

Political Cleavages within Industry: Firm level lobbying for Trade Liberalization*

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Abstract

Existing political economy models rely on inter-industry differences such as factor endowment or factor specificity to explain the politics of trade policy-making. However, this paper finds that a large proportion of variation in U.S. applied tariff rates in fact arises *within* industry. I offer a theory of trade liberalization that explains how product differentiation in economic markets leads to firm-level lobbying in political markets. I argue that while high product differentiation eliminates the collective action problem exporting firms confront, political objections to product-specific liberalization will decline due to less substitutability and the possibility of serving foreign markets based on the norms of reciprocity. To test this argument, I construct a new dataset on lobbying by all publicly traded manufacturing firms after parsing all 838,588 lobbying reports filed under the Lobbying Disclosure Act of 1995. I find that productive exporting firms are more likely to lobby to reduce tariffs, especially when their products are sufficiently differentiated. I also find that highly differentiated products have lower tariff rates. The results challenge the common focus on industry-level lobbying for protection.

Key Words: international trade, heterogeneous firms, lobbying

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1 Introduction

What makes trade liberalization possible? This has been a central question in the study of politics of trade policy. Over the last several decades, much progress has been made in understanding how countries can achieve trade liberalization even when they have strong incentives to protect domestic markets.¹ We know, for example, that international institutions (Keohane, 1984; Bagwell and Staiger, 1999), global supply chain (Milner, 1987), delegation of negotiation authority to the executives (Bailey *et al.*, 1997), and political motivation (Maggi and Rodríguez-Clare, 2007) all play a role. However, a vast majority of both theoretical and empirical research on domestic politics of international trade either implicitly or explicitly assumes that the underlying individual trade preferences that drive these forces are shaped by how trade affects their income, which is tied directly to the *industry* they serve. That is, trade policy preferences of individuals diverge *across* industry (e.g., Rogowski, 1987; Hiscox, 2002).

This paper is motivated by some consistent empirical patterns that I find in the U.S. that contradict the industry-level explanations. First, I find that overall tariff differences occur largely *within* industries across similar products, the level at which tariffs are actually set. For example, as of 2013, the applied most favoured nation (MFN) tariff rate for Cotton, not carded or combed, having staple length of 28.575 mm or more but under 34.925 mm (HS8 52010038) is 31.4 cents/kg ($\approx 14\%$), whereas Cotton, not carded or combed, having a staple length under 19.05 mm (3/4 inch), harsh or rough (HS8 52010005) is duty free.² The tariff on Flashlights (HS8 85131020) is 12.5% while that of Portable electric lamps designed to function by their own source of energy, other than flashlights (HS8 85131040) is 3.5%. Second, firms, rather than industry as a whole, individually lobby on trade policies targeting very specific products. This suggests that trade policy preferences of firms in the same industry diverge. Despite these, we know relatively little about how politics affects the distribution of tariffs across products *within* industry (see Gowa and Kim (2005); Goldstein and Gulotty (2014) for notable exceptions.).

I argue that firm-level lobbying is an important determinant of product-specific liberalization,

¹ See Bagwell and Staiger (1999) for how the terms-of-trade externality creates an incentive to increase trade barriers. Grossman and Helpman (1994) characterizes the conditions under which governments protect domestic industries even without the terms-of-trade incentives. Guisinger (2013) finds that white Americans are more supportive of trade protection when they are in racially diverse communities because of redistributive concerns.

² Ad-Valorem Equivalents of non Ad-Valorem Tariffs are calculated based on UNCTAD Method 1, which is “a three-step method for estimating unit values: (1) from tariff line import statistics of the market country available in TRAINS; then (if (1) is not available) (2) from the HS 6-digit import statistics of the market country from UN COMTRADE; then (if (1) and (2) are not available) (3) from the HS 6-digit import statistics of all OECD countries. Once a unit value is estimated, then it is used for all types of rates (MFN, preferential rates, etc).”

and in particular, of high within-industry policy variation. To analyze political incentives of firms, I extend the theoretical framework of the new-new trade theory (e.g., Bernard *et al.*, 2003; Melitz, 2003) to include political interaction between firms and government. In order to allow for within industry heterogeneity, I extend the Grossman and Helpman (1994) model by introducing firm-level differences in their productivity. I show that it is both economically and politically optimal to reduce tariffs on differentiated products (defined as less substitutable goods).³ My argument differs from the theory of endogenous protection which identifies the conditions under which firms intensify their lobbying activity for *protection* (Hillman, 1982; Mayer, 1984; Baldwin, 1985; Magee *et al.*, 1989; Trefler, 1993). Although it is well known that governments reduce trade barriers responding to the interests of exporting industries/firms (Schattschneider, 1935; Milner, 1987; Destler and Odell, 1987; Milner and Yoffie, 1989; Gilligan, 1997a; Hansen and Mitchell, 2000), existing studies are unable to predict *which firms* within industry are more or less likely to lobby, *when* they lobby, and *which products* get lower tariffs. That is, few theoretical and empirical studies identify the conditions under which lobbying on product specific liberalization is successful.

My theory provides the microfoundations of the argument that exporting firms lobby for free trade (Milner, 1988a; Gilligan, 1997b; Yaşar, 2013).⁴ Specifically, I focus on the effects of product differentiation on product-specific trade liberalization by examining the strategic interaction between firms and government. First, I argue that product differentiation eliminates the collective action problem exporting firms confront because only a *small* number of firms actually trade specific products on which governments set tariff. Thus, the firm's lobbying decision is an endogenous response to their own cost-benefit calculation rather than a collective problem at the industry level.⁵ Second, product differentiation mitigates domestic firms' perceived threats of foreign competition compared to when their products are completely substitutable by cheaper foreign products. Finally, product differentiation increases the level of intra-industry trade, which subsequently encourages firms to strategically lobby for open trade on the basis of the norms of reciprocity.

To estimate the effect of product differentiation on firm level lobbying and trade liberalization, I construct a firm-level lobbying dataset based on 838,588 lobbying reports filed under the Lobbying Disclosure Act (LDA) of 1995. For each lobbying report, I identify the firms lobbying for

³ Throughout this paper, I use product differentiation and less substitutability interchangeably.

⁴ Yaşar (2013) makes an important empirical contribution by showing that exporting firms are politically influential in trade policy-making based on evidence from 27 Eastern European and Central Asian countries.

⁵ Gilligan (1997b) shows that *protection* becomes a private good when firms engage in monopolistic competition. He finds that industries with large intra-industry trade tend to request more protection due to less severe collective action problems. Contrarily, I argue that product differentiation mitigates the threat that import-competing firms face, and thus results in less demand for protection.

any trade bills introduced since 1999 (from 106th Congress: both the Senate and the House of Representatives). I then use financial databases (e.g., Compustat and Orbis) to obtain economic data for those firms. I show that productive firms are more likely to lobby on trade policy only when they compete in industries with differentiated products. I also analyze the content of trade bills that have been introduced since 1999 (from 106th to 113th Congress). Consistent with my theory, I find that firms individually lobby to reduce trade barriers on highly specific products. By emphasizing the importance of firm-level political activities and their subsequent effects on trade liberalization, this paper contributes to the empirical literature on the domestic politics of trade policy-making (e.g., Goldberg and Maggi, 1999; Gawande and Bandyopadhyay, 2000; Scheve and Slaughter, 2001; Hainmueller and Hiscox, 2006; Mansfield and Mutz, 2009; Lü *et al.*, 2012).

The rest of the paper is organized as follows. Section 2 highlights the large within industry variation and discusses the limits of existing studies. Section 3 theoretically discusses why a high level of product differentiation implies trade liberalization. Empirical results will be presented in Section 4. The final section concludes.

2 Inconsistencies between Existing IPE Models and Trade Flows

This section undertakes an empirical analysis of tariffs and trade flows of the U.S. at the product level. I find that most of the variation in tariff rates can be explained by differences in tariffs for products within the same industry. This is in contrast to existing theories which generally focus on conflicts of interests across factor owners or industries (e.g., Rogowski, 1987; Hiscox, 2002). I revisit the validity of two dominant theories of trade policy formation. I then review the recent development of the new-new trade theory to motivate the study of firm-level political activity.⁶

2.1 Product-level Trade Policy Variation within Industry

With sophisticated global consumer tastes and the development of production technology, international trade has increased not only in volume but also in the variety of goods. There are more than 17,000 internationally traded products on which countries set distinct tariffs and non-tariff barriers.⁷ Krugman (1980) showed how consumer’s love of variety creates new gains of trade independent from the conventional source of comparative advantage. This paper examines the political

⁶ This paper focuses on the theoretical implication of the new-new trade theory on firm-level political incentives. There is a large literature on the importance of firms in international political economy (e.g., Milner, 1988b; Chase, 2004; Manger, 2005; Broz and Plouffe, 2010; Weymouth and Broz, 2013). I make no attempt to offer an exhaustive list of the literature.

⁷ For the U.S., there are approximately 9,000 distinct exporting goods (Schedule B) and 17,000 imported products (HTS) used for export/import documentation.

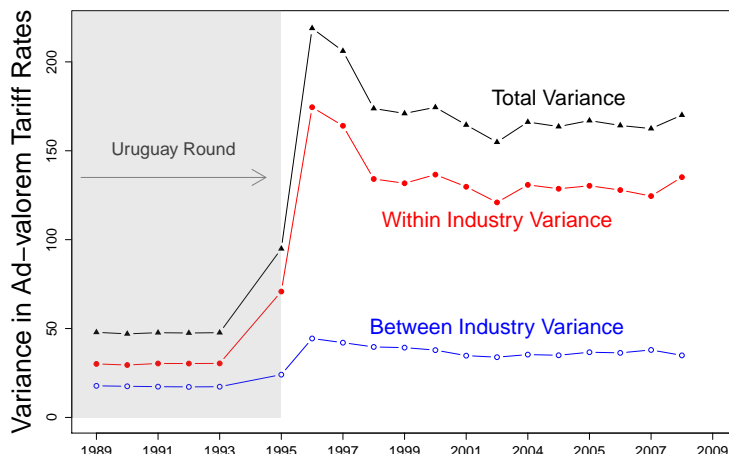


Figure 1: **Large Within-Industry Variance in Applied Tariff Rates of the U.S.:** This figure demonstrates that a significant proportion ($\approx 70\%$) of the current variance in MFN (Most Favored Nation) tariff rates of the U.S. can be explained by the variation in tariff rates *within* industries, rather than variation across industries. It also illustrates that most tariff reduction, as a result of Uruguay Round negotiation, occurred across products within industry. This suggests that industry-level analysis is no longer adequate to explain trade policy-making, especially for developed countries like the U.S. Note that mathematically, the within industry variance plus the between industry variance sums up to the total variance.

implication of high product differentiation in the U.S., a country that is commonly used as a testing ground for endogenous protection literature. Specifically, I compare and contrast the political incentives of firms to identify the conditions under which lobbying on product-specific liberalization is successful.

We now demonstrate that variation of trade policy within industries comprises most of the variation in tariff rates. Thus, I decompose the overall variation in applied tariff rates in each year into a within industry and a between industry component.⁸ Figure 1 shows that *within* industry component accounts for most of the total variation in U.S. tariffs.⁹ The difference in variation is most noticeable after the Uruguay Round negotiation, which resulted in major tariff reductions. This calls into question the adequacy of relying on industry-level variation to explain trade policy-making in developed countries. To the extent that trade policy is endogenously determined by

⁸ The total variance is decomposed into within and between component such that $T_t = W_t + B_t$. We calculate each component by $T_t = \frac{1}{N_t} \sum_{\text{HS2}} \sum_{i \in \text{HS2}} (\tau_{it} - \bar{\tau}_t)^2$, $W_t = \frac{1}{N_t} \sum_{\text{HS2}} \sum_{i \in \text{HS2}} (\tau_{it} - \bar{\tau}_{\text{HS2},t})^2$, and $B_t = \frac{1}{N_t} \sum_{\text{HS2}} N_{\text{HS2},t} (\bar{\tau}_{\text{HS2},t} - \bar{\tau}_t)^2$ where Harmonized System 8 digits level products (HS8) are indexed by i and time by t ; industry is denoted by 2-digits Harmonized System Chapters (HS2); N_t and $N_{\text{HS2},t}$ denote the overall number of products and the products within each industry HS2; τ_{it} , $\bar{\tau}_{\text{HS2},t}$ and $\bar{\tau}_t$ are the applied tariff rates, the average tariff rates within each industry, and the overall average of tariff rates across all products, respectively.

