Lobbying for Trade Liberalization and its Policy Influence*

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April 1, 2022

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Abstract

Lobbying activities are important to the promotion of Free Trade Agreements (FTAs). I quantify the influence of lobbying on ratification probability of FTA by constructing a novel dataset containing all lobbying activities about FTAs in the United States. I setup a contest model of lobbying where heterogeneous players choose lobbying expenditures to affect the ratification probability of FTAs. I use structural gravity estimation to predict the trade profit gains from FTAs and use Maximum Likelihood estimation to back out the ratification probabilities. Results show that lobbying expenditures in manufacturing sector increase ratification probability by 21 percentage points on average, and the expected gains from lobbying are five times of the lobbying expenditures on average. Additionally, free riding lowers lobbying expenditures by 40%. These findings highlight the effects of lobbying on the formation of international agreements.

Keywords: lobbying, free trade agreement, trade liberalization, contest model

JEL Codes: D72, F14, F53

*I am grateful to Michael V. Alexeev, Lee J. Alston, Mostafa Beshkar, Ahmad Lashkaripour, Volodymyr Lugovskyy, Gustavo Torrens, Stefan Weiergraeber and Ruli Xiao for excellent advice and suggestions that benefited this research. I also thank participants at Indiana University Trade Brownbag, seminars in Oberlin College and University of Nevada, Las Vegas for helpful comments. All errors are my own.

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1 Introduction

What are the political forces behind trade liberalization, and how effective are they? This is a long-standing research question for international economists. Recent works find that Free Trade Agreements (FTAs) are promoted by lobbying activities of large exporters (Rodrik, 2018; Blanga-Gubbay et al., 2021) but have not empirically quantified the policy influence and effectiveness of these activities. In this work, I attempt to close this gap by quantifying the effectiveness of lobbying activities on the ratification of FTAs.

The empirical quantification has two main difficulties. First, there is not enough variation in policy outcomes concerning FTAs. In the United States, 13 FTAs were proposed to Congress between 1995 and 2015, and all of the FTAs except one were ratified. The lack of variation precludes the reduced-form analysis of how lobbying activities affect FTA formation even if the lobbying expenditures are observed. Second, the lobbying activities spread widely across industries and differentiated interest coalitions. The heterogeneous benefits and costs make it difficult to put trade-offs of all coalitions into a unified empirical framework.

To address the two difficulties and quantify the effects of lobbying activities on the ratification outcomes of FTAs, I use a contest game with heterogeneous players to model the lobbying decisions of interest groups across various industries. In the contest, supportive and opposing interest groups would pay lobbying expenditures to affect the ratification probability of an FTA in the direction that they prefer. Their participation and expenditure amount depends on their expected gains and costs of lobbying activity. By mapping the observed lobbying expenditure to the equilibrium of this contest model, I back out the ratification probability as a function of lobbying expenditures.

To address the second difficulty, I model the players to have rational beliefs about each other, and that the lobbying efficiency is symmetric for lobbying expenditures of all players. In this setting, each player makes her optimal participation and expenditure decisions, while taking lobbying efforts of other players as given. Therefore, I can identify the coefficients governing effectiveness of lobbying from a portion of, instead of all, players' trade-offs in the contest game of lobbying. Specifically, I use the lobbying trade-offs of manufacturing industries to identify and estimate the contest for ratification of FTAs. The lobbying expenditures from entities in the agriculture sector, service sector and other political organizations

are taken as given, and they contribute to the initial ratification probability faced by manufacturing industries.

I construct a dataset of lobbying expenditures for FTAs in the United States using information on lobbying reports collected from the Senate's Office of Public Records (SOPR). These reports contain comprehensive information of lobbying activities from each client-lobbyist pair.[1] Besides the client's name, legal period, expenditure, and issues lobbied, I identify the position of the client on each issue according to the text of issues on the reports. The average total lobbying expenditure on each FTA is $7 million, and there is an increasing trend over time.[2] About half of the total expenditure is contributed by manufacturing industries, and all lobbying efforts from manufacturing industries are supportive of the FTA.

I begin by examining reduced-form evidence of how lobbying participation and expenditure depend on expected benefits and costs of lobbying. The expected benefits of lobbying for manufacturing industries consist of profit gains from FTAs and ratification probability. To estimate the profit gains, I specify a multi-sector general equilibrium gravity model with Constant Elasticity of Substitution (CES) preferences and monopolistic competition and derive a structural gravity equation. I estimate the equation using bilateral trade flow data at a two-digit ISIC level during 2001-2016 and predict bilateral trade flows before and after FTAs. The gravity equation is also used to estimate the trade elasticity. Under the assumptions in the trade model, profit gains from FTAs are the ratio between changes in trade flows and trade elasticity. Using the estimated profit gains from FTAs, I find that an industry is more likely to participate and spend more money on lobbying for an FTA if the profit gains are higher. However, this relation is weaker when the initial ratification probability is higher. Also, I find that higher fixed cost of lobbying discourages participation.

I then develop a contest model of rent-seeking to structurally investigate the lobbying strategies and their policy influences. I model each year during the ratification process of each FTA as an independent contest game. The ratification probability is determined by both lobbying efforts and the initial ratification probability. Each manufacturing industry consists of two players: one player supporting the FTA and the other one opposing the FTA. All players across industries make lobbying decisions simultaneously.

[1] I also use 2021 version data from LobbyView.org, an institution applying data science research in interest group politics, to merge and aggregate details on lobbying reports into industry level.

[2] Of all 13 FTAs signed by the United States during 1995-2015, only the one with Jordan has no related lobbying record.

In the Nash equilibrium, players with larger expected benefits than total costs (lobbying expenditures plus fixed costs) choose to participate. The optimal lobbying expenditure of a participant equates her marginal benefit and marginal cost. To be consistent with the reduced-form evidence, I assume diminishing returns of lobbying, i.e., the marginal increase of ratification probability from additional expenditure is decreasing in total lobbying expenditure, number of participants, and initial ratification probability. This property is also interpreted as free riding, which lowers optimal expenditures and increases returns to lobbying.

I identify four parts of the model (i.e., initial probability, distribution of FTA values, lobbying effectiveness, and fixed cost of lobbying) using variations in public opinion, lobbying expenditures, trade flows, and industry characteristics. In addition, I use two error terms to match the model to data. The dispersion of the entry decision's error term is identified from the correlation between the participation decision and the sign of net benefit from lobbying, and the dispersion of the valuation's error term is identified from the correlation between lobbying expenditure and expected benefits from lobbying.

I apply the model to the ratification contests to estimate the lobbying effectiveness. Results show that the number of lobbying industries has a crucial impact on the ratification probability given total lobbying expenditures. In addition, lobbying history of both FTAs and industry matters for the fixed cost of lobbying. It is cheaper for an industry with lobbying experience to lobby for an FTA, and it is cheaper to lobby an FTA that has been lobbied in previous years. Also, I find that industries with a union or a higher concentration ratio face lower fixed cost of lobbying.

With these parameter estimates, I examine the policy influence of lobbying. First, in order to calculate the marginal effect of lobbying expenditures, I simulate a baseline ratification probability using averages of initial ratification probability, lobbying expenditures, and number of participants across all ratification contests. The results show that an extensive margin is larger than the intensive margin, i.e., an additional lobbying participant has a larger impact on ratification probability than incumbent participants with the same amount of additional lobbying expenditure. This comes from the fact that the curvature coefficient for lobbying effectiveness is less than one.

Second, I calculate the total effects of lobbying on ratification probability. I find that on average, the lobbying expenditures from manufacturing industries increase ratification probability of FTAs by 21 percentage points. I also calculate gross returns of lobbying as the

ratio of expected benefits and lobbying expenditures. The expected additional trade profits brought by lobbying are five times of the lobbying expenditure on average.

Last, I quantify the free-riding effects by comparing the counterfactual lobbying strategies in a single-agent model with those in the Nash equilibrium of the baseline contest model. I find that free riding lowers lobbying expenditures by 40% and increases gross return by 24%. These findings highlight the effects of lobbying on the formation of international agreements.

Related Literature. This paper is related to two strands of literature. First, it relates to the literature on empirical studies of lobbying influence on policy outcomes. Previous works have estimated lobbying effectiveness using data with large variation in policy outcomes, focusing on how lobbying efforts affect tax rate and policy passage (Richter et al., 2009; Grasse and Heidbreder, 2011). Other papers examine the influence of lobbying on long-term trade policy (Goldberg and Maggi, 1999; Gawande and Bandyopadhyay, 2000) and temporary protection (Drope and Hansen, 2004; Lee and Baik, 2010).[3]

This work contributes to the literature by quantifying influences of lobbying with data that lack variation in policy outcomes. To achieve this end, I use the structural estimation method of a contest model closely related to Kang (2016) and parameterize fixed cost of lobbying in the spirit of Kerr et al. (2014) to shed light on the study of rent-seeking for liberalization.

Second, this paper is related to the literature on lobbying organization and participation for trade policy. The classical work of Grossman and Helpman (1994) models trade policy as the government choice to trade off between welfare and lobbying contributions. Given the government's objective function, industries choose lobbying strategies to equate marginal benefits and costs of lobbying expenditures. Later works test the empirical predictions of the model and extend the literature to include endogenous lobbying participation (Mitra, 1999), the free-rider problem of lobbying organizations (Gawande, 1998; Baylis and Furtan, 2003; Gawande and Magee, 2012) and persistence of lobbying (Kerr et al., 2014; Bertrand et al., 2014).[4] A recent work of Cole et al. (2021) use contest game to model lobbying activities

[3] Tavares (2006), Stoyanov (2009) and Tung (2014) use data from countries other than the U.S. to examine the influence of lobbying on long-term trade policy.

[4] Gawande (1998) is the first to test the Stigler–Olson theory of special-interest behavior, which emphasizes the free-rider problem of lobbying organizations using the lobbying power function proposed by Magee et al. (1989).

on trade agreements, where lobbying outcomes in each country interact with ratification uncertainty in other member countries.

Another rising interest on this topic is in firm level heterogeneity within industries (Bombardini, 2008; Kim, 2017; Blanga-Gubbay et al., 2021). With a theoretical argument and empirical evidence, they show that it is most efficient for the largest and most productive firms in an industry to lobby for trade policies.

This paper contributes to the literature by using a contest model with heterogeneous fixed costs and Nash equilibrium to capture various features of lobbying participation. Focusing on industry level lobbying strategies, I also take into account the asymmetric effects of FTAs on heterogeneous firms. Moreover, this work is the first study to quantify free-riding effects on the expenditure and returns of lobbying.

The upcoming sections are organized as follows. Section 2 describes the institutional background of lobbying for FTAs in the U.S. and data construction. Section 3 presents reduced-form evidence. Section 4 presents the model. Section 5 discusses identification and estimation of the model. Section 6 shows estimated policy influence of lobbying. Section 7 concludes.

2 Background and Data

For interest groups affected by FTAs, lobbying is an important means to affect the negotiation and ratification outcomes. Besides spending actual money to lobby, representatives of industries can also state their positions in more straightforward ways, such as submitting reports to Congress or joining the trip to witness the negotiation. In addition, they can express their views through campaign contributions and news articles, etc. The legislators also conduct public surveys and collect opinions from people of wide backgrounds to receive extended opinions.

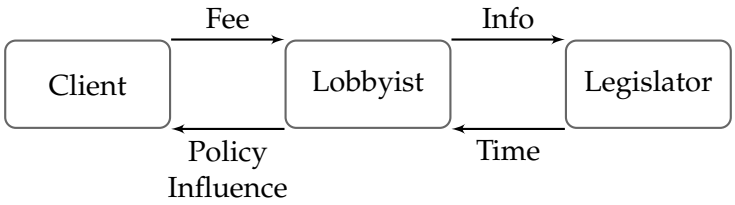
Since the amount of lobbying expenditures is an order of magnitude larger than campaign contributions (Richter et al., 2009), and that political effort through other means cannot be directly measured in dollars, this paper focuses on the influence of lobbying expenditures on the ratification outcomes of FTAs. In the meantime, I include public opinion from surveys as a contributing factor to the initial ratification probability of FTAs.

