, or they may even choose to invest in other

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[6] These firms include those which do not file 10-K forms and firms which have gone out of business. Many very small firms are not included on the *Compustat* tapes.

[7] We scanned the database using the keywords 'steel', 'steel trade', and 'trade'. We examined each retrieved piece and retained those that fit our definition of protection seeking.

industries. The point is that the propensities to lobby for protection of firms in different groups are affected differently by the same firm characteristics.

Which firm characteristics are likely to be important? First, there are likely to be static economies of scale in lobbying. Big firms have more financial resources to absorb the fixed up-front costs of lobbying better than small firms. Big firms plausibly also have lower marginal costs of lobbying because they have in-house legal staff. At the same time, steel firms with a greater volume of business are likely to benefit more from protection. We therefore need a measure of firm size, namely:

Total Assets (*Size*) is used as a measure of firm size. This variable is adjusted for inflation and is in millions of 1983 dollars.

Likewise, firms that are more specialized in steel may obtain more important benefits from protection than more diversified firms would obtain. We thus need a measure of steel focus. For this, we use the dummy variable:

Concentration in steel production dummy (*Steel*) is equal to one if a firm's primary line of business, as listed in the *Standard and* Poor's manual for that year is 3312, 3315, 3316, or 3317 - the four SIC codes for steel production. It is also set to one if all four steel SIC codes are included in the list of the firm's lines of business. Otherwise, the dummy is set to zero[8]. The dummy is used to capture a firm's concentration in steel production.

Second, innovative firms are more likely to have investment opportunities with returns higher than lobbying returns. We therefore need a measure of investment in innovation, namely:

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8 Another alternative is to use industry segmented data to construct an index indicating a firm's involvement in steel industries. However, the alternative is not very attractive because segmented data are less reliable and adequate segmented data are unavailable for many firms in our sample.

Research and Development Spending (*RD/A*) is measured per dollar of total assets. If research and development spending is not reported, but all other financial data is available, we assume R&D spending to be nil. R&D spending is scaled by total assets to capture the intensity in investment in innovation.

Finally, firms are plausibly more likely to invest in lobbying when the returns on their other investments are low and when their sales are declining. This situation also makes satisfying the "material injury" requirement in dumping and countervailing duty cases easier, so the likelihood of successful lobbying increases with poorer market performance. As well, these firms characteristically have made less investment in physical assets in the past. To capture these characteristics, we use the following set of variables:

Accumulated Depreciation (*Depreciation*), taken from the firm's balance sheet and divided by the book value of its net plant and equipment, is used as a measure of the lack of past investment in productivity (i.e. accumulated depreciation / gross plant and equipment).

Sales Growth is defined as the firm's most recent sales figure minus its sales the previous year, all divided by the latter. This variable is constructed using deflated sales figures in 1983 dollars to correct for inflation.

Change in Returns on Assets (*CROA*) is the first difference of income before extraordinary items gross of depreciation and interest expenses per dollar of total assets. This variable measures the change in cash flow produced per dollar of corporate assets.

We expect that, on a year by year basis, these firm characteristics and market performance variables should affect occasional lobbyers' behavior, but not that of habitual lobbyers. (That is, habitual lobbyers have a more inelastic lobbying supply function than occasional lobbying firms.)

Habitual lobbying firms have already invested and set up their lobbying apparatus. Dynamic economies of scale in lobbying imply that the marginal cost of lobbying for these firms decreases over time while the return on lobbying rises. Theoretical work by Magee *et al*. (1989) predicts that lobbying firms should eventually become inelastic participants in rent-seeking. To capture the possibility that lobbying is habit forming, that past lobbying increases the current tendency to lobby, we incorporate lagged value of a dummy indicating past involvement in lobbying.

Past lobbying ($lobby_{-1}$) is the lagged value of a dummy indicating a firm's involvement in lobbying.