⁹ Using different levels of aggregation for industry such as HS4 and HS6 results in essentially the same result: high variation across products within industry.

NAICS	HS4	(HS6) HS8	Description	MFN tariff
3114 (Fruit and vegetable preserving and specialty food manufacturing)	2008 (Fruits, nuts and other edible parts of plants, otherwise prepared or preserved)	20089910	Avocados	10.6 cents/kg
		20089913	Banana pulp	3.4%
		20089915	Bananas (other than pulp)	0.8%
		20089925	Dates	22.4%
		20089929	Grapes	7.0%
		20089930	Guavas	0%
		20089940	Mangoes	1.5 cent/kg
		20089960	Plums	11.20%
		20089980	Pulp of fruit	9.60%
		20089990	Fruit, nesi	6.00%

Table 1: **Variation in applied most favored nation (MFN) tariff rates:** This table illustrates that there exists large variation in MFN applied tariff rates of the U.S. even in the same industry (canned-fruit industry) as of 2013. It also shows that highly differentiated products tend to have lower tariff barriers (the ad-valorem equivalence of 1.5cent/kg for HS8 20089940 is about 1.1% based on the UNCTAD Method 1. See footnote 2 for the method). Applied tariff rates are from WITS (World Integrated Trade Solution).

political dynamics, the pattern observed in the U.S. suggests that firms might differ in their trade policy preferences even within the same industry depending on which products they produce.¹⁰ Indeed, the level of trade barriers differ across fairly similar products in the U.S.. Table 1 shows the large variation in tariffs across products even within a narrowly defined canned-fruits manufacturing industry.

Explaining this variation is important although researchers have increasingly played down the significance of Most Favored Nation (MFN) applied tariff rates of the U.S., due in large part to its low overall mean ($\approx 3.89\%$). First, countries spend enormous resources on negotiating tariff rates at this level of disaggregation, reflecting diverse domestic and foreign interests in the policy making process. For example, trade representatives of South Korea engaged in lengthy negotiation efforts to reduce current tariff barriers of the U.S. even when both countries already enjoy MFN status as members of the WTO (World Trade Organization). Second, 60% of products are still dutiable (i.e., positive tariffs), and the mean applied MFN tariff rate for dutiable products is ($\approx 7.27\%$). According to International Trade Commission, the tariff revenue is estimated to be \$31 billion in FY 2012, which is comparable to the amount that the U.S. spent on foreign aid (\$23 billion) and foreign military assistance (\$14 billion) combined. Finally, tariffs can function as an important foreign policy tool. For example, Carnegie (2013) finds that the U.S. used its tariffs to pressure

¹⁰ This is starkly different from the pattern observed in developing countries. For example, a same analysis shows that *between* industry component explains more than 80% of total variation in China. The large between-component in China is consistent with the prediction of industry-level theories, i.e., diverging preferences across industries. This paper focuses on the trade policy-making of industrialized nations.

Vietnam to improve its human rights record until it joined the WTO in 2006. As such, a deeper understanding of product specific trade policy making on tariffs is needed.

I argue that the existing theoretical frameworks with their primary focus on inter-industry variation inadequately explain the politics of trade policy making. For example, the U.S. exports and imports each product in Table 1, and similar factors of production are used to produce these products.¹¹ This makes it difficult to determine whether the products belong to an exporting industry or import-competing industry, or whether they are capital or labor intensive goods. Clearly, neither sectoral nor factoral models can explain variations in these tariffs. Below, I provide further evidence of the limits of the existing frameworks in explaining trade policy-making of the U.S. based on some inconsistencies between the theoretical frameworks and actual trade flows of the U.S.

2.2 Factor-based Model (Heckscher-Ohlin)

The Stolper-Samuelson Theorem predicts political cleavages will arise between owners of different factors of production. Countries endowed with high-skilled labor, for instance, will have class conflict between high-skilled and low-skilled laborers because trade liberalization will have differential effects on their factor prices. Goods will equalize the factor prices across countries through trade, decreasing the wages of low-skilled labor with the imports from a country that is endowed abundantly with the same type of labor (i.e., lower factor prices for low-skilled labor). This perspective has laid an important theoretical foundation for understanding the domestic political cleavages within countries (Rogowski, 1987).¹²

However, Figure 2 suggests that the trade pattern of the U.S. is inconsistent with the factor-based theory. Contrary to the factoral theory, which predicts large trade flows from/to middle and low wage countries (shaded region), the imports and exports of the U.S. (a country relatively abundant in high-skilled labor) have been dominated by products from the high and medium wage countries. More importantly, the top panel shows that a large number of products originate in countries with highly different factor prices (circles *inside* the triangles). This is striking because the Stolper-Samuelson Theorem does not hold if the same product is produced by countries with

¹¹ By using disaggregated industry-level trade data from the U.S. Census Bureau, Pinto and Weymouth (2013) estimated that this industry (NAICS 3114) is one of the most capital-intensive industries.

¹² Moreover, the factor-based theories have been also useful in examining the relationship between political institutions and trade policies. In general, democratic countries are hypothesized to have more open trade policies than autocracies since their median voters, whose factor of production tends to reflect the country's abundant factor, would gain from trade liberalization (e.g., Mansfield *et al.*, 2002; Milner and Kubota, 2005).



Figure 2: **Inconsistencies Between Heckscher-Ohlin Model and Actual Trade Flows:** This figure shows that the main sources (destinations) of the U.S. imports (exports) are high and medium wage countries. This is in contrast to the Heckscher-Ohlin model, which predicts that most trade flows should be in the shaded region, i.e., from/to medium or low wage countries. Each vertex of the triangles represents countries with different factor prices for labor: high, medium, and low. Each circle represents a HS6 product with the size proportional to the total value of trade. The location of each circle represents the distribution of source/destination country types. For example, a circle at the center of the triangle means that 1/3 of the product is from/to high, medium, and low wage countries at the same time. Each country's wage level is calculated based on the level of GDP per capita (GDPPC) adjusted by their purchasing power parity: low wage countries have GDPPC levels less than the 20th percentile (\approx \$2,000); high wage nations have GDPPC higher than the 70th percentile (\approx \$10,000); and medium wage countries are in between. Note that China is responsible for the increasing imports from the medium wage country in recent years. Bilateral trade data is from UN Comtrade. GDPPC data is from Penn World Tables 7.0

different factor endowments.¹³ In fact, trade flows should be concentrated only at the bottom two vertices according to the logic of the theorem. The fact that a large number of products are located either inside the triangle or along the northwest edge implies that factor ownership alone cannot explain the patterns of trade liberalization since it is unclear to which direction their factor prices would move.

¹³ Factor price equalization is found to hold even in the case of more goods than factors (Dixit and Norman, 1980; Feenstra, 2003). As such, this theoretical result is implicitly assumed in the literature.

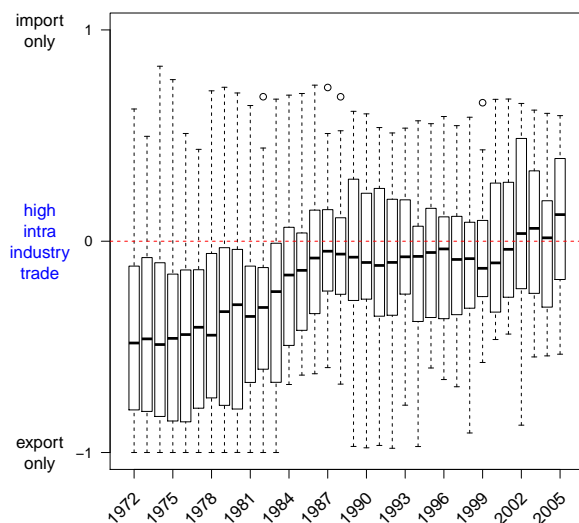


Figure 3: **Inconsistencies Between Ricardo-Viner Model and Actual Trade Flows:** The box plots of Grubel–Lloyd index for the top 20 exporting industries of the U.S. for each year underscore that the level of intra-industry trade even within exporting industries has steadily increased over time. The level of intra-industry trade for each manufacturing industry (at SIC 4 digits) is calculated based on a modified version of Grubel–Lloyd index: $-\frac{exp-imp}{exp+imp}$. The red dotted line (zero) in the vertical axis indicates the highest level of intra-industry trade while the two other extremes (-1 and 1) correspond to the industries with only exports and imports, respectively. The top 20 exporting industries are separately identified by the total value of trade for each year (freight-on-board value for imports).

2.3 Sector-based Model (Ricardo-Viner)

The Ricardo-Viner theory is also limited because sectoral divide between exporting and import-competing industry becomes unclear with high degrees of intra-industry trade. The specific-factors model predicts political cleavages across industries assuming completely immobile factors of production (at least in the short-term). From this perspective, exporting industries generally prefer trade liberalization while import-competing industries seek protection. However, the argument breaks down when intra-industry trade is high.¹⁴

Figure 3 shows that the degree of intra-industry trade in U.S. trade has increased significantly across time. The U.S. now *imports* as much as it exports the products within top 20 *exporting*

¹⁴ I use the following a modified version of the widely used Grubel–Lloyd index: $-\frac{exp-imp}{exp+imp}$. Intra-industry trade is highest when the index is equal to zero. As an example, suppose that the total value of trade (import + export) for an industry is 100. Conventionally, researchers have categorized the industry as an exporting (import-competing) industry if “most” of the value 100 is from exports (imports). However, the distinction between exporting versus import-competing industries becomes problematic when countries simultaneously export and import goods (50-50), i.e., there is a large amount of intra-industry trade. The conventional Grubel–Lloyd index is defined as $1 - \frac{|exp-imp|}{exp+imp}$. The modified version is used to distinguish exports from imports as well as the degree of intra-industry trade, e.g., (100-0) versus (0-100) cases.

industries. It also shows that the level of variation has decreased over time. The results in Figure 3 cast doubt on many empirical studies in the field of IPE that dichotomize import-competing versus exporting industries. For instance, Hiscox (2002) measures the trade policy preferences of legislators based on total production in the fixed “10 leading exporting and import-competing industries in each year as a proportion of the state income.” However, the U.S. increasingly imports products even in its top export industries, while it also exports products that import-competing firms produce. Thus, legislators may not prefer a pro-liberalization policy when firms within their state produce a large volume of goods within the top exporting industries, because those firms may actually be import-competing. Analysis at the firm level is necessary in order to correctly identify the heterogeneous political interests.¹⁵

2.4 Firm-based Model (New-New Trade Theory)

The high volume of trade between countries with similar factor endowments (intra-industry trade) goes against the predictions of both factor and sector-based theories. To address the inconsistency, new trade theory models were developed to show that increasing returns to scale, imperfect competition, and product differentiation can explain the increasing intra-industry trade (Helpman and Krugman, 1985; Krugman, 1979, 1980).¹⁶ First, the access to bigger foreign markets allows firms to take advantage of large-scale production. Consequently, the average cost of production will decline as the output increases when they serve bigger markets (i.e., increasing returns to scale).¹⁷ For example, both the U.S. and South Korea exchange cars because firms in each country can increase output and enjoy the gain in efficiency by selling their products in both markets. Second, an important technical implication of increasing returns to scale is that trade models can no longer rely on the assumption of perfect competition. This is because firms now have different market power with different average cost charging different prices for similar products, i.e., prices of cars are all different although they should be same under perfect competition. Finally, product differentiation is one of the most important microfoundation of intra-industry trade. Countries exchange similar goods because each market is populated with consumers with different tastes. For example, some

¹⁵ Leading empirical analysis such as Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000) rely on industry level (SIC4) data. They find that industries with high import-penetration lobby more and receive protection.