In this section, I describe the institutional background and data sources of lobbying expenditures and FTAs in the United States. My main dataset consists of two parts. The first part is firm-FTA level lobbying activity records, and the second part is industry-country level trade flows and policies. I introduce lobbying for FTAs in the U.S. and describe the construction of an industry-FTA level dataset for lobbying expenditures in the first subsection. In the second subsection, I describe data sources and preparation for other variables.

2.1 Lobbying for FTA in the United States

Lobbying in practice is a business of relationship with three sets of players: clients, lobbyists, and legislators.[5] Figure 1 summarizes the market of lobbying. Lobbyists are in the center of this relationship. On the one hand, they provide honest information to build a good reputation and strengthen their political access to legislators. On the other hand, they sell their political access to clients as a product that brings policy influence. Legislators distribute their time among groups and individuals who want to access their offices to maximize their gains in information and campaign support. Clients are interest groups or individuals who purchase political access from lobbyists. The fee paid from clients to lobbyists are the lobbying expenditures that econometricians observe.

Figure 1: Market of Lobbying



Lobbyists build relationships with legislators through various ways. The most important practice is repeated interactions through emailing information of genuine interest to the legislator. The emails signal to the office that the lobbyist understood the needs of the office while taking little of the legislator's time. Lobbyists also provide electoral, legislative, and personal supports to legislators as "a gift economy" instead of a quid pro quo transaction.[6]

[5] See McKinley and Groll (2015) for more details about lobbying in practice.

[6] A gift economy is a market where gifts are given to increase a relationship without any clear contractual

Last, in some cases, there are "revolving door lobbyists" who bring established relationships to private practice from earlier government employment. These facts imply that there is significant fixed cost of lobbying, which is mainly used to build and maintain the lobbyists-legislator relationship. The annual fees paid from clients to lobbyists may not fully reflect all costs of lobbying activities. Additionally, the fixed cost of lobbying is heterogeneous across lobbyists-legislator pairs and issues.

Lobbying Expenditures. There is public access to data on fees paid from clients to lobbyists. The Lobbying Disclosure Act that was introduced in 1995 requires all individuals and organizations to provide information on their federal-level lobbying activities. Since 1996, each lobbyist must file semiannual reports to the secretary of the Senate's Office of Public Records (SOPR) and list the name of each client and the total income received from them. Figure A1 shows an example of a lobbying report. Importantly, lobbyists are required to disclosure the federal officials they contacted and the issues they lobbied. SOPR keeps a list of 76 general issues, and each filer must enter at least one of them. Filers normally include detailed descriptions of their lobbying issues for each entry of general issue. For example, specific trade barrier adjustments or international FTAs would be listed under the general issue of trade ("TRD"). Figure A2 gives an example of lobbying issues listed on reports.

To construct the main dataset, I collected detailed information on lobbying reports from SOPR and LobbyView.org.[7] Each report lists one client, one lobbyist, and one legal period, which can be a quarter, six months, or a year. Each report includes all issues lobbied by this client-lobbyist pair during this time period.

Since lobby reports do not provide a breakdown of expenditures by issue, I calculate the lobbying expenditures by industry and FTA using a four-step procedure. First, I consider those reports that list Trade ("TRD") or Miscellaneous Tariff Bills ("TAR") as their general lobbying issues, and I split the total expenditure on each report equally among all general issues. Second, I search for key words in lobbying texts under each general issue to identify the specific issues related to FTAs. The key words are country names and bill numbers of FTAs in the House and the Senate. Third, I count the total number of specific issues under each general issue and split expenditures again among all specific issues. At this time, I obtain the lobbying expenditures on each report for each FTA. For example, if there are

obligation on the receiver to reciprocate but where the relationship then provides the motivation to reciprocate.

[7] A detailed introduction of the dataset is in Kim (2018).

two general issues on a report, which are Trade ("TRD") and Health Issues ("HCR"), and there are three specific issues under Trade ("TRD"), with one of them about an FTA, then I use one-sixth of the report's total lobbying expenditure as the expenditure linked to the FTA. Last, I aggregate the expenditures from all reports to calculate industry-FTA-year level lobbying expenditures.

Lobbying for FTA. To determine the time period of observations, I explore the legal process to develop an FTA in the U.S. There are four steps in the legal process. First, the U.S. Trade Representative would notify the U.S. Congress of the intent to negotiate an FTA with a foreign country. Second, countries would negotiate and come up with a draft as a conclusion. When they publish the draft, the U.S. Administration would notify Congress of the intent to sign the FTA. Normally, countries would sign the FTA at this point. Third, it is the job of U.S. Congress to discuss and ratify the FTA. Upon ratification, the President of the United States could sign legislation to enact the FTA on a future date.[8]

Table 1: Average Lobbying by Stage

Stage	Num. of Industry	Lobbying per industry ($million)
Before negotiation	0.0658	0.0049
Negotiation	1.8125	0.7113
Signed not ratified	6.6667	4.6552
Ratified	2.3439	0.7551

Notes: This table presents the average lobbying effort for FTA. Num. of Industry is the count of lobbying industries among the total 13 manufacturing industries. Lobbying per industry is the average of industry level expenditure on FTAs.

Since the last step hardly has any uncertainty to lobby for, I focus on the first three steps. They divide the continuous time lines into four stages. Table 1 presents the average lobbying efforts by two-digit ISIC industries in the manufacturing sector. The first stage is status quo before any negotiation. The first row shows that there is little lobbying activity concerning trade issues with the foreign country at the first stage. The second stage is during the negotiation of FTAs. The second row in Table 1 shows that interest groups start to address FTAs in their lobbying reports at this stage. Lobbying at this stage could have multiple pur-

[8]The information about FTAs are collected from the Foreign Trade Information System. See Table A2 for more details.

poses and can affect both the content of the FTA and the progress of negotiation. In the third stage, after the FTA is signed, lobbying efforts boom. The third row in Table 1 shows that this stage has the largest number of lobbying industries and expenditures. Since lobbying in this stage can hardly modify the content of the FTA, I regard all lobbying influence to be about ratification outcomes. In the last stage, after an FTA has been ratified, there is still some lobbying efforts concerning the FTA, but the average volume is much smaller than that in the third stage. Thus, I use the lobbying observations in the third stage to estimate the effects of lobbying on ratification outcomes.

As of 2021, the U.S. has 14 ongoing FTAs. Two of the FTAs, NAFTA and the agreement with Israel, were signed before 1995, and there is no lobbying record for them. The lobbying records for the other 12 FTAs signed after 1995 are publicly available. The FTAs are signed with: Jordan, Chile, Singapore, Australia, Morocco, Bahrain, Dominican Republic, Central America, Oman, Peru, Colombia, Korea,and Panama. Noticeably, the FTA with Colombia was proposed to Congress twice. The first attempt of ratification in 2007 failed because of the arguments on Colombia's labor rights issues. There are also failed negotiations with five groups of countries: Ecuador, Malaysia, Southern African Customs Union (SACU), Thailand, and United Arab Emirates (UAE). The failed negotiations never reached a conclusion, and there is no lobbying records about them.

Table 2 summarizes the lobbying activity in the third stage during ratification discussion for the 12 FTAs.[9] Most FTAs were signed and ratified within 12 months, so the lobbying period is one year. Notice that there is a time trend in lobbying efforts. The total lobbying expenditure is higher for later FTAs than earlier ones. To control for inflation effects, I deflate the expenditures to be constant U.S. dollars in 2001. Also, the number of lobbying industries increases over time. One reason for this trend is the persistence of lobbying, which means the fixed cost is cheaper for clients who have lobbied in the past. I control for the persistence of lobbying when I set up the contest model in Section 4.

2.2 Other Data

To complement the lobbying data, I also collected information on trade flows, trade barriers, and industry statistics from various international and federal organizations. First, I collected

[9]The lobbying from industries other than manufacturing is summarized in Table A1.

Table 2: FTA Ratification and Lobbying

FTA	Period	Num. of Industry	Expenditure ($million)	Ratifed
Jordan	2001	0	0	Yes
Chile	2003	2	0.1975	Yes
Singapore	2003	1	0.0868	Yes
Australia	2004	2	1.2865	Yes
Morocco	2004	1	0.0118	Yes
Bahrain	2005	1	0.0114	Yes
CAFTA-DR	2005	6	1.7867	Yes
Oman	2005-2006	5	0.3702	Yes
Peru	2006-2007	11	7.0000	Yes
Colombia-1	2007	10	6.0314	No
Colombia-2	2008-2011	12	44.307	Yes
Korea	2011	11	9.1369	Yes
Panama	2007-2011	12	35.602	Yes

Notes: This table presents the details of lobbying expenditures in the third stage of FTA development and ratification outcomes of FTAs. Period is the year that the FTA is signed but not yet ratified. Num. of Industry is the count of lobbying industries among the total 13 manufacturing industries. Expenditure is the total lobbying expenditure across all industries. Ratified is "Yes" if the FTA is passed before the end of the Congress and is "no" otherwise.

bilateral trade flows of 29 countries in two-digit ISIC manufacturing industries during 2001-2016 from the World Bank World Integrated Trade Solution (WITS). In order to cover most trade flows in the world, I also included 15 other major countries besides the 12 countries with FTAs. Then I aggregated the trade flows of the rest of world into flows of a single country called Rest Of World (ROW).

Second, I collected implemented tariffs from the United Nations Conference on Trade and Development's Trade Analysis Information System (TRAINS) database. I used the same set of countries, industries, and time periods that I had used for the trade flows. The tariff data are the applied most-favored-nation (MFN) rates. I took simple averages of the six-digit Harmonized-System-level tariff data to obtain tariffs at the two-digit ISIC level and use the concordance between the two systems.

Third, I obtained detailed information on international agreements from the Centre d'Études Prospectives et d'Informations Internationales (CEPII) database and public survey center and the public supportive rate of FTAs from the Roper Center for Public Opinion Research. For each FTA, I looked for the most relevant survey question and used the total percentage

of answers not against the FTA as the supportive rate in public opinion. For FTAs that had no related survey questions, I used 0.5 as their supportive rate. The list of the supportive rates generated from survey statistics are in Table A4.

In addition, I collected the four-firm concentration ratios at three-digit NAICS level from Census Bureau. The four-firm concentration ratio in an industry is the total market share of the top four firms in the industry. The Economic Census is conducted every five years. I took the average of the ratios across four surveyed years (2002, 2007, 2012, and 2017) and aggregated them into a two-digit ISIC level through the concordance of the two systems.

Last, I merged all the information into one dataset through the concordance of three industry categorizing systems (two-digit ISIC, six-digit HS, and three-digit NAICS). The time period of my dataset is 2003-2011.

3 Reduced-form Analysis

This section describes the reduced-form analysis for the determinants of lobbying activities. I use the observations in manufacturing industry at industry-FTA-year level. The expected benefits from lobbying for FTAs in the manufacturing industry is mainly the expected trade profit gains from FTAs, which consist of two parts, profit gains from FTAs and the ratification probability. In the first subsection, I calculate profit gains from FTAs using counterfactual trade flows predicted from structural gravity estimation. In the second subsection, I use the profit gains, together with other variables capturing ratification probability and costs of lobbying, to analyze how lobbying activities are determined by costs and the expected benefits from lobbying for an FTA.