Our main focus is whether "$lobby_{-1}$" increases the tendency to lobby. If lobbying is habit forming, past lobbying should increase the likelihood of current lobbying. In addition, we expect that the propensity to lobby increases with "*size*," "*steel*," and "*depreciation*," but decreases with "*R&D/A*," "*CROA*," and "*sales growth*." If lobbying is indeed habit forming, but not all firms are addicted to lobbying, we also expect the EM algorithm to produce more than one functional relationship between the set of independent variables and the probability to lobby. In particular, we expect that one functional form should describe habitual lobbying while other functional forms should describe occasional lobbying. Past lobbying should be much more important in the habitual lobbyer group; it may be the only significant determinant of current lobbying. All the other variables should matter more in the other groups while past lobbying ought to be much less significant.

V Results

Table 1 reports the correlation matrix of our data. The lobbying dummy is positively and significantly correlated with size, steel production focus, depreciation (indicating older physical assets), and with the dummy indicating past lobbying ($lobby_{-1}$). It is negatively and significantly correlated with sales growth. The lobbying dummy is negatively but insignificantly correlated with change in returns on assets. Contrary to our expectations, the lobbying dummy is positively correlated with R&D spending.[9]

[Table 1 about here]

Overall, a quick scan of the data suggests that lobbyers are larger, more concentrated in steel production, and have invested less in modernizing their plant and equipment. Also, lobbyers suffer from declining sales and returns on assets. Past period lobbying also seems to increase the probability of current period lobbying.

We run the algorithm described in section III with all the independent variables included assuming 1, 2 and 3 pools in the data (i.e. K = 1, 2 and 3). The resulting estimates, standard deviation (STD) and p-value are reported in table 2.

[Table 2 about here]

When there is only one pool (i.e. K = 1), the model is equivalent to an ordinary probit on pooled firm level panel data. In the one pool model, past lobbying ($lobby_{-1}$) positively and significantly increases the probability of current lobbying. *Size*, *Steel*, and *Depreciation* all have positive and significant coefficients, while that of *Sales Growth* is negative and significant. The coefficient of *RD/A* is negative and marginally significant, while that of CROA is positive but insignificant. Hence, larger firms more concentrated in steel production with declining market performance and which invest less in

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[9] Many non-lobbying firms are smaller firms not reporting R&D spending. They also tend to exit the industry after 1984 (Lenway, Morck and Yeung (1996)). We obtain the correlation matrix based on firm-year entries. Larger lobbying firms which lasted for the whole sample period is than given a greater weight.

productivity improvements are more inclined to lobby. The focal result is that past lobbying increases the likelihood of current lobbying, which is consistent with that lobbying is habit-forming.

When we allow the data to form two pools, i.e. K = 2, our firms clearly sort themselves into habitual and occasional lobbyers. In the first pool, containing 57% of our firm-year observations, past lobbying positively and highly significantly affects the probability of current lobbying. *Size* and *Steel* also positively and significantly affect the probability of current lobbying. However, all other variables are insignificant. These are the characteristics of habitual lobbying: a lobbyer finds the dynamic economies of scale in lobbying and becomes an inelastic supplier of lobbying.

In the second pool, lagged lobbying does not affect the probability of current lobbying. The coefficient for lagged lobbying is negative and insignificant. *Size*, *Steel* and *Depreciation* are positive and significant while *Sales Growth* is negative and significant, indicating that larger steel firms with older equipment become more inclined to seek protection when they experience poorer sales growth. Both *CROA* and *RD/A* are insignificant.

We hypothesize that the first pool contains habitual lobbyers while the second contains occasional lobbyers. All estimated coefficients associated for the pool of occasional lobbyers' are greater in magnitude than those for the pool of habitual lobbyers, which is consistent with habitual lobbyers having a more inelastic tendency to lobby. Unfortunately, we are unaware of any statistical way to test the differences in the coefficient estimates between the two groups of lobbyers. Note that when $Lobby_{-1}$ is zero, indicating no lobbying in the previous period, it has zero effect on the probability of lobbying in the current period. Therefore, the estimated probit function for the first pool says that not lobbying in the past does not affect the likelihood of not lobbying in the present period.