¹⁶ Helpman and Krugman (1985) considers a theoretical framework within which both inter- and intra-industry trade can be analyzed. Bernard *et al.* (2007b) offer a general equilibrium model that have both firm-level heterogeneity in productivity and different country-level factor abundance.

¹⁷ Economic theories have examined the effect of increasing returns to scale both *external* and *internal* to the firm (Ethier, 1982). This paper focuses on the increasing returns to scale internal to the firm by allowing firm-level productivity differences. Usually, increasing returns to scale arise firms can spread their fixed cost over a larger output. The efficiency gain is greater when firms are more productive with lower marginal cost of production.

people like to drive 3000cc sedans while others prefer pickup trucks. Simply put, consumers “love variety.”

Although successful in explaining the high volume of intra-industry trade, new trade theory is still limited in explaining why some firms are successful in engaging in international trade while others are not (Bernard and Jensen, 1999). New-new trade theory was developed to explain the vast differences across firms in their levels of trade engagement (e.g., Bernard *et al.*, 2003; Melitz, 2003). It predicts that productivity plays a key role in determining firm-level heterogeneity in exporting. Specifically, productive firms, with lower marginal costs of production, can reduce their average cost by serving foreign markets (increasing returns to scale). In addition, their productivity difference will result in different market power whereby more productive firms can charge lower prices on their goods (imperfect competition). In new-new trade theory, each firm produces a differentiated product, which implies that more varieties will be available after trade liberalization (product differentiation).¹⁸ The advent of firm-level micro data has pushed the framework further to empirically examine the significance of firm-level productivity. Now, there exists ample empirical evidence of productivity differences across firms within industry. In particular, more productive firms tend to be bigger, pay higher wages to employees, and make larger profits. Moreover, only a very small number of firms engage in international trade. That is, both exporters and importers are rare, and they tend to be productive (Bernard *et al.*, 2007a; Eaton *et al.*, 2011).¹⁹

I focus on the distributional consequences of the new-new trade theory at the firm-level. Although new-new trade theory can account for economic heterogeneity across firms within industry, its theoretical analysis of market is predicated upon the assumption that trade policy is exogenous to political interaction between firms and government. Moreover, if product differentiation alone is driving policy outcomes, one should expect more variability between industries as products become less and less substitutable as they belong to different industries (Broda and Weinstein, 2006).²⁰ This is in contrast to the large variation in tariffs within industry as shown in Figure 1. I argue that it is firm-level political activities that endogenously determines trade policy outcomes. This paper makes both theoretical and empirical contribution to the fast-growing firm-based research of international trade policy within the framework of the new-new trade theory (Bombardini, 2008; Osgood, 2012; Plouffe, 2012).²¹

¹⁸See Bernard *et al.* (2011) for an extension of new-new trade theory to incorporate multiproduct firms.

¹⁹ There is mixed evidence on whether trade liberalization leads to productivity increase (e.g., Clerides *et al.*, 1998; Van Biesebroeck, 2005). Examining this is beyond the scope of this paper.

²⁰Technically, the elasticity of substitution should be lower as products are more aggregated.

²¹ Bombardini (2008) is the first that incorporates firm-level heterogeneity into a political economy model. Her

3 Theory

This section shows that *firms* may have more concentrated political interests regarding trade policy than an industry as a whole when products are sufficiently differentiated. First, I discuss how product differentiation fundamentally changes political incentives of firms. Second, I introduce a formal model to analyze the strategic interaction between firms and government under product differentiation. I find that lobbying by productive exporting firms, accompanied by the absence of objections by firms who only serve the domestic market, can shift trade policies in the direction of open trade especially when products are highly differentiated.

3.1 Product Differentiation

Product differentiation decreases exporting firms' free-riding incentives, while also reducing the potential threat that import-competing firms face from foreign competition. The logic is as follows: 1) The cost of international trade is high; only a *small* number of productive firms can bear the cost. Thus, the benefits of lobbying for trade liberalization accrue only to the small number of firms that actually produce the differentiated products in question; 2) in contrast, because consumers cannot easily substitute one good for another, firms that only produce goods domestically face less threat to their survival because they can still secure a certain market share with the introduction of foreign products; 3) finally, product differentiation increases the level of intra-industry trade, which subsequently encourages productive firms to strategically lobby for open trade on the basis of the norms of reciprocity. Simply put, exporting firms see more concentrated benefits while import-competing firms have more dispersed losses with higher levels of product differentiation.

This paper argues that product differentiation increase exporting firms' influence in the tariff-setting process by directly comparing the incentives between exporting and import-competing firms within the same industry. This is in contrast to the existing literature on the domestic determinants of trade policy which assumes that conflicts of interest divide consumers and producers: free trade leads to gains for consumers and losses for domestic producers. In this regard, it has been generally assumed that import-competing firms are privileged actors in the tariff-setting process because they can more easily solve the collective-action problem that lobbying creates than can consumers. The assumption has been justified by the severe costs of existing market from the perspective of import-competing firms (Hillman, 1982). Product differentiation alters these political dynamics.

study focuses on the structure of protection across *sectors* rather than products. Osgood (2012) makes an important theoretical contribution to the study of diverging economic preferences across firms. My research is different from his with a focus on political interaction between firms and government.

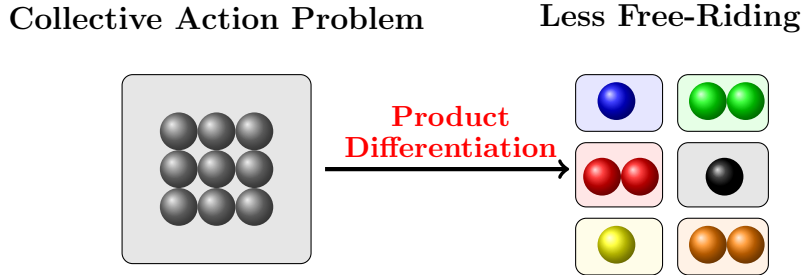


Figure 4: **Mitigated Collective Action Problem:** This figure illustrates the logic by which product differentiation mitigates collective action problems that firms face. That is, firms have more concentrated interests to influence trade policy. Each square plate represents a product with a distinct tariff rate while each ball corresponds to a firm that produces the product.

First, product differentiation mitigates collective action problems that exporting firms confront. This is because a very small number of productive firms actually engage in international trade (Olson, 1971); 3.1% of all firms in the U.S. export while 2.2 percent of firms import.²² It is important to note that exporters tend to be importers as well: more than 50 percent of the firms that import also export and these firms account for about 90 percent of U.S. trade (Bernard *et al.*, 2005). Moreover, the legal tariff lines are becoming increasingly fine-grained with high degrees of product differentiation. For instance, the U.S. had about 8,600 unique products with distinct tariff rates in 1989. It now has over 17,000 products at the legal tariff line as of 2011. Tariffs are set at a highly specific product level, and there are very few firms that produce the product in question. As such, productive firms want to reduce trade barriers when they 1) enter the foreign market, 2) import products back to their home country through global production chain, and/or 3) import intermediate goods for production. Figure 4 graphically shows the relationship between product differentiation and mitigation of the collective action problem.

Second, with product differentiation, domestic firms are *less* likely to oppose open trade because consumer’s love of variety implies that import-competing firms can still secure some domestic market share. Thus, compared to the case where goods are perfectly substitutable (i.e., not differentiated), whereby cheap foreign products might replace domestic products, firms face relatively less threat of being forced out of the market if goods are less substitutable (differentiated). As a result, firms will not actively lobby for protection unless the costs of lobbying are less than the benefits, conditional on their likely survival in the face of trade liberalization. Figure 5 illustrates this argument.

²²Many firms import intermediate goods for manufacturing or to distribute final goods to the domestic market.

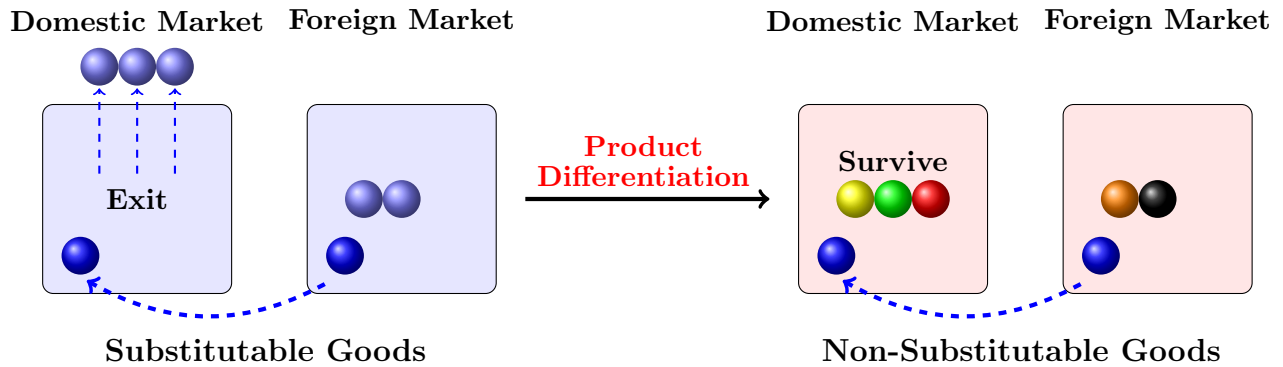


Figure 5: **Reduced Threat Perception of Import-Competing Firms:** This figure graphically compares the levels of perceived threat posed by foreign competition as a function of product differentiation. The left panel shows that when goods are substitutable, domestic firms are threatened by foreign competition. Contrarily, the right panel illustrates that less substitutability implies the possibility of import-competing firms staying in the market under trade liberalization. Increased colorization of balls represents increased product differentiation.

Finally, product differentiation creates a political environment in which firms can strategically use the norms of reciprocity. Specifically, productive firms can pressure their home government to ensure reciprocal tariff reduction in foreign markets. This is because high product differentiation accompanies more intra-industry trade as foreign consumers want different varieties. Therefore, the use of norms of reciprocity will create a feedback loop to reduce trade barriers both at home and abroad as illustrated in Figure 6. That is, firms would oppose trade liberalization less in hopes of increasing their foreign market share *conditional on* reciprocal reduction of foreign trade barriers.

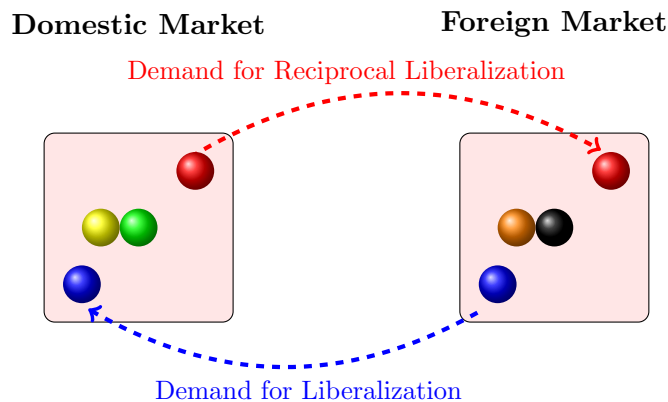


Figure 6: **Strategic Use of the Norms of Reciprocity:** This figure illustrates the use of norms of reciprocity by domestic producers with product differentiation. When there exists demands for open trade, domestic firms can pressure domestic government to ensure foreign market liberalization. That is, domestic firms will oppose trade liberalization less conditional on reciprocal reduction of barriers abroad.