3.1 Profit Gains from FTA

I estimate a structural gravity model to predict profit gains from FTAs. The gravity equation is derived from a multi-sector general equilibrium gravity model with Constant Elasticity of Substitution (CES) preferences and monopolistic competition as in Ossa (2014). There are N countries indexed by i or j and K industries indexed by k. Consumers have access to a continuum of differentiated varieties. Preferences over these varieties are given by the

following utility functions:

$$U_j = \prod_k \left(\sum_i \int_0^{M_{ik}} x_{ijk} \left(\nu_{ik}\right)^{\frac{\sigma_k - 1}{\sigma_k}} d\nu_{ik} \right)^{\frac{\sigma_k}{\sigma_k - 1}\mu_{jk}},$$

where x_{ijk} is the quantity of an industry k variety from country i consumed in country j, M_{ik} is the mass of industry k varieties produced in country i, $\sigma_k > 1$ is the elasticity of substitution between industry k varieties, and μ_{jk} is the fraction of country j income spent on industry k products.

Each variety is uniquely associated with a firm. Firms are homogeneous within industries, and their technologies are summarized by the following inverse production functions:

$$l_{ik} = \sum_j \frac{\theta_{ijk} x_{ijk}}{\varphi_{ik}}, \tag{1}$$

where l_{ik} is the labor requirement of an industry k firm in country i featuring iceberg trade barriers θ_{ijk} and a productivity parameter φ_{ik}. Each firm has monopoly power with respect to its own variety, and the number of firms is given exogenously.

Utility maximization implies that firms in industry k of country i face demands

$$x_{ijk} = \frac{\left(p_{ik}\theta_{ijk}\tau_{ijk}\right)^{-\sigma_k}}{P_{jk}^{1-\sigma_k}} \mu_{jk} X_j, \tag{2}$$

where p_{ik} is the ex-factory price of an industry k variety from country i and P_{jk} is the ideal price index of industry k varieties in country j. Also, profit maximization requires that firms in industry k of country i charge a constant markup over marginal costs

$$p_{ik} = \frac{\sigma_k}{\sigma_k - 1} \frac{w_i}{\varphi_{ik}}, \tag{3}$$

where w_i is the wage rate in country i.

Using Equations (1), (2) and (3), industry trade flows follow

$$T_{ijk} = M_{ik}\tau_{ijk} p_{ik} x_{ijk} = M_{ik}\tau_{ijk}^{-\sigma_k} \left(\frac{\sigma_k}{\sigma_k - 1} \frac{\theta_{ijk}}{\varphi_{ik}} \frac{w_i}{P_{jk}} \right)^{1-\sigma_k} \mu_{jk} X_j = \tau_{ijk}^{-\sigma_k} \delta_{ik} \chi_{jk} \omega_{ijk} \xi_{ijk}, \tag{4}$$

where δ_{ik} aggregates all exporter-industry specific factors and is regarded as exporter-industry

fixed effect, χ_{jk} aggregates all importer-industry specific factors and is regarded as importer-industry fixed effect, and ω_{ijk} aggregates all exporter-importer-industry specific factors and is regarded as industry specific country pair fixed effect. ξ_{ijk} is the error term in the gravity equation.

Equation (4) leads to the following structural gravity equation for bilateral trade flows in period t, T_{ijkt}, where

$$T_{ijkt} = \exp\left(\eta_1 FTA_{ijt} + \eta_2 \ln \tau_{ijkt} + \delta_{ikt} + \chi_{jkt} + \omega_{ijk} + log\xi_{ijkt}\right). \tag{5}$$

The first explanatory variable is a dummy of FTA enactment, denoted as FTA_{ijt}. It equals 1 if there is an enacted FTA between countries i and j in year t, and 0 otherwise. The second variable $\ln \tau_{ijkt}$ is the log of the implemented tariff for trade flows from country i to country j in industry k at year t.[10] δ_{ikt} and χ_{jkt} are industry-exporter-year fixed effects and industry-importer-year fixed effects, respectively. They account for the multilateral resistance terms–the theoretical constructs from a gravity equation not directly observable by the researcher and policy makers. ω_{ij} are country pair fixed effects. They provide a flexible and comprehensive account of the effects of all time-invariant bilateral trade costs.

To avoid the distance puzzle and to identify effects of non-discriminatory trade policy, I include intra-nation trade flows in the estimation.[11] I use Poisson Pseudo-Maximum Likelihood (PPML) as in Piermartini and Yotov (2016) to estimate Equation (5). This method includes information contained in zero trade flows and provides unbiased and consistent estimates when the error term, $log\xi_{ijkt}$, is in logarithms and heteroskedastic. In this estimation, I use panel data with intervals for 29 countries in 13 manufacturing industries. To allow for the adjustment of trade flows, I use non-consecutive periods with three year intervals, as in my sample $t \in \{2001, 2004, 2007, 2010, 2013, 2016\}$. This equation also delivers estimates of trade elasticity that $\sigma_k = -\eta_2$. The estimates of trade elasticity by industry is in Table A3.

With these estimates, I calculate exporting profit gains from the FTA. Let $ProfitGain_{jk}$ denote the exporting profit gains of industry k in the U.S. from an FTA with country j, $T_{jkt}(\tau_{k1})$ denote the predicted trade flow from the U.S. to j in industry k in year t with FTA and zero tariffs, $T_{jkt}(\tau_{k0})$ denote the predicted trade flow from the U.S. to j in industry k

[10] $\ln \tau_{ijkt}$=log (1+implemented tariff)

[11] The effects of distance on international trade increases over time, even though transportation cost is lower.

in year t without an FTA and with average implemented tariffs before the FTA. Under the optimal pricing rule, the exporting profit gains from an FTA can be calculated in three steps. First, I predict bilateral trade flows $T_{jkt}(\tau_{k0})$ and $T_{jkt}(\tau_{k1})$ between the U.S. and a foreign country. Second, I calculate the difference between two sets of trade flows and take the simple average of the difference across years. Last, I divide changes in trade flows over trade elasticities to obtain exporting profit gains from an FTA for U.S. manufacture industries. The calculation process can be summarized as Equation (6)

$$ProfitGain_{jk} = \frac{1}{\sigma_k}\frac{1}{S}\sum_{t=1}^{S}[T_{jkt}(\tau_{k1}) - T_{jkt}(\tau_{k0})], \tag{6}$$

where σ_k is trade elasticity in industry k.[12]

3.2 Reduced-form Evidence

In order to see how lobbying efforts are determined by the costs and benefits of lobbying, I use two empirical models to analyze the participation and expenditure decisions separately. The data I use for this reduced-form analysis is an unbalanced panel at the industry-FTA-year level, with observations of 13 manufacturing industries, 12 FTAs, and a period of nine years.

Table 3 reports the summary statistics of the key variables. For all FTAs, 46% of the industries lobbied during the ratification stage. The average expenditure for each FTA among the lobbying industry is \$0.735 million. The profit gain from an FTA for an industry is \$36 billion on average. The average supportive rate in public opinion for 12 lobbied FTAs is 0.547. Among all industry-FTA lobbying relation pairs, industry-level unions were involved in 82.4% of them.

First, I use Poisson Pseudo-Maximum Likelihood (PPML) method to examine how lobbying expenditures depend on expected benefits from lobbying.[13] Let Z_{jk} denote first period

[12]Pricing rule and profit give $\frac{p-mc}{p} = \frac{1}{\sigma}$, which means $(p - mc)q = \frac{1}{\sigma}pq$.

[13]I use PPML estimation to obtain unbiased and consistent estimates for a log-linear equation when error term is in logarithms and heteroskedastic. The estimates using OLS for the log-linear model is in Table A5.

Table 3: Summary Statistics

	Obs	Mean	S.D.	p25	p75
Lobbying activities					
Entry	312	0.462	0.499	0	1
Expenditure ($million)	144	0.735	0.929	0.090	1.015
Other variables					
Profit Gain ($billion)	312	0.036	0.064	0.004	0.055
Public Opinion	12	0.547	0.050	0.500	0.590
Union	74	0.824	0.383	0	1

Notes: This table presents summary statistics of the lobbying activities and their determinants in the manufacturing industries for FTAs. The data are by year, by FTA, and by industry. Entry is a dummy variable that equals 1 if the industry lobbied for the FTA in a specific year and 0 otherwise. Public Opinion is a variable between 0 and 1 to measure the supportive rate in the survey. Lobbied is a dummy variable that equals 1 if the FTA was lobbied before the year by any industry and 0 otherwise. Union is a dummy variable that equals 1 if there is union in an industry ever lobbied for the FTA.

lag of lobbying expenditures. The equation is as follows:

$$Expenditure_{jk} = \exp\left(\beta_0 + \beta_1 log(ProfitGain)_{jk} + \beta_2 PublicOpinion_j \right.$$
$$\left. + \beta_3 log(ProfitGain)_{jk} \times PublicOpinion_j + \beta_4 Z_{jk} + log\xi_2\right). \quad (7)$$

Table 4 shows the estimation results of Equation (7). The first column shows the baseline results without any fixed effects. In the first row, if $ProfitGain$ from FTAs increase by 1% and $PublicOpinion$ is 0, lobbying expenditures of the industry will increase by 1.65%. In the second row, when the supporting rate in the survey of public opinion increase by 1 percentage point, the lobbying expenditure on average increases by 0.45%. In the third row, expenditure is negatively correlated with the interaction between $log(ProfitGain)$ and $PublicOpinion$. When $PublicOpinion$ is 0.5, a 1% increase in $ProfitGain$ will raise lobbying expenditures only by 0.38 percentage points. This shows that higher initial ratification probability discourages the positive response of lobbying expenditure to profit gains from FTAs. Last, if the first-period lag of lobbying expenditure of an industry for an FTA increases by $1 million, the lobbying expenditure in this period will increase by 0.1%. The positive relation is significant, but the magnitude is small. Comparing Table 5 and Table 4, the first-period lag

Table 4: PPML Model of Lobbying Expenditures

	(1)	(2)	(3)	(4)
		Expenditure		
$log(ProfitGain)$	1.652***	1.242	1.568**	0.324
	(0.600)	(0.821)	(0.729)	(0.894)
$PublicOpinion$	45.60***		49.10**	
	(17.40)		(21.45)	
$log(ProfitGain) \times PublicOpinion$	−2.533**	−1.698	−2.595**	−0.502
	(1.026)	(1.411)	(1.237)	(1.525)
$LagExpenditure$	0.108***	0.103***	0.067***	0.035***
	(0.021)	(0.019)	(0.014)	(0.011)
Industry FE			✓	✓
FTA FE		✓		✓
Dep. Var. Mean	0.735	0.735	0.735	0.735
R-squared	0.244	0.262	0.313	0.341
Obs	144	141	144	141

Notes: This table reports the estimated coefficients of the PPML model in Equation (7) with different controls. The observation is by industry-FTA-year level. The dependent variable is lobbying expenditure. Standard errors are robust-heteroskedasticity-consistent. They are presented in parentheses below the coefficients. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

of lobbying expenditure has a larger effect on lobbying participation than the expenditure decision.

Columns in Table 4 compare estimates for the PPML model under different fixed effects. The second column shows estimates under FTA fixed effect, and the third column shows estimates under industry fixed effect. The last column are results under both the FTA and industry fixed effects. Since Public Opinion is FTA-specific, it is omitted when the FTA fixed effect is included in column (2) and (4). The sign of all coefficients are robust under different fixed effects, while pseudo R-squared increases as more fixed effects are included.