To verify the hypothesis that the first pool contains habitual lobbyers while the second contains occasional lobbyers, we need to assign firms to either the first or second pool. The estimated probit function lets us obtain the likelihood function for each firm when assigned to a pool. For example, when we assign firm i to pool k, the independent variables of the firm and the probit function for pool k give us the likelihood function of the firm, $LLF_{k,i}$, the expression within the parentheses in equation 1. We assign firm i to pool one if $LLF_{1,i} > LLF_{2,i}$ and to pool two otherwise. We find that firms which never lobbied are indeed all assigned to pool two. The average lobbying frequency per firm in pool one is 29% while that in pool two is 4%. Fifty-two percent of firms assigned to pool one have a STEEL dummy equal to one while 34% of firms assigned to pool two do so. Firms assigned to pool one have on average about 1.5 times more depreciation in plants and equipment than those assigned to pool two, and have on average spent only about 70% as much on R&D per dollar of total assets. (The two groups are similar in size: group one’s average dollars of total assets is 1.06 of the other group’s.)

This bifurcation of the sample is consistent with the idea that rent-seeking is addictive, and that addicted rent-seekers lobby continually. For other firms, an intuitively sensible relationship between lobbying and changes in a firm's market performance and past investment in productivity holds, and past lobbying does not predict present lobbying. Generally, within our sample, addicted lobbyers tend to have older equipment and less invested in R&D. They account for the lion share of lobbying activities in our sample period.

To determine the most likely number of pools (K), we use the Akaike's (1974) information criterion (AIC),

$$AIC(K) = -2 \log L + 2\, N(K) \qquad \textbf{(3)}$$

where N(K) is the number of free parameters in the model. The statistically desirable K has a low AIC. Table 2 indicates that models with three pools or more (results not shown) are statistically less likely than the one pool and two pools models. The one and two pools models are virtually indistinguishable. Unfortunately, the likelihood surface in the neighborhood of q = (1, 0, 0, ..) under the null hypothesis is discontinuous, so ordinary likelihood ratio tests are not possible.

Our main empirical result is that past lobbying indeed positively and significantly increases a firm's tendency to lobby. In addition, our data support the contention that there are two groups of firms with different tendencies to lobby: habitual lobbyers whose tendency to lobby is almost solely explained by past lobbying; and occasional lobbyers whose tendency to lobby is increased by poor business performance. The result strengthens the credibility of the argument that lobbying is habit-forming.

VI Conclusions

The rent-seeking literature (Brock, Magee, and Young, 1989; Baumol, 1990; Murphy, Shleifer and Vishny, 1993;) implies dynamic economies of scale in rent-seeking. Past rent-seeking makes further rent-seeking more attractive. This paper examines political lobbying for trade protection by American steel firms and finds evidence consistent with this view. By pooling all firms' data, we show that on average past lobbying indeed increases the likelihood of current lobbying. When we let our data sort themselves into sub-groups with similar tendencies to lobby, two groups emerge, occasional and habitual lobbyers. Occasional lobbyers' lobbying is closely tied to firm performance and strategy variables; and habitual lobbyers' lobbying is relatively unrelated to such factors but depends heavily on past lobbying. Non-lobbyers group themselves with occasional lobbyers. Habitual lobbyers are firms with older equipment and have less invested in R&D, and account for the lion share of lobbying. Thus, the results suggest that habitual lobbyers have indeed invested less in productivity, but are inclined to depend on political rent-seeking activities.