Note that this logic is different from conventional understanding of the norms of reciprocity

applied to products across industries, e.g., reducing tariffs on agricultural products in return for liberalizing passenger cars. That is, I argue that there exists political pressures to reciprocally reduce trade barriers on products within the same industry. This accounts for the tariffs reduction on automobile products as an outcome of the U.S.–Korea Free Trade Agreement (FTA). The U.S. car makers have become *in favor of* the FTA contrary to popular belief that they would strongly oppose it. The statement from Sander M. Levin (D-MI) demonstrates that reciprocity played an important role.

“Fortunately, last year, with the support of Members of Congress, including Chairman Camp, the automakers and the United Auto Workers, the Obama Administration negotiated an additional agreement that will provide U.S. automakers with a real opportunity to compete and succeed in the Korean market. With the changes achieved through the additional agreement, the U.S. auto industry (Ford, Chrysler, GM and the UAW) are supporting the U.S.-Korea FTA.”

3.2 The Model

The political economy model presented in this section combines an oligopolistic competition model under product differentiation with the Grossman and Helpman (1994) model. First, I show that intra-industry trade increases with product differentiation: some firms export while others compete with foreign firms even within the same industry. I then examine the strategic interaction between firms and government and the role of lobbying in making trade policy. The theory I propose in this section will explain why both domestic and foreign firms should be understood as political agents who can affect trade policy through their strategic interaction with governments.²³

I analyze the behavior of firms under the following scenario. A representative consumer maximizes the utility function given in equation (1).²⁴ The utility function incorporates the level of product differentiation in an industry through the parameter $0 \leq \sigma \leq 1$, where lower σ implies a higher degree of product differentiation. Consumers “love variety” in that they want to consume a bundle of differentiated products rather than buying only one product, i.e., products are less

²³ This paper considers firms as political actors with different economic capability. For instance, some firms are successful in pushing their governments to be active in eliminating trade barriers abroad, while others fail to initiate an anti-dumping investigation against their foreign competitors. Likewise, some firms are better at convincing legislatures to introduce a trade bill on their behalf, whereas others fail to obtain subsidies in the form of tax-cuts or cheap input costs.

²⁴ This paper focuses on a partial equilibrium with one industry for the ease of exposition. One can introduce a numeraire good to absorb income effect, and conduct an general equilibrium analysis maintaining the main results.

substitutable.

$$U(q_i; \sigma, \alpha) = \alpha \sum_i q_i - \frac{1}{2} \left(\sum_i q_i^2 + 2\sigma \sum_i \sum_{j \neq i} q_i q_j \right) \quad (1)$$

$$\text{s.t. } \sum_i p_i q_i \leq E \quad (2)$$

where α , p_i and q_i denote size of economy, price and quantity of a product i , respectively. Maximizing equation (1) subject to the standard budget constraint E , we obtain the following inverse demand function for product i .

$$p_i(q_i, q_j) = \alpha_s - q_i - \sigma \left(\sum_{j \neq i} q_j \right). \quad (3)$$

We suppose that there are two states $s \in \{D, F\}$ (domestic and foreign), and four firms: $i \in \{1, 2, 3, 4\}$, where product i is associated with firm i .²⁵ Firms 1 and 2 are domestic firms and firms 3 and 4 are foreign firms with different marginal cost of production c_i (productivity). Variables that correspond to the foreign market will have an asterisk. I assume that the firms with lower index value (1,3) in each market have lower marginal cost of production: $c_1 < c_2$, $c_3 < c_4$. That is, firms 2 and 4 are not considered to be productive. I further assume that only productive firms 1 and 3 can export to the other market.²⁶ Countries are symmetric in that consumers in each market face the same utility function when consuming product i in a given industry.²⁷ Firm i maximizes its profit Π_i by choosing the quantity in each market as given in equation (4). We can then solve the maximization problem to derive the equilibrium quantity and corresponding prices of each good. Appendix 6.1 contains the results.

$$\begin{aligned} \Pi_1 &= (p_1 - c_1)q_1 + (p_1^* - c_1 - \tau)q_1^* \\ \Pi_2 &= (p_2 - c_2)q_2 \\ \Pi_3 &= (p_3 - c_3 - \tau)q_3 + (p_3^* - c_3)q_3^* \\ \Pi_4 &= (p_4^* - c_4)q_4^* \end{aligned} \quad (4)$$

Note that firm 1 and firm 3 face the same tariff τ in their respective exporting market. This reflects our assumption of reciprocity in trade negotiations. Although this assumption is made for analytic

²⁵ Considering a more general model with multiple countries and firms is beyond the scope of this paper.

²⁶ There exist ample theoretical and empirical justification for this assumption (e.g., Melitz, 2003; Bernard and Jensen, 2004; Bernard *et al.*, 2005).

²⁷ One can relax this assumption by explicitly modeling a bargaining step between asymmetric countries. This is beyond the scope of this paper, and I leave it for future research.

tractability, it is worth noting that the reciprocal reduction of tariff barriers introduces stronger demand for protection by domestic producers as well. In fact, the results below show that high tariffs are optimal only under some conditions even with the norm of reciprocity. Furthermore, in order to reflect the reality that actual tariff levels between nations are not exactly the same, I introduce an asymmetry between country D and F by allowing them to have different choke prices $\alpha_s \in \{\alpha_D, \alpha_F\}$ (the lowest price at which the quantity demanded of a good is equal to zero) in their respective demand function. To ensure a positive demand, we make a technical assumption that α_D and α_F are sufficiently high. In particular, we assume the following.

ASSUMPTION 1 (POSITIVE DEMAND)

$$\alpha_D + \alpha_F > c_1 + c_3 + 2\tau, \quad \alpha_D + \alpha_F > c_2 + c_4 - 2\tau,$$

I first show that increased product differentiation implies a high degree of intra-industry trade. This will lay an important theoretical foundation for understanding the gains of trade independent of comparative advantage or technological difference on which existing political economy models are based. Specifically, it will shed light on who the potential winners and losers from trade are. Intra-industry trade is defined in terms of the quantity of goods that productive firms export to each market, i.e., foreign firm's export to the domestic market (q_3) + domestic firm's export to the foreign market (q_1^*).

DEFINITION 1 (INTRA-INDUSTRY TRADE)

$$IIT(\cdot) := q_3 + q_1^* \tag{5}$$

PROPOSITION 1 (INTRA-INDUSTRY TRADE) *Suppose products are sufficiently differentiated such that $0 \leq \sigma < \frac{1}{2}$. Then, intra-industry trade increases as the degree of product differentiation increases.*

$$\left. \frac{\partial IIT}{\partial \sigma} \right|_{\sigma < \frac{1}{2}} < 0 \tag{6}$$

Proof is in Appendix 6.2.²⁸

The proposition shows that consumers' love of variety results in a high degree of intra-industry trade.²⁹ It also highlights the fact that profit maximizing firms will see a big opportunity abroad. That is, it is not only consumers who love variety, but also productive exporting firms who will gain

²⁸ A more general result can be achieved with a stronger assumption. It can be shown that $\frac{\partial IIT}{\partial \sigma} < 0$ for all $0 < \sigma < 1$ if $\{3(\alpha_c + \alpha_F) - (2c_1 + c_2 + 2c_3 + c_4)\}/2 < \tau < (c_2 - c_1 + c_4 - c_3)/4$ and $\alpha_D + \alpha_F > c_2 + c_4 - 2\tau$.

²⁹ Note that the new-trade theory and new-new trade theory emphasize this mechanism through Dixit-Stiglitz CES utility function (Krugman, 1980).

greatly from trade liberalization, particularly when products in an industry are not substitutable with each other. In this respect, I argue that the incentives of exporting firms to lobby can be stronger than those of their import-competing counterparts when products are sufficiently differentiated. Although any firm will benefit by having protection at home and open markets abroad, highly productive exporting firms find the latter more attractive due to increasing returns-to-scale. Subsequently, governments, who cannot credibly commit to introducing protective measures when consumers value variety, reduces trade barriers in return. In the following section, I examine the political interaction between firms and government.

3.3 Lobbying by Exporters and Trade Liberalization

How can we understand the strategic interaction between firms and governments when firms within the same industry see the benefits from liberalization differently? What if foreign firms can also lobby domestic government? Existing political economy models of trade policy have left these questions unanswered.³⁰

Following Grossman and Helpman (1994), I consider the following two stage game. In the first stage, firms simultaneously choose their political contribution schedules, and in the second, government sets policy τ and collects contribution $L_i(\tau)$ from each firm in the second stage. I consider the lobbying game in the domestic market ($i \in \{1, 2, 3\}$) since similar results will follow in foreign market due to symmetry.

The government values social welfare. Specifically, it tries to increase consumer surplus defined in equation (7) and tariff revenue. I assume that the government distributes tariff revenue equally to its population. The revenue is defined as $r(\tau) = \tau q_3$.

$$\begin{aligned} s(\tau) &= U(\cdot) - \sum_i q_i p_i \\ &= \alpha_D \sum_i q_i - \frac{1}{2} \left(\sum_i q_i^2 + 2\sigma \sum_i \sum_{j \neq i} q_i q_j \right) - \sum_i q_i p_i \end{aligned} \quad (7)$$

The government maximizes the following objective function. Note that a is a weight that the government assigns to welfare relative to political rents.

$$\max_{\tau} \sum_i L_i(\tau) + aW(\tau) \quad (8)$$

³⁰ Grossman and Helpman (1994) assume that pre-tariff world prices are fixed exogenously. Consequently, foreign firms do not have any incentives to lobby because domestic tariff rate will not affect their profits. As Section 4 shows, foreign firms do lobby.

where $W(\tau) = \Pi_1(\tau) + \Pi_2(\tau) + s(\tau) + r(\tau)$

The government faces the following trade-off depending on the level of product differentiation. When products are highly substitutable, increasing a tariff protects domestic firms from foreign competition. The demand for protection will be particularly strong if foreign firm 3 is highly productive and charge a much lower price than domestic firms 1 and 2. When consumers value variety, on the other hand, introducing protective measures will decrease consumer surplus. It is important to note that domestic firms will not suffer from foreign competition as much as they would under high substitutability across goods within industry. In fact, productive domestic firm 1 will see a big opportunity from the foreign market since foreign consumers love variety as well. I characterize the optimal tariff of the game with product differentiation.

PROPOSITION 2 (OPTIMAL TARIFF) *Suppose firms use lobbying schedules that are differentiable around equilibrium tariff rate τ^o . Then, government optimally chooses tariff τ^o that satisfies,*

$$\tau^o = \frac{\zeta\sigma^3 + \eta\sigma^2 + \xi\sigma + \kappa}{10a\sigma^3 + (10 + 21a)\sigma^2 + (16 - 20a)\sigma + 16 - 20a} \quad (9)$$

where

$$\begin{aligned} \zeta &= 4a(c_1 + 2c_2 - 2c_3 - \alpha_D) \\ \eta &= 2(c_2 - c_3 + \alpha_D) - (2 + 7a)c_1 - a(c_2 + 15c_3 - 2c_4 - 15\alpha_D + 2\alpha_F) \\ \xi &= 4[2c_2 + c_4 + a(-2c_1 + 6c_3 + c_4 - 3\alpha_D) - 2\alpha_D - \alpha_F] \\ \kappa &= -8(1 + a)c_1 + 4(-2 + 5a)c_3 - 4(-2 + a)\alpha_D + 8(1 + a)\alpha_F \end{aligned}$$

Proof in Appendix 6.3

The Proposition shows the optimal tariff can be expressed as a ratio of two third-order polynomial functions of the level of product differentiation. Although the equation is hard to interpret on its own, an oligopoly game with a finite number of firms has a benefit of giving a closed-form solution as a result of political interaction between firms and the government. Evaluating the equation at $\sigma = 0$ helps understand the intuition.³¹ With sufficiently large a (the government values social welfare more than political rents), it is optimal to set a *negative* tariff. In other words, import-subsidy should be optimal when products are not substitutable with each other.³²

This result suggests that strong political pressures to open trade would exist when products are differentiated: open-trade-for-sale rather than protection-for-sale occurs. Figure 7 graphically

³¹ The optimal tariff schedule is continuous at $\sigma = 0$.