Next, I examine how lobbying participation depends on costs and benefits of lobbying. The dependent variable is a dummy representing the participation decision of each industry k for FTA j, $Entry$. I use Probit model to estimate Equation (8):

$$Pr(Entry_{jk} = 1) = \Phi\left(\beta_0 + \beta_1 log(ProfitGain_{jk}) + \beta_2 PublicOpinion_j + \beta_3 log(ProfitGain_{jk}) \times PublicOpinion_j + \beta_4 X_{jk}\right). \quad (8)$$

The key independent variable is the profit gain from the FTA in log values, $log(ProfitGain)$, which is part of the expected benefit from lobbying. $PublicOpinion$ represents the uncertainty of an FTA. X_{jk} captures factors contributing to the fixed cost of lobbying. It consists of three variables. *Lobbied* is a dummy variable that equals to 1 if the FTA has been lobbied in previous periods and 0 otherwise. $UnionDummy$ equals 1 if there is union in the industry lobbying for the FTA and 0 otherwise. $LagExpenditure$ is the first period lag of lobbying expenditure by industry-FTA relation pair in millions of dollars.

Table 5: Probit Model of Lobbying Participation

	(1)	(2)	(3)	(4)
		Entry		
$log(ProfitGain)$	0.151	0.208	0.112	−0.003
	(0.127)	(0.162)	(0.119)	(0.158)
$PublicOpinion$	5.456		4.668	
	(3.855)		(3.682)	
$log(ProfitGain) \times PublicOpinion$	−0.293	−0.355	−0.249	−0.021
	(0.233)	(0.293)	(0.221)	(0.269)
Lobbied	0.049	0.132*	0.024	0.073
	(0.038)	(0.071)	(0.036)	(0.063)
$UnionDummy$	0.168***	0.139***		
	(0.042)	(0.042)		
$LagExpenditure$	1.707***	1.515***	2.560***	2.382***
	(0.212)	(0.252)	(0.423)	(0.461)
Industry FE			✓	✓
FTA FE		✓		✓
Dep. Var. Mean	0.462	0.462	0.462	0.462
Pseudo R-squared	0.641	0.686	0.702	0.742
Obs	312	312	312	312

Notes: This table reports the estimated coefficients of the Probit model in Equation (8) with different controls. The observation is by industry-FTA-year level. The dependent variable is the dummy variable of entry. Standard errors are robust-heteroskedasticity-consistent. They are presented in parentheses below the coefficients. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 5 shows the estimates for the Probit model as Equation (8). The first column shows the baseline results without any fixed effects. The first row shows that when $PublicOpinion$ is 0, a 1% increase in $ProfitGain$ raise the probability for an industry to lobby by 0.15 percentage points. It is intuitive that industries are more willing to lobby when benefits from an FTA are higher, while this magnitude is small. In the second row, when the supporting

rate in the survey of public opinion increases by 1 percentage point, the probability for an industry to lobby increases by 5.46 percentage points. In the third row, lobbying participation is negatively correlated with the interaction between $ProfitGain$ and $PublicOpinion$. When $PublicOpinion$ is 0.5, a 1% increase in $ProfitGain$ brings the participation probability higher by only 0.005 percentage point. This shows that higher initial ratification probability discourages the positive response of lobbying participation to profit gains from FTAs. This evidence inspires the structure of expected benefit from lobbying in the contest model of Section 4.

In the last three rows of Table 5, $Lobbied$, $UnionDummy$, and $LagExpenditure$ are positively correlated with lobbying participation. The probability for an industry to lobby an FTA is 4.9 percentage points higher if the FTA is lobbied in previous periods, and the probability is 16.8 percentage points higher if there is organized union in the industry lobbying for the FTA. Last, if the industry increases its expenditure on the same FTA by $0.1 million in the last period, the probability of participation in this period will increase by 17 percentage points. This is evidence that organized industries have a lower fixed cost and that lobbying is persistent. This evidence inspires the structure of fixed cost for lobbying in the contest model of Section 4.

Columns in Table 5 compare estimates for the Probit model under different fixed effects. The second column shows estimates under an FTA fixed effect, and the third column shows estimates under an industry fixed effect. The last column are results under both the FTA and industry fixed effects. Since $PublicOpinion$ is FTA specific, it is omitted when the FTA fixed effect is included in column (2) and (4). Similarly, the industry specific variable Union dummy is omitted in column (3) and (4) where industry fixed effect is included. The sign of all coefficients are robust under different fixed effects, while pseudo R-squared increases as more fixed effects are included.

4 Model

This section describes the contest model of lobbying for FTAs. Players act in the two-stage game simultaneously. They first decide whether to participate or not, and then they decide optimal expenditures. The following subsections present the model setup, strategies for players, and the equilibrium concept.

4.1 Model Setup

Consider a contest model of rent-seeking with complete information. Players are risk-neutral, with rational beliefs and no budget constraints. They take actions in a two-stage game simultaneously. For each FTA in a specific year, players first form beliefs of other player's action and decide whether or not to lobby on the FTA. Upon participation, a player pays a fixed cost. Based on the expected lobbying efforts of other participants, each player decides how much to spend to affect the probability that the FTA will be ratified in this year.

The payoff for a lobbying player k is the difference between the expected benefit from lobbying and the total cost of lobbying. The expected benefit from lobbying is the value of the FTA for player k, v_k, weighted by ratification probability, $Pr\left(x_k, \mathbf{x}_{-k}, \pi\right)$. The total cost of lobbying consists of two parts, the variable part is lobbying expenditure, x_k, and the other part is fixed cost, F_k. The fixed cost is heterogeneous across players and FTAs. The payoff for a lobbying player is

$$Pr\left(x_k, \mathbf{x}_{-k}, \pi\right) v_k - x_k - F_k, \tag{9}$$

where x_{-k} is the set of lobbying expenditure of players other than k. Similarly, the payoff for a non-lobbying player k is the value of the FTA weighted by ratification probability, $Pr\left(0, \mathbf{x}_{-k}, \pi\right)$. There is no lobbying cost for this player. The payoff for a non-lobbying player is

$$Pr\left(0, \mathbf{x}_{-k}, \pi\right) v_k.$$

Given players' lobbying decisions, the ratification probability production function defines the probability that an FTA is ratified, denoted as $Pr\left(\mathbf{x}, \pi\right)$. It is determined by the initial enactment probability π, a profile of supporting players' spending $\{x_{fk}\}$, and opposing players' spending $\{x_{ak}\}$. The ratification probability increases in initial enactment probability and supports lobbying efforts such that an FTA is more likely to be ratified if the initial probability is higher, and there are more supporters or more supportive lobbying expenditures. The probability decreases in opposing lobbying efforts such that an FTA is less likely to be ratified if there are more opponents or more opposing lobbying expenditures. Following Baik (2008), I use the following ratification probability production function:

$$Pr\left(\mathbf{x}, \pi\right) = \frac{\pi + \beta \sum_{k \in \mathcal{K}_f} x_{fk}^{\gamma}}{1 + \beta \sum_{k \in \mathcal{K}_f} x_{fk}^{\gamma} + \beta \sum_{k \in \mathcal{K}_a} x_{ak}^{\gamma}}, \tag{10}$$

where β and γ govern the effectiveness of lobbying. β is efficiency of lobbying, and $\gamma \in (0,1)$ is the curvature coefficient.[14] There are a few notable features in this specification. First, the initial enactment probability allows a prior advantage or disadvantage to each group such that when only the supporting (opposing) group lobbies, the probability that a policy is enacted is not necessarily one (zero). Second, when $\gamma < 1$, the number of lobbying participants matters in determining the ratification probability. If the same amount of money is spent on one side, the more participants there are, the more effective the money is. Third, the ratification probability production function has decreasing margins, i.e., the marginal change in ratification probability decreases in total lobbying expenditures and the initial probability. In addition, I assume that each contest game for a specific FTA in a specific year is independent from each other.

4.2 Player's Strategy

Players make participation and expenditure decisions to optimize their expected net benefits from lobbying. Expected net benefit is the difference between expected benefit and the total cost of lobbying. In the first stage of the contest game, the indicator variable d_k equals 1 if player k decides to lobby for an FTA and 0 otherwise. The participation rule involves comparing the expected benefit and total cost of lobbying:

$$d_k = 1\left\{\triangle Pr\left(x_k, \mathbf{x}_{-k}, \pi\right) v_k > x_k + F_k\right\}, \tag{11}$$

where

$$\triangle Pr\left(x_k, \mathbf{x}_{-k}, \pi\right) v_k = \left[Pr\left(x_k, \mathbf{x}_{-k}, \pi\right) - Pr\left(0, \mathbf{x}_{-k}, \pi\right)\right] v_k$$

denotes the expected benefit from lobbying, which is the change in the ratification probabilities from the player's optimal expenditure multiplied by the value of the FTA. When the expected benefit exceeds the total cost for a player, she will lobby the FTA. Otherwise, she will not participate. If $v_k > 0$, the player supports the FTA. Otherwise, she is on the opposing side.

In the second stage, each participating player chooses optimal lobbying expenditure x_k

[14] See also Nitzan (1994), Corchón (2007), Katz et al. (1990), and Riaz et al. (1995) for references of contest model setup. I let β and γ be symmetric for supporting and opposing sides because supporters and opponents can come from the same industry.

to equate their own marginal benefit and marginal cost of lobbying. The marginal benefit is given by the first derivative of expected benefit from lobbying with respect to expenditure at present expenditure amount. The marginal cost is the value of the first derivative of lobbying expenditure with respect to itself, which is 1. The first order condition of optimal expenditure is

$$\frac{\partial}{\partial x_k} \triangle Pr\left(x_k, \mathbf{x}_{-k}, \pi\right) v_k = 1. \tag{12}$$

4.3 Equilibrium

The Nash equilibrium of this lobbying game is the set of entry decisions $\{d_k\}$ and expenditures $\{x_k\}$ of players, such that

(a) Ratification probability follows Equation (10)

(b) Players choose d_k as in Equation (11), given the value of the FTA, initial probability, and fixed cost

(c) Players choose x_k as in Equation (12), given the value of the FTA, initial probability, and fixed cost

A unique equilibrium in pure strategies exists in the second stage, and a payoff matrix in the first stage can be uniquely determined. As a result, the first-stage game boils down to a finite normal-form game. Since every finite normal-form game has a mixed-strategy equilibrium, in the first stage, a (mixed-strategy) equilibrium exists but may not be unique. See Kang (2016) for the detailed proof and Szidarovszky and Okuguchi (1997) for a more general proof.

5 Identification and Estimation

In this section, I explain the identification and estimation method of the model from three aspects. First, I explain how to parameterize the model for estimation. Second, I use three sets of information to identify the model: lobbying expenditures, survey statistics of public opinion, and industry statistics. Last, I explain the estimation method, results, and model fitting.

5.1 Parametric Assumptions

I make the following assumptions for players in the contest game. In each manufacturing industry, there are two interest groups. One group is exporters having export profit gains from lower trade barriers, and the other group is domestic sellers having import profit loss from fading protections. I regard each group as a player. Therefore, there are two players in each manufacturing industry with opposite positions. In the data, all lobbying expenditures from manufacturing industries are from supportive players. I assume there exist opposing interest groups, but they choose not to lobby in the equilibrium.

I take lobbying expenditures from the agriculture sector, service sector, and other political interest groups as given. I include their expenditures in the ratification probability production function but do not use their lobbying trade-offs to estimate the model because I cannot measure their expected benefits from lobbying under the unified framework as for manufacturing industries. Specifically, the lobbying expenditures from non-manufacturing entities contribute to the initial ratification probabilities facing the players in manufacturing industries.

The value of FTAs for player k consists of two parts: (1) the profit gain or loss from a FTA, denoted as $\tilde{v}_k$, and (2) a valuation error, denoted as η. The valuation error captures the part of gains from FTAs that not observed by an econometrician and is uncorrelated with observed variables for ratification probability and lobby cost. For interest groups in manufacturing industries, $\tilde{v}_k$ is either export profit gains or import profit loss from FTAs:

$$v_k = \tilde{v}_k + \eta,$$

where $\eta \sim N(0, \sigma_\eta)$. For a player k, if the value of FTA m is non-negative ($v_{k,m} \geq 0$), she supports the FTA. Otherwise, she opposes the FTA. I calculate $\tilde{v}_k$ from the structure gravity equation as in Section 3.