Lenway, Morck, and Yeung (1996) show that lobbying for trade protection is clearly a type of political rent-seeking which reduces the returns on non-lobbyers' investment on productivity. Murphy, Shleifer, and Vishny (1993) argue (i) that political rent-seeking has increasing returns that make it self-sustaining, and (ii) rent-seeking undermines innovative activities and reduces the rate of economic growth. Our results here clearly confirm the first of these arguments, and support the plausibility of the second.

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Table 1: Correlation matrix

	Lobby	Size	Sales Growth	Change ROA	R&D /A	Steel	Depre-ciation
Size	0.246 (0.000)						
Sales Growth	-0.085 (0.017)	0.009 (0.805)					
Change ROA	-0.002 (0.946)	-0.033 (0.355)	0.198 (0.000)				
R&D /A	0.024 (0.498)	0.489 (0.000)	-0.024 (0.509)	-0.050 (0.164)			
Steel	0.252 (0.000)	-0.112 (0.002)	-0.007 (0.835)	0.032 (0.365)	-0.205 (0.000)		
Depre-ation	0.388 (0.000)	0.604 (0.000)	-0.034 (0.349)	0.010 (0.775)	0.379 (0.000)	0.125 (0.000)	
Lobby_{-1}	0.005 (0.000)	-0.024 (0.000)	0.015 (0.035)	0.023 (0.078)	-0.001 (0.466)	0.008 (0.000)	-0.045 (0.000)

p-value in parentheses

Table 2: An E-M Algorithm pooling approach applied to lagged-dummy model: $y_{it}^{*} = \alpha y_{i,t-1} + x_{it}\beta + \varepsilon_{it}$. The lobbying dummy $y_{it} = 1$ if $y_{it}^{*} > 0$, $y_{it} = 0$ otherwise. All independent variables included.

		Const.	Size	Sales Growth	Change ROA	R&D /A	Steel	Depre- ciation	Lobby_{-1}
<u>K=1</u>									
AIC = 386.1684									
Estimate	=	-2.040	0.394	-0.152	0.057	-0.237	0.752	0.160	0.914
STD	=	0.140	0.113	0.071	0.069	0.139	0.171	0.081	0.185
p-value	=	0.000	0.001	0.031	0.415	0.087	0.000	0.048	0.000
<u>K=2</u>									
AIC = 389.0822									
Proportion	=	0.569							
Estimate	=	-1.876	0.514	-0.128	-0.005	-0.284	0.893	0.073	0.911
STD	=	0.164	0.155	0.080	0.086	0.175	0.212	0.093	0.210
p-value	=	0.000	0.001	0.109	0.957	0.104	0.000	0.430	0.000
Proportion	=	0.431							
Estimate	=	-4.216	0.721	-0.545	0.138	-0.394	1.869	0.775	-0.535
STD	=	0.898	0.327	0.230	0.142	0.342	0.819	0.238	0.501
p-value	=	0.000	0.028	0.018	0.331	0.249	0.023	0.001	0.285
<u>K=3</u>									
AIC = 403.1564									
Proportion	=	0.460							
Estimate	=	-2.438	0.492	-0.173	0.068	-0.457	1.009	0.454	-0.316
STD	=	0.288	0.191	0.128	0.111	0.248	0.314	0.161	0.373
p-value	=	0.000	0.010	0.175	0.539	0.065	0.001	0.005	0.398
Proportion	=	0.312							
Estimate	=	-2.191	1.055	-0.254	-0.087	-0.293	1.486	-0.101	0.674
STD	=	0.275	0.264	0.112	0.113	0.215	0.342	0.129	0.279
p-value	=	0.000	0.000	0.023	0.443	0.172	0.000	0.432	0.016
Proportion	=	0.229							
Estimate	=	-2.170	-0.262	-0.089	0.162	-0.083	0.076	0.240	2.754
STD	=	0.342	0.267	0.207	0.210	0.476	0.465	0.201	0.548
p-value	=	0.000	0.327	0.666	0.441	0.862	0.870	0.233	0.000

AIC = -2loglikelihood + 2(# of free parameters)