³² Note that import-subsidy might be politically unlikely in reality. However, this theoretical result highlights the importance of high product differentiation behind liberalization.

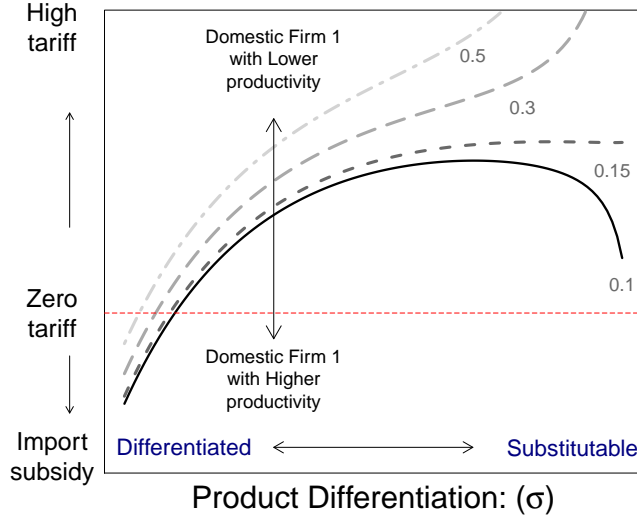


Figure 7: **Domestic Firm's productivity and optimal tariff:** This figure presents a simulation result from Proposition 2 to show that liberal trade policy is optimal when products are sufficiently differentiated. Each line corresponds to the optimal tariff evaluated at four different values of $c_1 \in \{0.1, 0.15, 0.3, 0.5\}$, where domestic firm 1's productivity increases (lower marginal cost of production) as we move downwards. Note that firm 1 is a domestic firm with productive type. The simulation result also suggests that it is optimal for the government to give import subsidy, and the parameter space corresponding to import-subsidy expands as the productivity of firm 1 increases.

presents the result from Proposition 2 simulating over different values of firm 1's productivity and the level of product differentiation.³³ Three general patterns are worth noting in this political game. First, it is optimal to set lower trade barriers when products are sufficiently differentiated. Second, the government should impose only small tariffs (if any) when products are highly differentiated. Furthermore, the range of parameter values of σ that requires negative tariff, i.e., import subsidy, increases as the productivity of domestic firm 1 increases. Finally, it is interesting to note that non-monotonicity exists when domestic firm 1 is highly productive. The inverse U-shape of the optimal tariff schedule suggests that the government may also want to liberalize when products are highly substitutable *and* its domestic firm is very productive. The intuition behind this result is that highly productive domestic firms can compete with foreign firms by setting much lower prices and take a larger market share due to the substitutability of goods.

To summarize, lobbying by productive exporters can shift trade policies toward more open

³³ For this simulation I hold other parameters constant at a set of parameter values that fits Assumption 1 on the relative productivity and market size: $c_2 = 0.65$, $c_3 = 0.1$, $c_4 = 0.65$, $\alpha_D = 5$, $\alpha_F = 2$, and $a = 6.5$. We evaluate τ° at four distinct values of c_1 : 0.1, 0.15, 0.3, 0.5 so that it is less than c_2 . With sufficiently large a , similar patterns exist even after setting the parameters at other values.

trade. The argument, in brief, presupposes the well known firm-level productivity differences: some firms are productive enough to export to foreign markets while other less productive firms face foreign competition in their own market. The preferences of each type of firm conflicts with each other since exporters have preferences for a free and fair market access abroad, while import-competing firms want their government to introduce more protective measures.³⁴ However, their political power and incentives to lobby may not be equal. Ample empirical evidence shows that resource reallocation occurs toward more productive exporting firms (Bernard *et al.*, 2007a; Eaton *et al.*, 2011). This implies that exporters have more economic resources to spend on lobbying than import-competitors. On the other hand, the lives of import-competitors are less threatened with high product differentiation. As such, product differentiation increases exporting firms' incentive to lobby while it reduces that of import-competing firms.

4 Empirical Analysis

This section presents the main empirical results that establish the effects of product differentiation on firm-level lobbying and product-level tariffs. My theory predicts that productive exporting firms lobby more when they produce differentiated products. Moreover, the results from Section 3 suggest that high product differentiation is associated with high intra-industry trade and lower tariff rates. Section 4.1 describes the data used for the analysis. Section 4.2 examines the conditions under which productive exporting firms are more likely to lobby on trade policy. Section 4.3 shows that a higher degree of intra-industry trade is associated with trade liberalization, which implies political cleavages within industry. Section 4.4 analyzes the substantive contents of lobbying by analyzing the texts of trade bills introduced since 1999. Finally, Section 4.5 examines whether products with a high degree of differentiation have lower tariffs.

4.1 Data

This paper makes an important empirical contribution by constructing an original dataset. First, I construct a firm-level lobbying dataset based on 838,588 lobbying reports that became available under the Lobbying Disclosure Act (LDA) of 1995. Although a number of studies have used the same data (e.g., Ansolabehere *et al.*, 2002; Bombardini and Trebbi, 2009; Ludema *et al.*, 2010), only a small part of the original data—in terms of its contents and time frame—has been analyzed

³⁴ Recall that I assume that the norm of reciprocity governs international trade negotiations (Bagwell and Staiger, 1999). That is, domestic exporting firms lobby their government for trade liberalization, which puts indirect pressure on foreign governments to eliminate their trade barriers.

due to the large scale and unstructured format of the raw data.³⁵ More importantly, because there is no unique identifier for firms (other than their names) in lobbying reports, it has been difficult to link firm level political activity with their economic characteristics. This has constrained the use of the data to study the link between lobbying and trade policy outcomes. My data combines the entire lobbying data, scraped with a text-parsing program, with firm level financial data as well as detailed information on legislative bills they have targeted for lobbying. To do so, I manually match each firm who lobbied at least once on trade issues with the firms in multiple finance databases such as Orbis to establish the link between political and economic variables.³⁶

The lobbying dataset identifies firm-level political activity and actual lobbying expenditures directly related to trade policy making. To date, empirical studies of political economy models of trade have primarily used the PAC (Political Action Committee) level Federal Election Commission (FEC) campaign contribution dataset (e.g., Goldberg and Maggi, 1999; Gawande and Bandyopadhyay, 2000; Bombardini, 2008). Although campaign contribution certainly reflect general preferences of industry as a whole, this approach relies on a strong assumption that political interests across firms within the industry are more or less homogeneous. Second, the literature relies on an arbitrary assumption about what constitutes a contribution. Given that all sectors make some contributions, the common practice of classifying some sectors as “organized” while others as not based simply on an arbitrary contribution-amount cut-off seems problematic (e.g., Goldberg and Maggi, 1999).

Finally, campaign contributions might conflate highly complex preferences of member firms within each PAC such as that over electoral outcomes, domestic social-political issues, and various economic policies that are distinct from trade policies. In contrast, the lobbying dataset captures each individual firm’s direct, expressed interest in a particular trade policy. Specifically, one can identify firms who lobby on particular trade and tariff bills thanks to Section 5(b)(2)(A) of the Lobbying Disclosure Action of 1995 that requires each report to contain “a list of bill numbers” that are targeted to be lobbied.³⁷ To be sure, this is not to argue that campaign contributions do not

³⁵ It is not clear how the dataset is constructed for these studies. I parse the original xml files available from the Senate Office of Public Records (SOPR). This allows me to construct a more detailed and accurate dataset than the one available at the Center for Responsive Politics. Parsing each lobbying report with a personal computer not only takes enormous time, but also is unviable due to memory limits. I used high performance cluster machines at the TIGRESS High Performance Computing Center at Princeton University to parallelize the parsing program. As of now, the entire dataset can be constructed within five hours. The code and data will be disseminated publicly with the financial support from NSF Grant SES-1264090. An example of a lobbying report can be found in Appendix 6.7

³⁶ Orbis contains more than 99 million global firms including very small private firms. This allows me to match all firms in lobbying report.

³⁷ Firms are not required to report whether they support or oppose a given bill. I partially overcome this problem

Dataset	Original source	Variables	N
Lobbying	LDA dataset (Senate’s Office of Public Records)	lobbying expenditures; issues; related bills; contacted government agencies; lobbyists; primary place of business; affiliated organizations	838,588
Financial	COMPUSTAT	audited financial and geographical sales data	46,241
	Osiris (Bureau van Dijk)	audited financial data on European private firms	over 65,000
	Orbis (Bureau van Dijk)	limited financial data on U.S. private firms	over 99 million
Trade	WITS	HS8 ad-valorem tariff (UNCTAD Method 1)	219,971
	Feenstra, Schott	product level volume of trade (import/export)	153,666
	U.S. Census Bureau	related party trade at 6 digits naics industry	509,971
	TTBD (Chad Bown)	antidumping, countervailing duties	1,813
Bills	Library of Congress (Thomas)	committees, related bills, CRS summary, sponsors	90,124
Industry	Broda & Weinstein	product differentiation, elasticity of substitution	8,213
	Bartelsman & Gray	annual industry-level (naics) data	22,704

Table 2: **Final database:** The final database is a panel of annual firm-level lobbying data combined with firms’ financial characteristics and trade policies.

matter at all. In fact, campaign contributions can serve as both substitutes and complements to lobbying. Rather, I argue that existing studies have omitted an important political channel whereby profit-maximizing private corporations utilize *lobbying* in order to buy “access” to legislators to affect specific policies and bills, rather than to make campaign contributions to influence electoral outcomes.³⁸ This justifies the use of LDA dataset in studying heterogeneous political behavior of firms that are relevant for affecting trade policy.

I consider trade flows and trade policies at highly refined levels of product categorization. I consider the U.S. tariffs at the 8-digits Harmonized System (HS), which is the actual legal tariff line of the U.S. The degree of intra-industry trade has been calculated at HS6, which is the most refined level possible for the measure given the distinct product categories that the U.S. uses for exported goods (Schedule B) and imported goods (HTS). I also use the Temporary Trade Barriers Database (TTBD) to address the concern that countries increasingly use non-tariff barriers instead of (or in addition to) traditional tariff barriers. All HS8 products which have been subject to at least one anti-dumping case and countervailing duties are included in the analysis.

To verify whether the content of lobbying is consistent with the theoretical predictions, I parse

by analyze the contents of bills in Section 4.4

³⁸ Drutman and Hopkins (2013) analyze more than 250,000 internal emails from Enron, and show that the company devoted “minimal attention to campaigns, elections, or fund-raising.” Instead, the firm’s political attention is more on participating in rule-making. The finding provides convincing reasons why LDA data is particularly useful in studying firm-level political activities. Note that, Ansolabehere *et al.* (2002) show that ideologically oriented groups such as labor unions, on the other hand, are more likely to utilize PAC contributions.

all legislative bills introduced since 1999 (from 106th Congress: both the Senate and the House of Representatives). In particular, I focus on Congressional Research Service (CRS) bill summaries to examine whether firms lobby on differentiated products. I identify all lobbied bills using automated text matches either by bill title or bill number appearing in lobbying reports.