I do not observe initial ratification probability of FTAs, so I let the probability depend on the sum of a linear index of $\mathbf{Z}_\pi$

$$\pi = \Phi\left(\alpha_\pi \mathbf{Z}_\pi\right),$$

where Φ is a cumulative density function of the standard normal distribution. $\mathbf{Z}_\pi$ is a vector of a constant, supportive rate in the public opinion survey, previous expenditures lobbying

the FTA, and net supportive expenditure from other industries. Previous expenditures lobbying the FTA are the sum of all expenditures lobbying for the same FTA before the present year. Net supportive expenditure from other industries is the difference between total supportive and opposing expenditures from industries other than manufacturing. I include expenditures from industries other than manufacturing into initial ratification probability so that the estimates of γ is not affected by how I aggregate expenditures from industries other than manufacturing.

As for the fixed cost of lobbying, I let it depend on finite dimension variables $\mathbf{Z}_{fk}$ and a random error ε:

$$F_k = \tilde{F}_k + \varepsilon = \alpha_{fk}\mathbf{Z}_{fk} + \varepsilon,$$

where $\varepsilon \sim N(0, \sigma_\varepsilon)$. The random error captures the part in fixed cost that is unobserved by an econometrician and is uncorrelated with observed variables for expected benefits from lobbying. $\mathbf{Z}_{fk}$ is a vector including a constant, lobbying history of an FTA, the organization of lobbying at the industry level, and the market concentration by industry.[15] The zero mean of ε serves as location normalization. The scale normalization is given by Equation (9) where payoffs of lobbying are in the same units as lobbying expenditures. Finally, I assume that η and ε are independent.

5.2 Identification

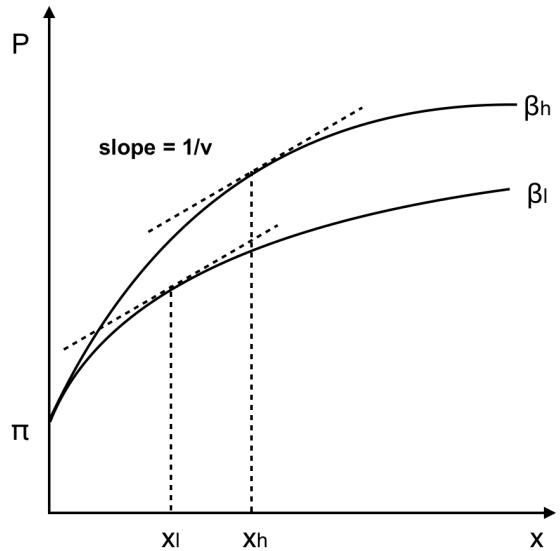
This subsection discusses the identification of the contest model. There are four sets of parameters in the model: ratification probability production function (β and γ), distribution of FTA values (η), the initial ratification probability (α_π), and the fixed cost of lobbying (α_{fk} and ε). I use the following set of information to identify the model: lobbying expenditures, trade flows, survey statistics in public opinion, and industry statistics.

Specifically, Figure 2 shows how lobby efficiency β is identified. Given the value of FTA v, the optimal expenditure equates the slope of ratification probability production function and the inverse of the value $1/v$. A larger β would lead to a higher lobbying expenditure. Thus, β is identified from the correlation between the value of the FTA and the optimal expenditures.

Next, lobbying curvature γ is identified from the correlation between the value of the

[15] More detail of the equations used in the estimation is in Appendix A.

Figure 2: Identification of β



FTA and the number of lobbying players when total lobbying expenditures are given. The effect of an additional lobbying player on ratification probability is larger when γ is smaller.The set of parameters α_π are identified from the one-to-one mapping between the variation of the initial probability factors $\mathbf{Z}_\pi$ and the variation in lobbying expenditure, given expected benefits from lobbying for each player and the FTA. The set of parameters α_{fk} are identified from the one-to-one mapping between the variation of fixed cost factors $\mathbf{Z}_{fk}$ and the variation in lobbying participation, given expected benefits from lobbying for each player and the FTA.

Further, the dispersion of the entry decision error term σ_ε is identified from the correlation between the participation decision and the sign of net benefit. Net benefit from lobbying is the difference between expected benefit and the total cost of lobbying. When σ_ε is small, most players with positive net benefit should lobby, and the probability of participation should increase with the absolute value of net benefit. Such relation would be weaker when σ_ε is larger. The dispersion of the valuation error term σ_η is identified from the correlation between the lobbying expenditure and expected benefits from lobbying. When σ_η is small and close to 0, there is a one-to-one mapping between lobbying expenditure and profit gain or loss from an FTA for each player, given initial ratification probability and lobbying

expenditures of other players.

Last, I assume the equilibrium selection rule is such that the equilibrium with the highest total payoff is selected.[16]

5.3 Estimation

As discussed in the previous section, I map lobbying expenditures to the model using combined information from various data. To estimate the model, I use an estimator that combines the likelihood of observing the participation decisions and expenditures of lobbying.

Denote θ the vector of parameters of the model. I use a weighted likelihood estimator where the scalar objective function $Q_M(\theta)$ is defined as:

$$Q_M(\theta) = \frac{1}{MK} \sum_{m=1}^{M} \sum_{k=1}^{K} \ln f\left(x_{k,m}, d_{k,m} \mid \theta\right) - \frac{\lambda}{ML} \sum_{i=1}^{L} \left(1 - \frac{\tilde{x}_i\left(\theta\right)}{x_i}\right)^2 \tag{13}$$

for any given $\lambda > 0$. $\tilde{x}_i\left(\theta\right)$ is the total optimal expenditure of player k. The number of players, K, equals 26 in the dataset, which is two players in each of the 13 industries. This is the total number of players, whether lobbying or not. The number of FTAs, M, equals 13 in the dataset. This is the total number of FTAs, whether lobbied or not. The number of player-FTA pairs of lobbying participation, L, equals 144 in the dataset. This is the number of observations with positive lobbying expenditures. λ is the weight between two parts of objective function; I choose a λ that makes the two parts have similar values to each other under variant initial guesses of parameters.[17]

The first part of the objective function is the log-likelihood of observing players' lobbying participation, and more details of the equation are in Appendix A. This estimation method is different from that in Kang (2016), where she used the policy enactment likelihood as the first part of objective function since there is variation in the policy enactment outcomes in her data. Lacking variation in ratification outcomes of FTAs, I use the participation and expenditures to estimate parameters and back out ratification probabilities from the observables.

[16] More discussion about equilibrium selection of a discrete game is in Bajari et al. (2010) and Kang (2016)

[17] Another estimation method is to use a two step method that fits the moment condition for expenditures first and then estimates the parameters for the fixed cost. The two-step estimation lowers the dimension in computation but is less efficient. The choice of λ determines the efficiency of this estimator, but the consistency of the estimator holds for any positive value of λ.

The second part of the objective function is the weighted average of the squared differences between the observed lobbying expenditures and the model-predicted optimal lobbying expenditures. In the estimation, I regard observed lobbying expenditures collected from lobbying reports as variable costs.

Since $Pr_m(\theta)$ and $\tilde{x}_{i,m}(\theta)$ do not have closed-form solutions, I simulate them to obtain the value of $Q_M(\theta)$ for any θ.[18] This proposed estimator $\tilde{\theta}_M \in \text{argmax}_{\theta \in \Theta} Q_M(\theta)$ is consistent because the first part of the objective function is maximized at the true parameter, and the second part converges to zero as $M \to \infty$.

I estimate shadow optimal expenditure, $\tilde{x}$, for players who choose not to lobby in observed equilibrium. The underlining assumption is that these players use these amounts to make participation decisions, given others' lobbying strategies. They choose not to lobby because their net benefits from these shadow optimal expenditures are negative. In this way, I extract information from zeros in the dataset, and therefore, M is larger than L in the likelihood function $Q(\theta)$. This method includes the decision process of players who choose not to lobby in the equilibrium and extends the total number of observations for estimation. Omitting the zeros could bias the estimation. See Table A6 in the Appendix.

5.4 Parameter Estimates

Table 6 shows the parameter estimates. The asymptotic standard errors are estimated from bootstraps. All estimates have expected signs. A positive β indicates that more lobbying expenditure leads to higher ratification probability. γ is positive and smaller than 1. This shows that more lobbying industries for the same FTA on the same side lead to larger changes in ratification probability, given total lobbying expenditure.[19] The five variables to capture fixed cost of lobbying are also informative. The fixed cost intercept shows there is indeed a fixed cost of lobbying not included in observed expenditures. The coefficients for Lobbied dummy and Lag expenditure show that lobbying history for both FTAs and industries are influential to lobbying participation. The coefficients for the Concentration ratio and Union dummy show that organized and concentrated industries are more likely to lobby, given other factors in the contest. Last, two standard deviations of error terms are

[18] More details about equations used in estimation are in Appendix A.

[19] I restrict β and γ to be between 0 and 1 in estimation. The restriction is reasonable since the estimates are inner solutions.

positive.[20]

Table 6: Estimation Results

Variable	Name	Mean	S.E.
Lobby efficiency	β	0.043	0.009
Lobby curvature	γ	0.324	0.014
Public opinion	$\alpha_{\pi 1}$	-5.852	10.87
Previous lobbying	$\alpha_{\pi 2}$	-44.69	1.405
Other lobbying	$\alpha_{\pi 3}$	85.65	2.151
Fixed cost intercept	α_{f1}	20.80	1.823
Lobbied dummy	α_{f2}	-44.55	1.977
Concentration ratio	α_{f3}	-0.293	0.039
Union dummy	α_{f4}	-23.81	1.082
Lag expenditure	α_{f5}	-329.2	143.6
S.D. of value	σ_η	9.5E-06	0.043
S.D. of fixed cost	σ_ϵ	24.77	0.921
Number of Players		26	
Number of Contest		24	

Notes: Parameter estimates of the contest model. The lobbying expenditures in a specific year on the same FTA are in one contest. Lobbied dummy equals 1 if the FTA is ever lobbied before the present year. The concentration ratio is average of a four-firm concentration ratio in each of the 13 manufacturing industries. Union dummy equals 1 if a union ever participated in lobbying for the FTA. Lag expenditure is one-period lag of lobbying expenditure for each industry-FTA pair.

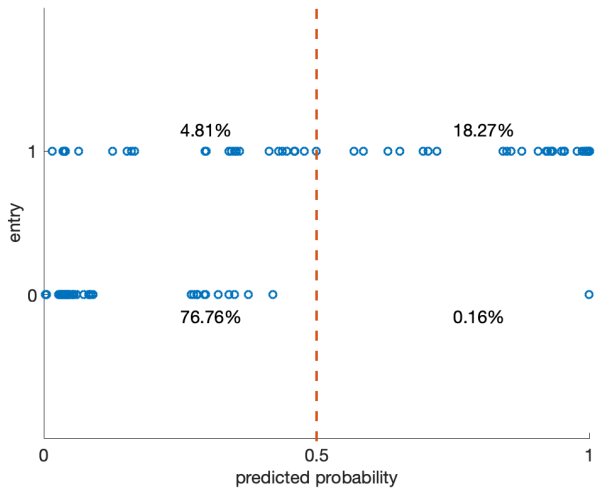
Of the following subsections, the first one describes model fit for entry decisions and expenditures of lobbying. Using parameter estimates, the second subsection calculates the marginal and total influence of lobbying expenditure on FTA ratification probability. By comparing lobbying gains and expenditures, the third subsection shows the gross returns from lobbying. The last subsection describes counterfactual lobbying activities in a single-agent lobbying setup and quantifies the free-riding effects on lobbying expenditures and gross returns.