Finally, given that there exist limitations in identifying actual products that each firm produces, I added the most refined industry level variables—NAICS (North American Industry Classification System) 6-digits— into the analysis.³⁹ This allows me to control for industry level characteristics such as total employment, payment, value added, energy consumption, etc, which have been identified as important determinants of trade policy-making. Table 2 describes the original sources of data used in this paper.⁴⁰

4.2 Product Differentiation and Firm-level Lobbying

This section tests the hypothesis that exporters lobby more on trade policy, while import-competing firms lobby less when they produce differentiated products. The highly detailed data on firm-level lobbying activity offers an unique means to analyze which firms lobby under what condition. I find that firm-level productivity is an important determinant of lobbying on trade policy.

I use productivity, measured as value-added per labor, as a proxy measure for firm’s interest in exporting markets.⁴¹ My focus on productivity is justified on both theoretical and empirical ground. Theoretically, productivity difference has been an important building block for the new trade theory inducing heterogeneous economic interest of firms. The model in Section 3 also suggests that productivity differences across firms is important in understanding strategic interacting between firms and governments. Furthermore, there exists ample empirical evidence that productivity difference is critical in determining firm’s ability to export.⁴² Finally, firms with higher productivity will have stronger interests in foreign market access because of the increasing returns-to-scale. That is, larger profits will be expected by having access to a bigger market, and

³⁹ Product level imports/exports data at the firm level is confidential. I am currently in the process of applying for getting an access to a number of confidential datasets such as LFTTD and LBD from the U.S. Census Bureau.

⁴⁰The entire database is interconnected by SQL (Structured Query Language), and will be available publicly.

⁴¹ Productivity is measured as value-added (total sales less cost of goods sold) per labor. A more rigorous productivity estimation technique is explained in detail in Appendix 6.5 for interested readers.

⁴² Each firm trading in the U.S. stock market files FORM 10-K pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934. In this form, firms report their geographic sales data. I calculated the U.S. sales share based on the most recent data stored in Wharton Research Data Services (WRDS) UNIX secure server. The segment history database is separated into multiple sub-datasets. In order to identify actual geographic sales share, one needs to carefully merge SEG-ANFUND and SEG-GEO datasets in Compustat. Unfortunately, not every firm reports their geographic sales data, and I found that many multinational firms with foreign presence actually reports that 100% of their sales is from the U.S. I thank Alexis Furuichi and Todd M. Hines for bringing this dataset into my attention.

this becomes more attractive when firm’s marginal cost of production is small, i.e., productive.

For my empirical analysis, I consider all publicly trading firms in the U.S. stock market since 1999– a total of 34,048 observations.⁴³ I manually match each of these firms with the names of clients who lobbied at least once on either trade or tariff issues based on all lobbying reports filed since 1999. In the LDA dataset, a client is defined as “Any person or entity that employs or retains another person for financial or other compensation to conduct lobbying activities on behalf of the person or entity. An organization employing its own lobbyists is considered its own client for reporting purposes.” Out of 4,089 firms from 235 different industries (SIC 4 digits level), there are 588 firms who have lobbied at least once on trade/tariff issues.⁴⁴

Figure 8 shows that firms are more likely to lobby when they are more productive. It also captures an important variation in firm level lobbying depending on the level of differentiation in the industry in which each firm competes. Specifically, it shows that when products are highly differentiated (first column), productive firms dominate lobbying. This provides a political explanation for lower tariff for differentiated products. In contrast, firms with different levels of productivity lobby at the same rate when they produce substitutable goods. This is consistent with the theory that less productive firms have higher incentives to lobby for protection to prevent them from exiting the market.

To further examine this, I fit a logistic regression of lobbying on firm level characteristics such as employment, sales, and capital expenditure. `Domestic producer` is a binary variable that is unity when the firm provides goods only domestically. This variable controls for the incentive of import-competing firms. I use three different measures for product differentiation. `Differentiated` and `Homogeneous` is the binary measure for product differentiation that is the primary measure used for the empirical analysis. The original continuous measure for product differentiation (σ) is estimated by Broda and Weinstein (2006), where smaller value implies larger differentiation. As a robustness check, I also use the `Rauch` product differentiation index. Rauch (1999) categorizes goods traded on organized exchanges as homogeneous (W), and other goods as differentiated (N).⁴⁵ Note that the

⁴³ Only publicly traded firms are considered because it gives a well-defined population of firms. Otherwise, it is impossible to define a population of all firms as the boundary of firms become increasingly arbitrary with private firms. Moreover, private firms in the U.S. are not legally required to report their financial information, which will further limit the ability to estimate productivity. Despite this restriction, enough variation exists among public firms in terms of their economic and political activities. The time frame was chosen because the LDA dataset is available from 1999.

⁴⁴ I analyze the contents of their lobbying based on the specific legislative bills that have been indicated as being lobbied. Section 5(b)(2)(A) of the Lobbying Disclosure Action of 1995 requires that each report shall contain “a list of bill numbers.”

⁴⁵ For instance, price per pound of homogeneous chemical products such as Polyoxyethylene Sorbitan Monostearate is quoted weekly in Chemical Marketing Reporter. W, and N is the original index developed by Rauch, where R is

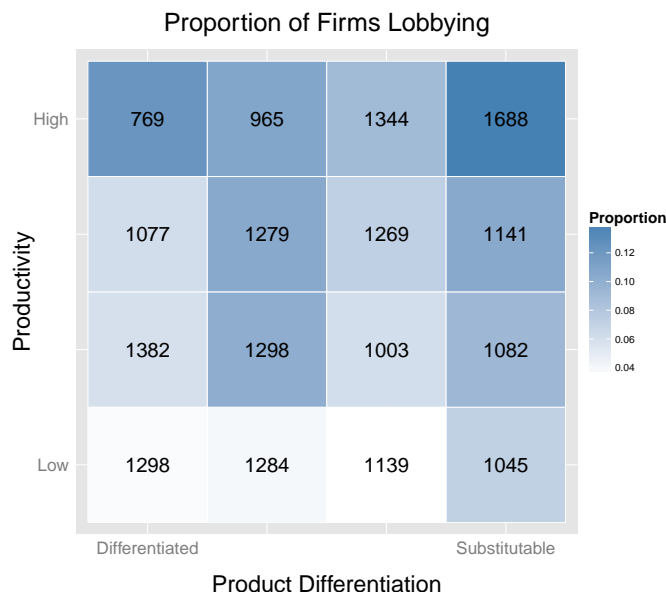


Figure 8: **Lobbying and Product Differentiation:** This figure shows that firms are more likely to lobby when they are more productive (darker shade means a higher proportion of firms lobbying). It also shows that when products are highly differentiated (first column), productive firms dominate lobbying. Contrarily, when products are substitutable (last column) a larger proportion of firms with different levels of productivity lobby suggesting higher level of political competition. As expected, productive firms are more likely to lobby either when goods are highly differentiated or highly substitutable. This corroborates the result from Proposition 2, and suggest that U.S. firms are in general highly productive as seen from Figure 7. Productivity is measured as value-added per labor. Each number inside of each cell represents the total number of firms belonging to each category.

productivity measure is time invariant and varies across NAICS6 industries that each firm mainly competes. Thus, this measure also controls for industry level unobservable heterogeneity.

Table 3 summarizes the result. It shows that productive firms are more likely to lobby when their products are differentiated within industry. This result holds consistently across different measures of product differentiation.

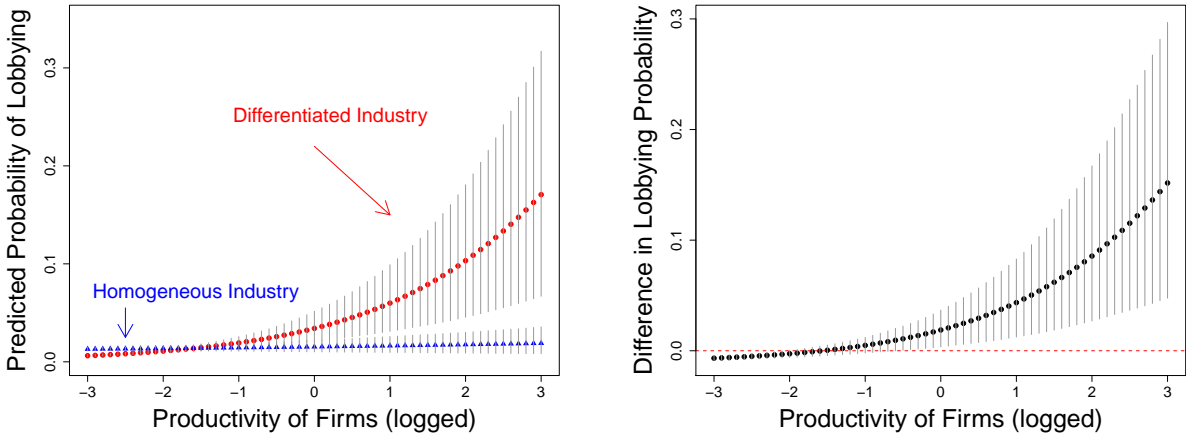
Finally, I examine the predicted probability of lobbying simulating over different levels of productivity observed in the data holding other variables at their mean (scalar variables) and median values (categorical variables). Panel (a) of Figure 9 shows that productive firms are more likely to lobby on trade issues *only when* they compete in an industry with highly differentiated products. This is starkly different from the firm level lobbying behavior in homogeneous industries, where the lobbying activity of firm is unrelated to the productivity of those firms. By taking the difference between the two predicted probabilities, it becomes clear that less productive firms are less likely

used as a baseline category in the analysis. See Rauch (1999) for details.

	Model 1	Model 2	Model 3	Model 4	Model 5
Productivity × Differentiated	0.51*** (0.09)	0.51*** (0.09)			
Productivity × differentiation (σ)			-0.02*** (0.00)		
Productivity × Rauch N				0.09* (0.04)	0.09* (0.04)
Productivity	0.01 (0.09)	0.01 (0.09)	0.41*** (0.10)	0.06 (0.10)	0.06 (0.10)
No-geo-sales-data	-0.02 (0.14)	-0.03 (0.14)	-0.04 (0.14)	-0.02 (0.14)	-0.03 (0.14)
Domestic producer	-0.06 (0.12)	-0.05 (0.12)	-0.09 (0.12)	-0.14 (0.13)	-0.13 (0.13)
Employment	0.33** (0.10)	0.31** (0.11)	0.25* (0.11)	0.30** (0.11)	0.28** (0.11)
Property, plant and equipment	0.38*** (0.06)	0.36*** (0.07)	0.38*** (0.07)	0.36*** (0.07)	0.33*** (0.07)
Capital Expenditure	-0.14* (0.07)	-0.13* (0.07)	-0.12* (0.07)	-0.13* (0.07)	-0.12 (0.07)
Sales/turnover	0.56** (0.20)	0.54** (0.20)	0.48* (0.20)	0.58** (0.20)	0.57** (0.20)
market-value	0.14*** (0.04)	0.15*** (0.04)	0.14*** (0.04)	0.15*** (0.04)	0.16*** (0.04)
Cost of goods sold	-0.08 (0.13)	-0.06 (0.13)	0.02 (0.13)	-0.09 (0.13)	-0.06 (0.13)
Differentiated	0.79*** (0.24)	0.79*** (0.24)			
Homogeneous	-0.13 (0.08)	-0.13 (0.08)			
differentiation (σ)			-0.05*** (0.01)		
Productivity × Rauch W				-0.26** (0.09)	-0.26** (0.09)
Year Fixed Effects	No	Yes	Yes	No	Yes
Log Likelihood	-3302.87	-3295.17	-3311.08	-3211.82	-3204.07
Num. obs.	22454	22454	22454	21826	21826

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, \cdot $p < 0.1$

Table 3: **Interaction between Product Differentiation and Firm-level Productivity:** Productive firms are more likely to lobby when products are differentiated. This result is robust to having different measures for product differentiation. For example the negative coefficient of the interaction term between productivity and σ is expected because lower value of σ means higher product differentiation.