[20] I restrict σ_η and σ_ϵ to be positive in estimation. The restriction is reasonable since the estimates are away from 0.

5.5 Model Fit

Using the estimated parameters, I predict the entry decision and optimal expenditures for each industry and FTA. The comparison between the predicted and actual lobbying activity is shown in Figure 3 and Figure 4.

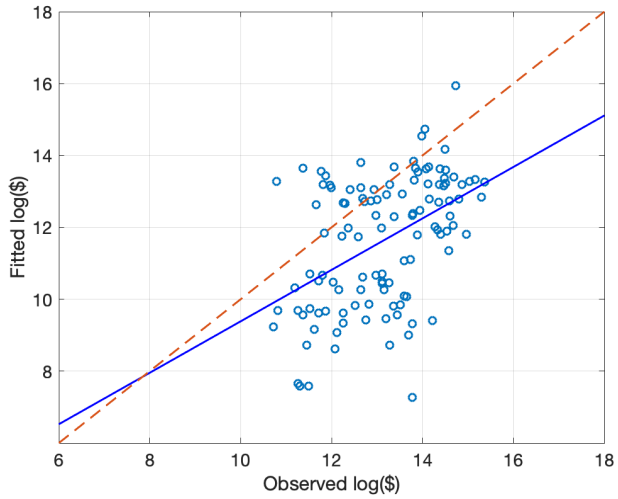
Figure 3: Entry fit



Notes: This figure shows the scatter plot of predicted participation probability and actual entry result. Each circle represents the lobbying participation of an industry in a given year for an FTA. The dashed vertical line is a 50% participation probability. The vertical line and entry dummy separate the plot into four cases. The four percentages represent the shares of observations belonging to each case.

Figure 3 shows that the predicted entry decisions match 95.03% of those in the data. 18.27% of observations are correctly predicted to enter the lobbying, and 78.76% of observations are correctly predicted to not enter. 5.97% of observations have incorrect predictions of lobbying entry decisions, of which 4.81% have predicted entry probability fewer than 0.5, and 0.16% non-lobbying observations have predicted entry probability larger than 0.5. Figure 4 compares the log value of the fitted and actual optimal expenditures. The mean of predicted value is 11.5, while the mean of the actual value in data is 13.1.

Figure 4: Expenditure fit



Notes: This figure shows the scatter plot of predicted expenditures in log against actual expenditures in log. Each dot in the plot represents a pair of predicted and actual expenditures in logs for an industry in a contest. The solid line is the fitted line, and the dashed line is the 45 degree line.

6 Policy Influence

In this section, I analyze the policy influence of lobbying on FTA ratification probability in the following four aspects: (1) I quantify the marginal effects of lobbying expenditures on ratification probability; (2) I calculate the total effects of lobbying expenditures on ratification probability for each FTA; (3) I calculate gross returns to lobbying; and (4) I compare lobbying expenditures with and without free riding.

6.1 Lobbying Influence on FTA Ratification

Using parameter estimates and equilibrium conditions, I calculate marginal and total lobbying influence on FTA ratification probability.

Marginal Effects. To calculate marginal effects, I simulate Pr_0, the baseline ratification probability of FTAs using the average initial ratification probability ($\bar{\pi} = 0.38$), average number of supportive lobbying industries ($\bar{n}_f = 6$), average number of opposing lobbying industries ($\bar{n}_a = 0$), average supportive lobbying expenditures ($\bar{x}_f = \$0.9$ million), and

average opposing lobbying expenditures ($\bar{x}_a = \$0$ million), as well as estimates of β and γ:

$$Pr_0 = \frac{\bar{\pi} + \bar{n}_f \beta \bar{x}_f^\gamma}{1 + \bar{n}_f \beta \bar{x}_f^\gamma + \bar{n}_a \beta \bar{x}_a^\gamma}.$$

I first examine the intensive marginal effect of supportive lobbying expenditure by doubling the expenditure of one of the supportive industries:

$$\Delta Pr = \frac{\bar{\pi} + (\bar{n}_f - 1)\beta \bar{x}_f^\gamma + \beta(2\bar{x}_f)^\gamma}{1 + (\bar{n}_f - 1)\beta \bar{x}_f^\gamma + \beta(2\bar{x}_f)^\gamma + \bar{n}_a \beta \bar{x}_a^\gamma} - Pr_0 = 0.005.$$

I find that the ratification probability increases by 0.5 percentage points if one incumbent supportive player doubles her expenditure, given the average initial ratification probability, number of lobbying industries and lobbying expenditures.

Next, I examine the extensive marginal effect of supportive lobbying expenditure by adding a new lobbying industry that supports the FTA:

$$\Delta Pr = \frac{\bar{\pi} + (\bar{n}_f + 1)\beta \bar{x}_f^\gamma}{1 + (\bar{n}_f + 1)\beta \bar{x}_f^\gamma + \bar{n}_a \beta \bar{x}_a^\gamma} - Pr_0 = 0.023.$$

I find that the ratification probability increases by 2.3 percentage points if there is a new entry of a supportive industry spending the average amount of lobbying expenditure, given the average initial ratification probability, number of lobbying industries, and lobbying expenditures. The difference between intensive and extensive marginal effects of lobbying expenditure is the results from $\gamma < 1$, indicating that the curvature coefficient makes the number of participants important, besides lobbying expenditures.

Further, I examine the intensive marginal effect of opposing lobbying expenditure by doubling the expenditure for a lobbying player who opposes the FTA:

$$\Delta Pr = \frac{\bar{\pi} + \bar{n} \beta \bar{x}_f^\gamma}{1 + \bar{n}_f \beta \bar{x}_f^\gamma + (\bar{n}_a - 1)\beta \bar{x}_a^\gamma + \beta(2\bar{x}_a)^\gamma} - Pr_0 = -0.009.$$

It shows that the ratification probability decreases by 0.9 percentage points if one incumbent opposing player doubles her expenditure, given the average initial ratification probability, number of lobbying industries, and lobbying expenditures. The magnitude of marginal

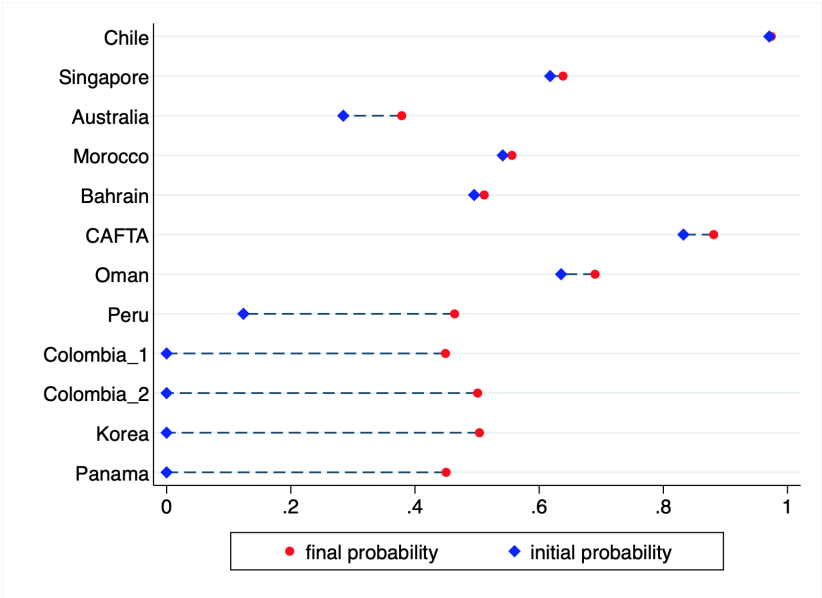
effects on the opposing side is larger than that on the supportive side. This is due to the concavity of ratification probability production function and the fact that there is less opposing lobbying expenditures from manufacturing industries in data.

Last, I examine the extensive marginal effect of opposing lobbying expenditure by adding a new lobbying industry that opposes the FTA:

$$\Delta Pr = \frac{\bar{\pi} + \bar{n}_f \beta \bar{x}_f^{\gamma}}{1 + \bar{n}_f \beta \bar{x}_f^{\gamma} + (\bar{n}_a + 1)\beta \bar{x}_a^{\gamma}} - Pr_0 = -0.039.$$

It shows that the ratification probability decreases by 3.9 percentage points if there is a new entry of opposing industry spending the average amount of lobbying expenditure, given the average initial ratification probability, number of lobbying industries, and lobbying expenditures.

Figure 5: Total effects of lobbying expenditure



Notes: This figure shows the ratification probability for each FTA with and without lobbying. The diamond dots represents the initial probability without lobbying, and the round dots represents the ratification probability under actual lobbying expenditures. The horizontal distance between each pair of dots represents the change in ratification probability because of lobbying.

Total Effects. To obtain total effects of lobbying expenditure on ratification probability, I conduct a three-step calculation. First, I simulate initial ratification probability using param-

eter estimates. Second, I simulate the ratification probabilities for each FTA with lobbying activities using parameter estimates, actual lobbying records, and simulated initial probability. Third, the total effects of lobbying are the difference between ratification probabilities with lobbying and the initial probability. The total effects are shown in Figure 5. The results show that for the FTAs with higher initial ratification probability, the total lobbying expenditures tend to be smaller, and the total effects are smaller as well. However, for the FTAs with lower initial ratification probability, the total expenditures tend to be larger, and the total effects are also larger. The details of ratification probabilities are in Table A7.

6.2 Gross Returns

To examine the returns of lobbying expenditure, I simulate the expected value of FTAs for each industry and calculate gross return with parameter estimates. Table 7 presents the average expected values and gross returns across industries for each FTA. The last row are the averages across FTAs weighted by the number of industries lobbying for each FTA. The second and third columns show the mean and standard deviation of expected values in millions of U.S. dollars. There is no standard deviation for the FTAs lobbied by only one manufacturing industry. The last two columns show the mean and standard deviation of gross return, which is the ratio of expected values over lobbying expenditures. All gross returns, except that for Chile, are larger than two.

One important pattern is that larger expenditure is related to lower gross return. This comes from the concave property of ratification probability production function in Equation (10). For the FTAs with Singapore, Australia, Morocco, and Bahrain, the average lobbying expenditures are smaller than those for Colombia, Korea, and Panama, as shown in Table 2. However, the gross returns to lobby the former four FTAs are much larger than those for the latter three FTAs, as shown in Table 7.

6.3 Free Riding and Lobbying Expenditures

I simulate the lobbying activity of industries under monopoly to quantify the effects of free riding. Given the initial ratification probability, the value of FTAs, and fixed cost, each industry makes lobbying decisions regarding themselves as the only player to lobby the FTA. I use "single-agent" to refer to this optimization outcome. In this single-agent setting,

Table 7: Average Returns to Lobbying

	Expected Value ($m) ($\triangle Pr_k v_k$)		Gross Return ($\triangle Pr_k v_k / x_k$)	
	Mean	S.D.	Mean	S.D.
Chile	0.072	0.014	0.748	0.268
Singapore	2.024	–	23.32	–
Australia	5.085	5.663	49.38	59.74
Morocco	0.575	–	48.72	–
Bahrain	0.224	–	19.60	–
CAFTA-DR	1.020	1.572	3.837	1.370
Oman	0.121	0.072	3.641	3.773
Peru	0.601	0.631	3.922	5.928
Colombia-1	1.449	1.308	4.700	4.164
Colombia-2	1.433	1.313	2.061	2.149
Korea	4.601	7.419	5.964	5.179
Panama	0.800	1.010	3.203	8.674
Weighted Average	3.679		4.989	

Notes: This table presents average and standard deviation of industry level expected values and gross returns from lobbying for each FTA and across all FTAs.

to decide optimal expenditure x_k, a supportive industry k uses the following equation to evaluate the change in ratification probability:

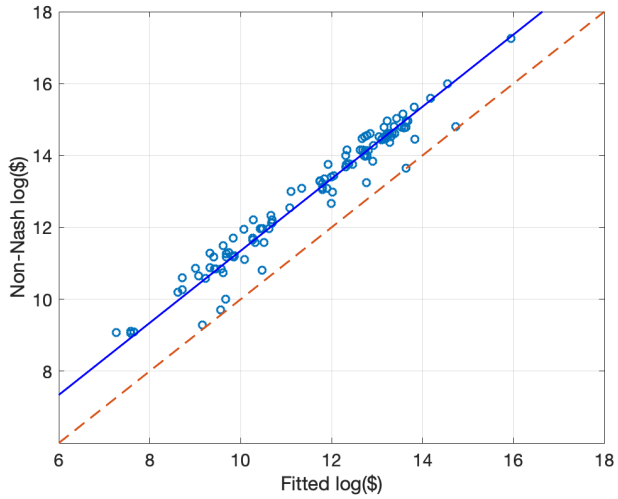
$$\triangle Pr_k = \frac{\pi + \beta x_k^{\gamma}}{1 + \beta x_k^{\gamma} + \beta \sum_i x_{ai}^{\gamma}} - \pi.$$

Other related variables are calculated similarly to the case under Nash equilibrium, where entry decisions are from Equation (11), optimal expenditures are from Equation (12), expected value of FTAs, and gross returns are from calculation indicated in Table 7.

Figure 6 shows the scatter plot of counterfactual lobbying expenditures in the single agent optimization. It shows that the expenditures are higher in the single agent scenario than in the Nash equilibrium. The difference between two sets of expenditures measure the free-riding effect on lobbying expenditures.

Table 8 compares the average lobbying expenditure and gross return under Nash equilibrium with those under the single-agent setting. The second column shows that the average expenditure decreases by 40% when industries respond to others' lobbying decisions.

Figure 6: Single Agent Lobbying Expenditure



Notes: This figure shows the scatter plot of single agent optimal expenditure in log against predicted Nash optimal expenditures in log. Each dot in the plot represents a pair of single-agent and Nash expenditures in logs for an industry in a contest. The solid line is the fitted line, and the dashed line is the 45 degree line.

Table 8: Free-riding Effects

	Expenditure ($million)	Gross Return
Nash	8.141	4.989
Single Agent	13.63	4.034

Notes: This table presents the total lobbying expenditure and average gross return for the contest model with Nash equilibrium and a single agent decision.

The third column shows that the gross return is 24% higher in the Nash equilibrium. These outcomes indicate that free riding across industries dramatically decreases lobbying expenditures while increases gross returns.

7 Conclusion

In this paper, I use data from lobbying reports to examine how industries make lobbying participation and expenditure decisions for FTA ratification and quantify influences of lobbying on the ratification probability of FTAs. I develop a contest model of rent-seeking to

structurally investigate lobbying strategies and apply the model to a set of 24 ratification contests for FTAs to estimate the effectiveness of lobbying. I find that lobbying increases ratification probability by 21 percentage points, and the average gross return is 500%. I also show that free riding lowers total lobbying expenditure by 40% and increases gross return by 24%. These findings highlight the effects of lobbying on the formation of international FTAs.

In future works, this model could be extended to study the lobbying decisions at the firm level instead of industry level to separate the within and across industry interactions of lobbying activities. Doing so would allow the prediction of lobbying expenditures under economic shocks that affect heterogeneous firms within the same industry asymmetrically. This work could also be extended to include dynamic decisions of lobbying entry in the spirit of Kerr et al. (2014). If firms have expectations on future trade issues or FTAs to negotiate, they might be more likely to lobby for present issues with lower expected profit gains. This effect generates interactions between rent-seeking and liberalization where lobbying promotes international FTAs and liberalization affects the incentive to lobby. Recent work finds that international FTAs save rent-seeking waste under a static game setup (Maggi, 2020). However, there could be other mechanisms under a dynamic framework where FTAs incentivize rent-seeking, such as persistence of lobbying.

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Appendices

A Estimation Details

Initial probability. The initial ratification probability of an FTA m is modelled as the following equation:

$$\pi_m = \Phi\left(\beta_{c1}(Opinion_m - 0.5) + \beta_{c2}Previous_m + \beta_{c3}(OtherSupport_m - OtherOppose_m)\right)$$

where is $Opinion_m$ supportive rate in public opinion survey, $Previous_m$ is expenditures on the FTA before the present year, $OtherSupport_m$ is supportive expenditures from entities not in manufacturing industries in the present year and $OtherOppose_m$ is opposing expenditures from non-manufacturing entities in the present year. All expenditures are in million dollars.

Fixed Cost. The fixed cost for player k to lobby for FTA m in a contest year is modelled as the following equation:

$$\tilde{F}_{k,m} = \beta_{f1} + \beta_{f2}Lobbied_m + \beta_{f3}ConcenRatio_k + \beta_{f4}Union_k + \beta_{f5}LagExpen_{k,m}.$$

$Lobbied_m$ is a dummy variable that equals 1 if FTA m ever lobbied and 0, otherwise. $ConcenRatio_k$ is the average 4-firm concentration ratio in industry k. $Union_k$ is a dummy variable that equals 1 if there is union lobbying for the FTA in industry k. $LagExpen_{k,m}$ is last year expenditure for industry k to lobby for FTA m in million dollars.

Supportive Lobbying and Ratification Probability. When supportive player k lobbies for FTA m, given lobbying expenditures of other players, ratification probability for the FTA is as the following equation:

$$Pr_m(d_{k,m} = 1) = \frac{\pi_m + \beta x_{k,m}^{\gamma} + \beta \sum_{j \neq k} x_{fj}^{\gamma}}{1 + \beta x_{k,m}^{\gamma} + \beta \sum_{j \neq k} x_{fj}^{\gamma} + \beta \sum_i x_{ai}^{\gamma}}.$$

The policy influence of such supportive lobbying is the change in ratification probability generated from the expenditure as in the following equation:

$$\triangle Pr_{k,m} = \frac{\pi_m + \beta x_{k,m}^{\gamma} + \beta \sum_{j \neq k} x_{fj}^{\gamma}}{1 + \beta x_{k,m}^{\gamma} + \beta \sum_{j \neq k} x_{fj}^{\gamma} + \beta \sum_i x_{ai}^{\gamma}} - \frac{\pi_m + \beta \sum_{j \neq k} x_{fj}^{\gamma}}{1 + \beta \sum_{j \neq k} x_{fj}^{\gamma} + \beta \sum_i x_{ai}^{\gamma}}.$$

Opposing Lobbying and Ratification Probability. When opposing player k lobbies for FTA m, given lobbying expenditures of other players, ratification probability for the FTA is as the following equation:

$$p_m(d_{k,m} = 1) = \frac{\pi_m + \beta \sum_j x_{fj}^{\gamma}}{1 + \beta x_{k,m}^{\gamma} + \beta \sum_j x_{fj}^{\gamma} + \beta \sum_{i \neq k} x_{ai}^{\gamma}}.$$

The policy influence of such opposing lobbying is the change in ratification probability generated from the expenditure as in the following equation:

$$\triangle Pr_{k,m} = \frac{\pi_m + \beta \sum_j x_{fj}^{\gamma}}{1 + \beta x_{k,m}^{\gamma} + \beta \sum_j x_{fj}^{\gamma} + \beta \sum_{i \neq k} x_{ai}^{\gamma}} - \frac{\pi_m + \beta \sum_j x_{fj}^{\gamma}}{1 + \beta \sum_j x_{fj}^{\gamma} + \beta \sum_{i \neq k} x_{ai}^{\gamma}}.$$

Optimal Supportive Expenditure. The optimal lobbying expenditure of a supportive player satisfies the first order condition in Equation (12), and I add error term η in estimation as:

$$(\tilde{v}_{k,m} + \eta) \frac{\beta \gamma x_{k,m}^{\gamma-1} (1 + \beta \sum_i x_{ai}^{\gamma} - \pi_m)}{(1 + \beta x_{k,m}^{\gamma} + \beta \sum_{j \neq k} x_{fj}^{\gamma} + \beta \sum_i x_{ai}^{\gamma})^2} = 1.$$

Optimal Opposing Expenditure. The optimal lobbying expenditure of an opposing player satisfies the first order condition in Equation (12), and I add error term η in estimation as:

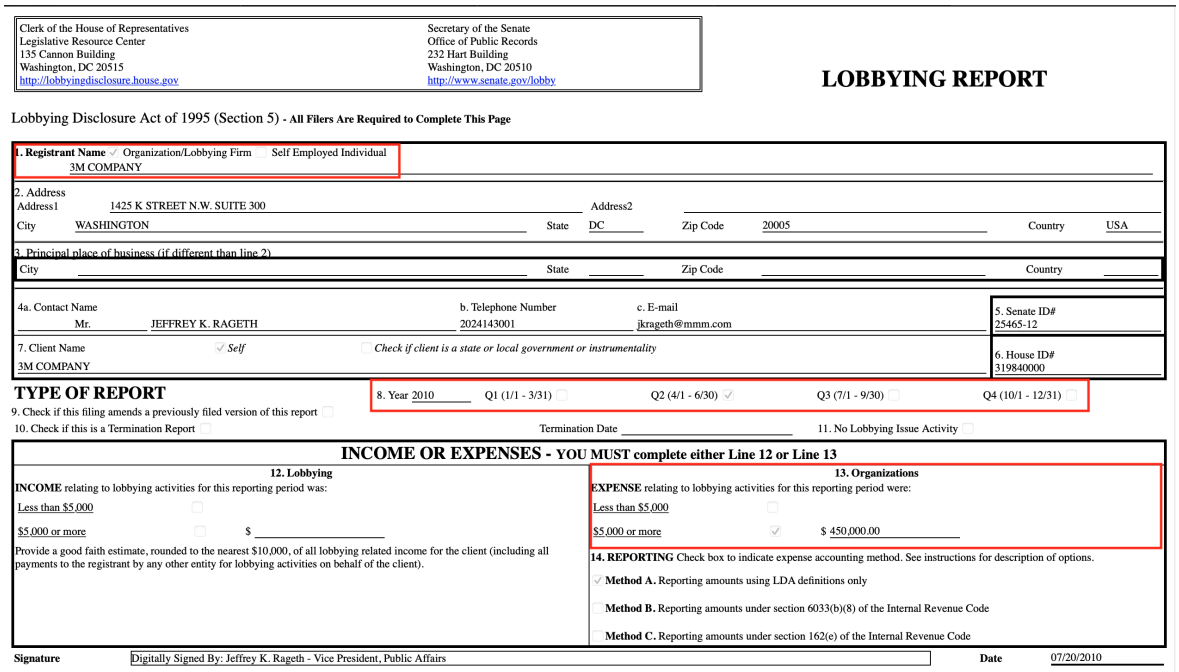
$$-(\tilde{v}_{k,m} + \eta) \frac{\beta \gamma x_{k,m}^{\gamma-1} (\pi_m + \beta \sum_j x_{fj}^{\gamma})}{(1 + \beta x_{k,m}^{\gamma} + \beta \sum_j x_{fj}^{\gamma} + \beta \sum_{i \neq k} x_{ai}^{\gamma})^2} = 1.$$

Participation Likelihood. For any observation $(x_{k,m}, d_{k,m})$, the value of participation likelihood function, f is:

$$f\left(x_{k,m}, d_{k,m} \mid \theta\right) = \begin{cases} \Phi\left(\left(\tilde{v}_{k,m} \triangle Pr_{k,m} - x_{k,m} - \tilde{F}_{k,m} + \varepsilon\right) / \sigma_{\varepsilon}\right), & \text{if } d_{k,m} = 1; \\ 1 - \Phi\left(\left(\tilde{v}_{k,m} \triangle Pr_{k,m} - x_{k,m} - \tilde{F}_{k,m} + \varepsilon\right) / \sigma_{\varepsilon}\right), & \text{if } d_{k,m} = 0. \end{cases}$$