(a) Predicted Probability of Lobbying

(b) Difference in the Probability

Figure 9: Productive Firms are More Likely to Lobby when Products are Differentiated: Panel (a) shows that productive firms are more likely to lobby on trade issues when they compete in an industry with highly differentiated products. This is starkly different from the firm-level lobbying behavior in homogeneous industries, where productivity of firms does not explain their lobbying activities. Panel (b) presents the difference, differentiated industry less homogeneous industry, in the probability of lobbying. Note that the difference is negative when productivity of firms are low. Although the effect is relatively small, its statistical significance suggests that less productive firms are more likely to lobby when they produce substitutable goods.

to lobby when they produce differentiated products. This is consistent with the theoretical prediction that product differentiation explains both active lobbying by productive firms and *absence* of lobbying by less productive firms. Unlike earlier studies, my finding identifies which firm lobbies and *when* they actively do so (c.f., Milner, 1988b). That is, productive firms lobby when they produce differentiated products.

4.3 Intra-industry Trade and Trade Liberalization

My theory also predicts that high intra-industry trade is associated with liberal trade policy. This is because of consumers' love of variety as well as governments' ability to credibly commit to liberal trade policy as shown in Section 3. This section finds that the variation in trade policy across similar products within industry can be explained by high intra-industry trade.

I use the Grubel–Lloyd measure of intra-industry trade for a product i at time t .⁴⁶ I then fit the generalized mixed-effect model given in equation (10) in order to identify time-varying effects of intra-industry trade on trade liberalization. I follow the common practice of weighting tariffs by

⁴⁶ I use this conventional measure rather than the modified Grubel–Lloyd index introduced earlier in Section 2.3 because I explicitly control for the import value in the statistical analysis.

the total value of imports as in Treffer (1993). The unit of analysis is HS6 manufacturing product i —NAICS6 industry j —year t . HS6 categorization is chosen because it is the most refined level of product categorization at which import and export codes agree with each other.⁴⁷ Product level controls include total value of imports, number of countries that the U.S. exports and imports the given product. Several industry level (NAICS6) covariates for industry j such as employment, value-added, total-factor-productivity, payroll, and energy consumption are also included using the information from Bartelsman *et al.* (2000). This results in a dataset with a multilevel structure whereby each product belongs to an industry. A mixed-effect model is particularly useful to incorporate the variation at the different levels of hierarchy, i.e., HS6 and NAICS (Gelman and Hill, 2007). Finally, varying intercepts for each level is included in order to control for the heterogeneity in each product and time.

$$\begin{aligned}
\tau_{ijt} \mid \delta_i, \beta_t &\stackrel{\text{indep.}}{\sim} \mathcal{N}(\delta_i + \lambda_t + IIT_{it}\beta_t + Z_{it}\zeta + X_{jt}\gamma, s_y^2), \\
\delta_i &\stackrel{\text{i.i.d.}}{\sim} \mathcal{N}(\delta, s_\delta^2), \quad \lambda_t \stackrel{\text{i.i.d.}}{\sim} \mathcal{N}(\lambda, s_\lambda^2), \quad \beta_t \stackrel{\text{i.i.d.}}{\sim} \mathcal{N}(\beta, s_\beta^2), \\
\zeta &= (\zeta_1 \zeta_2 \zeta_3)^\top, \quad \gamma = (\gamma_1 \gamma_2 \gamma_3 \gamma_4 \gamma_5)^\top, \\
Z_{it} &= \begin{pmatrix} \text{imp.value}_{it} & \text{n.exp.cty}_{it} & \text{n.imp.cty}_{it} \end{pmatrix}, \\
X_{jt} &= \begin{pmatrix} \text{emp}_{jt} & \text{vadd}_{jt} & \text{tfp}_{jt} & \text{pay}_{jt} & \text{eng}_{jt} \end{pmatrix},
\end{aligned} \tag{10}$$

Figure 10 summarizes the results from two separate models. First, in order to account for the large number of products with zero tariff rate ($\tau_{ijt} = 0$), I estimated a generalized mixed-effect model with binary dependent variable indicating zero tariff rate. Note that there are 17,419 observations at the HS6 category that have zero tariff out of 127,972 from 1999 to 2005.⁴⁸ Panel (a) shows a simulation result based on quasi-Bayesian method after fitting the model above. It shows that hypothetically increasing the degree of intra-industry trade from the lowest to the highest has a positive effect on complete elimination of tariff barriers. The effect is statistically significant and steadily increases from late 1990s.⁴⁹

I fit the second-stage time-varying coefficient model conditional on positive tariff rates ($\tau_{ijt} > 0$). I then multiply the estimated coefficients for each year by the probability of having positive tariffs

⁴⁷ As noted, the U.S. has two separate coding system for documenting exporting (Schedule B) and importing (HTS) goods. They agree only up to 6 digits. That is, same 8 digits code at Schedule B and HTS does not necessarily refer to identical products. Therefore, the aggregation at the 6 digits level by taking an average appropriately weighted by respective volume of trade is necessary.

⁴⁸ I included total value of imports and the number of countries that the U.S. export for each product in order to account for the fact that the U.S. does not produce some of the products at all.

⁴⁹The tariff data for year 1994 is not available in WITS and thus omitted.

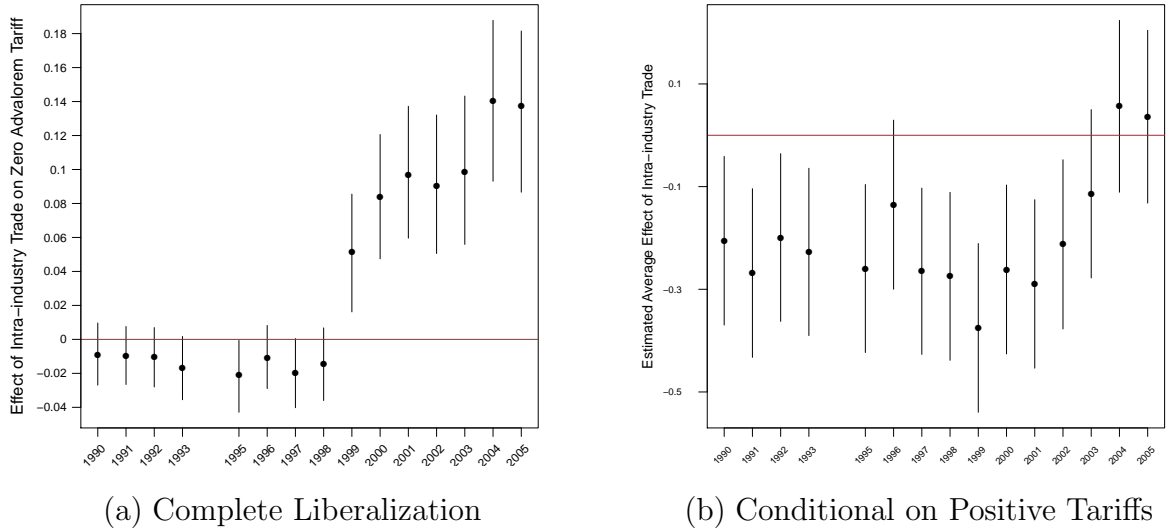


Figure 10: **Effects of Intra-industry Trade on Trade Liberalization:** Panel (a) shows the effect of changing the level of intra-industry trade from the lowest (Grubel–Lloyd index = 0) to the highest (Grubel–Lloyd index = 1) on the likelihood of the product’s ad-valorem tariff becoming zero. It shows that increasing the degree of intra-industry trade makes it more likely to remove tariff-barriers on each product from late 1990s. The effect is estimated by generalized linear mixed effect model with time varying effect of intra-industry trade. Panel (b) shows that increase in the degree of intra-industry trade, measured by Grubel–Lloyd index, is negatively correlated with the average ad-valorem tariff rate. Note that such effect has disappeared in recent years. This is because tariffs on more than 1/3 of products have been eliminated with little variation in applied tariff rates. Average ad-valorem tariff rate is calculated at the HS6 product level weighted by HS8 digits total values of import. For panel (a), quasi-Bayesian method is applied to the fitted model to simulate the hypothetical change from complete zero intra-industry trade to highest level of intra-industry trade.

in order to get the estimated effect of IIT on trade liberalization: i.e., $\mathbb{E}(\tau_{ijt}|T_{it}, Z_{it}, X_{jt}) = \mathbb{E}(\tau_{ijt} | T_{it}, Z_{it}, X_{jt}, \tau_{ijt} > 0) \cdot \mathbb{P}(\tau_{ijt} > 0 | T_{it}, Z_{it}, X_{it})$. As Panel (b) shows, a one-unit increase in the intra-industry trade index is associated with about a 0.2 percentage point decrease in average tariff rate. Note that the effect is statistically indistinguishable from zero in recent years. This is because a large number of products already have reached their zero-tariff level as Panel (a) shows. In sum, Figure 10 shows that a high degree of intra-industry trade is correlated highly with trade liberalization.

4.4 Text Analysis of Trade Bills

So far, I have shown that productive firms are more likely to lobby when they produce differentiated products and that high intra-industry trade is associated with liberal trade policy. However, we still do not know what exactly firms are looking for when they lobby. In fact, this is highly difficult

to identify relying solely on lobbying reports. I overcome this problem by establishing direct links between legislative bills and lobbying reports. Specifically, I consider the universe of trade and tariff related bills introduced since 1999 (106th Congress), and search through all lobbying reports one-by-one to determine which bill is lobbied. This section provides evidence of product specific lobbying by firms in favor of reducing trade barriers.

Identifying the universe of trade and tariff bills is not possible given that any bill can be deemed as related to trade: bills on immigration, environment, labor standard, or even defense can be “trade-related” depending on the perspectives of researcher. Searching based on single words also introduces problems given that a word such as “trade” can be used in multiple different contexts, e.g., “trade stocks in finance”. In order to address the first problem, I utilize the Congressional Research Service (CRS) summary of each bill. CRS aims to provide nonpartisan analysis of various policy issues both for the United States Congress and the public. In particular, it offers a detailed summary of all congressional bills. The summary is useful to identify the overarching issue areas related to a given bill with less political/contextual noise on topics than full texts of bills. Second, for all CRS summaries, I employ a tokenized words search in order to identify bills that are directly related to trade policy. I consider bills that include at least one of the following tokenized terms : `trade barrier(s)`; `tariff barrier(s)`; `non-tariff barriers(s)`; `tariff reduction`; `export subsidy`; `the U.S. trade representative`; `world trade organization`; `most favored nation`; `rules of origin`; `generalized system of preferences`; `free trade agreement`; `uruguay round`. This results in a total of 685 bills.⁵⁰ Table 4 presents 10 randomly selected bills.⁵¹ Given the list of trade bills, we can search the universe of 838,588 lobbying reports to check if there exists any lobbying activities associated with each bill. Which bills are lobbied? Are lobbied bills systemically different from non-lobbied bills in terms of their context? If so, how can we identify the pattern? By answering these questions, I examine whether the contents of lobbied bills are consistent with the theoretical predictions from Section 3.

Using full texts of each bill is problematic because actual texts of bills are endogenous to

⁵⁰ Adding other terms such as `foreign trade` usually introduce bills that have already been identified through the other terms, but it adds a large number of non-trade related bills due to the broad context of `foreign trade`. Including, `harmonized tariff schedule` significantly increases the size of the trade bills to 7,316. This is mostly from product-specific miscellaneous tariffs bills. However, the current parsing algorithm is not complete to search all of these in lobbying reports. A good example can be seen from Fig 14 which shows that the lobbying status of a large number of miscellaneous bills can not be identified if they are reported in a format such as “H.R.4182-4186. The algorithm is currently being improved to accommodate H.R.4183, H.R.4184, H.R.4185 in addition to the two bills that can be searched through regular expressions. Thus, I analyze miscellaneous tariffs bills separately below.