B Additional Figures

Figure A1: Lobby Report Part 1



Clerk of the House of Representatives
Legislative Resource Center
135 Cannon Building
Washington, DC 20515
http://lobbyingdisclosure.house.gov

Secretary of the Senate
Office of Public Records
232 Hart Building
Washington, DC 20510
http://www.senate.gov/lobby

LOBBYING REPORT

Lobbying Disclosure Act of 1995 (Section 5) - **All Filers Are Required to Complete This Page**

1. Registrant Name ✓ Organization/Lobbying Firm Self Employed Individual
3M COMPANY

2. Address
Address1 1425 K STREET N.W. SUITE 300 Address2
City WASHINGTON State DC Zip Code 20005 Country USA

3. Principal place of business (if different than line 2)
City State Zip Code Country

4a. Contact Name Mr. JEFFREY K. RAGETH
b. Telephone Number 2024143001
c. E-mail jkrageth@mmm.com
5. Senate ID# 25465-12

7. Client Name ✓ *Self* *Check if client is a state or local government or instrumentality*
3M COMPANY
6. House ID# 319840000

TYPE OF REPORT
8. Year 2010 Q1 (1/1 - 3/31) Q2 (4/1 - 6/30) ✓ Q3 (7/1 - 9/30) Q4 (10/1 - 12/31)
9. Check if this filing amends a previously filed version of this report
10. Check if this is a Termination Report Termination Date 11. No Lobbying Issue Activity

INCOME OR EXPENSES - YOU MUST complete either Line 12 or Line 13

12. Lobbying
INCOME relating to lobbying activities for this reporting period was:
Less than $5,000
$5,000 or more $
Provide a good faith estimate, rounded to the nearest $10,000, of all lobbying related income for the client (including all payments to the registrant by any other entity for lobbying activities on behalf of the client).

13. Organizations
EXPENSE relating to lobbying activities for this reporting period were:
Less than $5,000
$5,000 or more ✓ $ 450,000.00

14. REPORTING Check box to indicate expense accounting method. See instructions for description of options.
✓ **Method A.** Reporting amounts using LDA definitions only
Method B. Reporting amounts under section 6033(b)(8) of the Internal Revenue Code
Method C. Reporting amounts under section 162(e) of the Internal Revenue Code

Signature Digitally Signed By: Jeffrey K. Rageth - Vice President, Public Affairs **Date** 07/20/2010

Notes: This picture is an example of the first page in lobbying reports filed by lobbyists. The most important information on this page are name of lobbying client, time period and lobbying expenditures. The expenditure is the total amount of lobbying cost for all issues stated in the report on later pages. Each lobbyist will file a separate report for each of her clients in a given period.

Figure A2: Lobby Report Part 2

LOBBYING ACTIVITY. Select as many codes as necessary to reflect the general issue areas in which the registrant engaged in lobbying on behalf of the client during the reporting period. Using a separate page for each code, provide information as requested. Add additional page(s) as needed.

15. General issue area code TRA

16. Specific lobbying issues

Solvency of the Highway Trust Fund
Federal Procurement Regulations
Highway Planning
H.R. 2125 - Surface Transportation Safety Act
S. 791 - Surface Transportation Safety Act

17. House(s) of Congress and Federal agencies ☐ Check if None

U.S. HOUSE OF REPRESENTATIVES, U.S. SENATE, Federal Highway Administration (FHA), Transportation - Dept of (DOT)

18. Name of each individual who acted as a lobbyist in this issue area

First Name	Last Name	Suffix	Covered Official Position (if applicable)	New
Taylor	Bowlden			☐
Jeffrey	Rageth			☐

19. Interest of each foreign entity in the specific issues listed on line 16 above ☑ Check if None

LOBBYING ACTIVITY. Select as many codes as necessary to reflect the general issue areas in which the registrant engaged in lobbying on behalf of the client during the reporting period. Using a separate page for each code, provide information as requested. Add additional page(s) as needed.

15. General issue area code TRD

16. Specific lobbying issues

IP Protection / Technology Transfer
President TPA Authority
Lacey Act
Retailiatory Tariffs
Renewal of anti-dumping duty order or pressure sentitive plastic (psp) tape
Miscellaneous Tariffs and Duty Suspension Bills related to:
- Perfluorocarbons
- Perfluorobutane Sulfonyl Fluoride
- THV
- Catalytic Converter Mats
Korea FTA
Columbia FTA
Panama FTA

17. House(s) of Congress and Federal agencies ☐ Check if None

Notes: This picture is an example of issue statement in lobbying reports filed by lobbyists. Item 15 list the three digit category code for the general issues. Item 16 list the specific issues belong to the same general issue category. As the picture shows, FTA is a specific issue under the code "TRD".

C Additional Tables

Table A1: Third-stage Lobbying from Industries Other than Manufacture

FTA	Period	Num. Opposing Entity	Opposing Expenditure ($million)	Other Supporting Expenditure ($million)
Jordan	2001	0	0	0.0000
Chile	2003	1	0.0343	1.2470
Singapore	2003	1	0.0343	0.3372
Australia	2004	0	0	0.6034
Morocco	2004	0	0	0.0680
Bahrain	2005	0	0	0
CAFTA-DR	2005	2	0.1019	2.0318
Oman	2005-2006	0	0	0.4604
Peru	2006-2007	1	0.0461	4.3000
Colombia-1	2007	1	0.0461	2.5266
Colombia-2	2008-2011	3	0.2317	46.472
Korea	2011	2	0.1816	10.288
Panama	2007-2011	3	0.3230	36.354

Notes: This table presents the lobbying efforts from agriculture sector, service sector and interest groups representing more than one sectors. The entities that ever oppose any FTA are very few. They are National Retail Federation, The American Federation of Labor and Congress of Industrial Organizations (AFL-CIO), International Brotherhood of Electrical Workers, and Defenders of Wildlife.

Table A2: FTA Development Process

FTA	Negotiation Started	FTA Reached	Ratified	Enacted
Jordan	Jun 6, 2000	Oct 24, 2000	Sep 24, 2001	Dec 17, 2001
Chile	Dec 6, 2000	Dec 11, 2002	Jul 31, 2003	Jan 1, 2004
Singapore	Nov 16, 2000	Jan 16, 2003	Jul 31, 2003	Jan 1, 2004
Australia	Nov 13, 2002	Feb 8, 2004	Jul 15, 2004	Jan 1, 2005
Morocco	Apr 1, 2002	Mar 2, 2004	Jul 22, 2004	Jan 1, 2006
Bahrain	May 9, 2003	May 27, 2004	Dec 13, 2005	Jan 11, 2006
CAFTA-DR(El Salvador)	Sep 24, 2001	Dec 17, 2003	Jul 28, 2005	Mar 1, 2006
CAFTA-DR(Honduras)	Sep 24, 2001	Dec 17, 2003	Jul 28, 2005	Apr 1, 2006
CAFTA-DR(Nicaragua)	Sep 24, 2001	Dec 17, 2003	Jul 28, 2005	Apr 1, 2006
CAFTA-DR(Guatemala)	Sep 24, 2001	Dec 17, 2003	Jul 28, 2005	Jul 1, 2006
CAFTA-DR(Dominican Rep.)	Nov 1, 2003	Mar 15, 2004	Jul 28, 2005	Mar 1, 2007
CAFTA-DR(Costa Rica)	Sep 24, 2001	Jan 25, 2004	Jul 28, 2005	Jan 1, 2009
Oman	May 9, 2003	Oct 3, 2005	Sep 19, 2006	Jan 1, 2009
Peru	Nov 18, 2003	Dec 7, 2005	Dec 4, 2007	Feb 1, 2009
Colombia	Nov 18, 2003	Jun 28, 2007	Oct 12, 2011	May 15, 2012
Korea	Feb 2, 2006	Dec 3, 2010	Oct 12, 2011	Mar 15, 2012
Panama	Nov 18, 2003	Mar 30, 2007	Oct 12, 2011	Oct 1, 2012

Notes: This table presents the time of four legal process for FTA developed by the U.S between 1995-2015. The length of period between each two process varies across FTA.

Table A3: Estimated Trade Elasticity

Industry	Elasticity
1.Food and Tobacco	1.094
2.Textiles	3.274
3.Wood	5.855
4.Paper and Publishing	10.90
5.Fuels	2.752
6.Chemicals	6.397
7.Rubber and Plastics	6.949
8.Mineral	4.158
9.Metals	5.041
10.Machinery	4.678
11.Electrical Equipment	6.413
12.Transport Equipment	3.618
13.Manufacturing	3.706

Notes: This table presents industry specific trade elasticity estimated from structural gravity model. All estimates are larger than 1 and in the reasonable range for trade elasticity.

Table A4: Public Opinion from Survey

FTA	Supportive	Neutral	Total Supportive Ratio
Jordan			50%
Chile	32%	28%	60%
Singapore			50%
Australia			50%
Morocco			50%
Bahrain			50%
CAFTA-DR	50%	11%	61%
Oman			50%
Peru			50%
Colombia	38%	21%	59%
Korea	38%	21%	59%
Panama	38%	21%	59%

Notes: This table presents the initial ratification probability constructed from the survey statistics about public opinion on FTAs. For the FTAs not appeared in any survey questions, I set the initial probability to be 0.5.

Table A5: Log-linear Model of Lobbying Expenditures

	(1)	(2)	(3)	(4)
		log(Expenditure)		
$log(ProfitGain)$	1.691	2.158	2.161*	2.163
	(1.229)	(1.482)	(1.268)	(1.487)
$PublicOpinion$	47.03		68.72*	
	(35.33)		(36.67)	
$log(ProfitGain) \times PublicOpinion$	−2.477	−3.073	−3.523	−3.584
	(2.124)	(2.560)	(2.187)	(2.527)
$LagExpenditure$	0.314***	0.274***	0.233***	0.129***
	(0.0374)	(0.0394)	(0.0421)	(0.0448)
Industry FE			✓	✓
FTA FE		✓		✓
Dep. Var. Mean	0.735	0.735	0.735	0.735
R-squared	0.504	0.547	0.605	0.688
Obs	144	141	144	141

Notes: This table reports the estimated coefficients of the OLS model of Equation (7) in logarithm with different controls. The observation is by industry-FTA-year level. The dependent variable is lobbying expenditure. Standard errors are presented in parentheses below the coefficients. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A6: Computation Steps

(1)	Draw random choices for η and ε from standard normal distribution
(2)	(Initial) guess of θ
(3)	Compute model predictions for participation and expenditure, $\tilde{x}$, for guess θ
(4)	Evaluate likelihood function $Q(\theta)$
(5)	Repeat steps (2)-(4) until convergence criteria is satisfied and $Q(\theta)$ is maximized

Notes: This table presents the computation steps for maximum likelihood estimation.

Table A7: Change in Ratification Probability

	Initial	Change	Final
Chile	0.971	0.003	0.974
Singapore	0.618	0.021	0.638
Australia	0.285	0.094	0.379
Morocco	0.541	0.015	0.556
Bahrain	0.495	0.016	0.511
CAFTA	0.832	0.049	0.881
Oman	0.635	0.055	0.690
Peru	0.124	0.340	0.464
Colombia_1	0.000	0.449	0.449
Colombia_2	0.000	0.501	0.501
Korea	0.000	0.504	0.504
Panama	0.000	0.450	0.450

Notes: This table presents the total effect of lobbying expenditures on ratification probability of FTAs. The first column shows the initial probability. The second column shows the change in probability because of lobbying, and the third column shows the ratification probability of FTAs after being lobbied.