⁵¹The full list of bills will be available through a web-appendix.

Cong.	Bill	Official Title
106	S111	NAFTA Accession Act
106	S101	United States Agricultural Trade Act of 1999
108	HRES712	Providing for consideration of the bill (H.R. 4759) to implement the United States-Australia Free Trade Agreement.
112	S3568	Citrus, Wool, and Cotton Trust Fund Act of 2012
112	HR6539	United States-Brazil Joint Commission on Commerce and Trade Act
106	HR4885	Rural America Prosperity Act of 2000
112	HR6699	Liquefied Natural Gas for NATO Act
109	S2027	United States-Bahrain Free Trade Agreement Implementation Act
107	S944	United States-Republic of Korea Free Trade Agreement Act of 2001
106	SRES226	A resolution expressing the sense of the Senate regarding Japanese participation in the World Trade Organization.
⋮	⋮	⋮

Table 4: **Trade Bills:** This table lists 10 randomly selected trade bills identified by the tokenized word searching algorithm. It demonstrates that the bills are indeed trade related. The full list of bills will be available through a web-appendix.

political process: lobbyists often help draft bills or even write them; legislators insert certain texts to satisfy their constituencies. To remedy this problem, I utilize CRS summary. As noted, CRS offers highly detailed description of each bill from a nonpartisan perspective. Also, it is an independent organization that is outside of lobbying process, which allows researchers to establish a link between the contexts of a given bill to its propensity to be lobbied. Although the text of summary is inevitably affected by the contents of original bill, this is the best available source for deception of each bill created by bipartisan organization.

I first create the list of p words \mathbf{w} used in trade related bills.⁵² I then count w_{ij} , the number of times each word $j \in \{1, \dots, p\}$ appears in each bill i : $w_i = (w_{i1}, \dots, w_{ip})$.⁵³ This will create a bill-to-term matrix (number of trade-related bills $\times p$) summarizing the distribution of words over trade bills. However, estimating the effect of individual words on lobbying is computationally difficult due to the large dimensionality of p , the number of unique words. To address this problem, I use a variable selection method LASSO (Least Absolute Shrinkage and Selection Operator) to select the list of words that are particularly useful in explaining whether bill i is lobbied or not (y_i), while constraining other coefficients to be zero (Tibshirani, 1996; Friedman *et al.*, 2010). As described in equation (11), this can be achieved by putting the constraint on the sum of coefficients β_j associated with each word. I use the logistic link to do a LASSO regressing of binary indicator

⁵² For the analysis below, I used words appearing at least 10 bills after stemming them and removing stop words. This results in $p = 1659$.

⁵³ Note that most of the entries of w_i will be zero. For the purpose of prediction, I use frequency since the size of document itself is useful in predicting the occurrence of lobbying. I use proportion of words later in topic modeling.

for lobbying on the list of words.

$$\min_{\beta_0, \beta \in \mathbb{R}^{p+1}} \left[(y_i - \beta_0 - w_i^T \beta)^2 + \lambda \sum_{j=1}^p |\beta_j| \right] \quad (11)$$

I use cross-validation to choose λ that minimizes out-of-sample prediction error. Specifically, I do 20-fold cross-validation whereby λ is chosen to minimize the mean-squared error (MSE) in predicting the occurrence of lobbying. The model is then applied to 5% of randomly chosen bills to predict how likely each bill is going to be lobbied.⁵⁴ This process is continued 1000 times to examine whether there exist words in CRS summary that helps predict lobbying. On average, bills that are not lobbied are predicted to be lobbied 35%, whereas bills that are actually lobbied are predicted to be so in almost 80% of the time. The result is graphically presented in Figure 17 in Appendix 6.4.⁵⁵ Figure 11 presents the top 30 words that are found to increase (decrease) the predicted probability of lobbying for each bill. The size of each word is proportional to the absolute size of the coefficient β_j , where bigger size of the word in the first (second) column implies that a bill with the word are more (less) likely to be lobbied.

Having identified the words associated with frequent lobbying, I examine in which context they are actually used. The word “characterist” appears in multiple Reciprocal Market Access Act in 2007, 2009, and 2011. For example, as it is shown in Figure 12, Reciprocal Market Access Act of 2011 requires that foreign governments to reduce or eliminate trade and non-tariff barriers with respect to U.S. exports of any product with *same physical characteristics*.

Two important points are in order. First, the word “characteristics” is used in describing specific physical properties of products validating the theoretical connection between product differentiation and the incentives of lobbying. This bill was lobbied by Corning Inc. Based on the texts in the actual lobbying report as seen in Figure 13, we know that Corning Inc. is lobbying for reducing the trade barriers on optical fibers.⁵⁶ I checked the level of product differentiation (σ) for this particular product: **Optical fibers, optical fiber bundles and cables (HS8 90011000)**. The measure

⁵⁴ I used cross-validated estimates instead of out-of-sample-validated estimates given that my purpose is to identify the words associated with lobbying in the sample. I used the latter to check whether there is over-fitting sample-specific attributes of the observed data. Doing so also gives statistically significant separation. I thank Marc Ratkovic for his insights on applying the method.

⁵⁵ I did non-parametric statistical test to access the mean difference of predicted probabilities between lobbied and non-lobbied bills. Wilcoxon signed-rank test is used because the truncation of probabilities (between zero and one) makes it hard to make the normality assumption necessary for t-test. The result validates that there is a significant mean difference in cross-validation sample prediction (p-value < $2.2e - 16$). Wilcoxon signed-rank test is computed by calculating the following test statistic. $W = |\sum_{i=1}^{N_r} \{\text{sgn}(x_{2,i} - x_{1,i}) \cdot R_i\}|$, where R_i denotes the rank order of absolute difference between pairs $(x_{2,i} - x_{1,i})$. This test statistic is normally distributed. t-test gives the same result, where p-value is < $2.2e - 16$, and 0.232 respectively.

⁵⁶ As of 2013, the MFN tariff rate for HS8 90011000 is 6.7%.



Figure 11: **Words with Top 30 Loadings** The size of each word is proportional to the size of loading in the LASSO regression. The bigger the size of a given word in the first (second) column implies that a bill with the word will be more (less) likely to be lobbied.

“Reciprocal Market Access Act of 2011 - Prohibits the President from agreeing to the reduction or elimination of the existing rate of duty on any product in order to carry out a trade agreement entered into between the United States and a foreign country until the President certifies to Congress that: (1) the United States has obtained the reduction or elimination of tariff and nontariff barriers and policies and practices of such foreign country with respect to U.S. exports of any product that has the same physical characteristics and uses as the product for which the President seeks to modify its rate of duty, and (2) any violation of the trade agreement is immediately enforceable by withdrawal of the modification of the existing duty on such foreign product until the United States Trade Representative (USTR) certifies to Congress that the United States has obtained the reduction or elimination of the tariff or nontariff barrier or policy or practice of such foreign government...”

Figure 12: 112th Congress S. 1711: CRS Summary

of σ is 1.92 (Broda and Weinstein, 2006). Recall that lower value of σ implies high differentiation. The mean value of σ is 11.14 and the minimum value is 1.10 indicating that optical fiber is a highly differentiated product with different wavelength of light and bandwidths. Second, Corning

“WTO Multilateral Trade Negotiations and the treatment of optical fiber; Support for H.R. 1749 / **S. 1711**, Reciprocal Market Access Act of 2011; Treatment of optical fiber in foreign markets; Reform of Section 337 of Trade Act of 1974; Chinese Intellectual Property Rights Enforcement”

Figure 13: Lobbying Report by Corning Inc. (2012 Fourth Quarter)

Inc. lobbied in support of reducing trade barriers on the product both at home and abroad (reciprocally). This corroborates the theoretical prediction that domestic firms might find lobbying for reducing trade barriers at home optimal since reciprocal treatments of the *same* product abroad will significantly increase their profits due to increasing returns to scale.

Another word that is associated with frequent lobbying is “extends.” This term is used for extending early legislation that promotes trade: e.g., “Trade Act of 2002” (HR3009), “AGOA Acceleration Act of 2004” (S2529), “To extend the Generalized System of Preferences and the Andean Trade Preference Act, and for other purposes” (HR4284). It is also widely used for extending temporary duty-free measures applied to specific products (usually until the end of each Congress). As an example, the top panel of Figure 14 presents a part of Trade Act of 2002 where “extends” is used. Mattel Inc., a company producing differentiated brands of toys such as Barbie dolls and Fisher-Price, lobbied on this bill.⁵⁷ Note that lobbying reports are useful not only for determining any occurrence of lobbying but also for identifying firms’ direct interests with respect to product specific trade policy. All other lobbied bills lobbied by Mattel Inc. (H.R.4182-4186, S.2099-2103) are related to suspending duties on highly specific products that directly concern the firm’s interests. Interestingly, the bills were sponsored by Rep. Jane Harman (CA-36) and Sen. Dianne Feinstein (CA) on behalf of Mattel Inc. headquartered in California.

“**Extends**, through December 31, 2006, treatment free of any duties, quantitative restrictions, limitations, or consultation levels to certain apparel articles imported into the United States after assembly in one or more ATPDEA beneficiary countries from U.S. or ATPDEA country products.”

“**H.R.3009**, Trade Act of 2002. Certain miscellaneous tariff bills to suspend the rates of duty on certain toy-related articles (H.R.4182-4186; S.2099-2103). WTO market access negotiations for non-agricultural products Port and border security measures”

Figure 14: (Top) An example of the use of “extends” from the CRS summary of H.R. 3009. (Bottom) Lobbying Report by Mattel Inc. (2002 Midyear) who lobbied on the bill.

All of these are examples of Miscellaneous Tariff Bills that each Congress passes (except for 107th Congress) to suspend or *extend* the current suspension of duties on hundreds of products.

⁵⁷ Note that dolls are arguably differentiated products: σ for **Dolls representing only human beings, whether or not dressed** (HS8 90011000) is 2.55.

Cong.	Bill	Official Title	Firms (Location)	Sponsor (state)
109	S2325	A bill to reduce temporarily the duty on certain audio headphones achieving full-spectrum noise reduction	Bose (MA)	John Kerry (MA)
111	S2098	A bill to reduce temporarily the duty on certain isotopic separation machinery and apparatus	Louisiana energy services (NM)	Jeff Bingaman (NM)
112	S2334	A bill to reduce temporarily the duty on lithium ion electrical storage batteries	General Motors (MI) Hitachi Automotive Product (MI)	Carl Levin (MI)
112	HR5557	To reduce temporarily the rate of duty on certain girls' shorts	Nike (OR)	Earl Blumenauer (OR)
112	HR4796	To extend the temporary suspension of duty on electromechanical ice shavers	Hamilton Beach (VA)	Bobby Scott (VA)
112	S2808	A bill to reduce temporarily the duty on golf club driver heads	Reebok (MA)	John Kerry (MA)
106	HR3704	To amend the Harmonized Tariff Schedule of the United States with respect to certain toys	Mattel Inc (CA)	Xavier Becerra (CA)
109	S3313	A bill to reduce temporarily the duty certain color monitors video with a display diagonal of 35.56 cm or greater	Honeywell Intl (NJ)	Charles Schumer (NY)

Table 5: **Lobby on Miscellaneous Tariff Bills:** This table shows that firms lobby for reducing tariff barriers on specific products. Also, there generally exists a high correlation between firm's headquarter location and the sponsor state of each bill.

Tariff reductions imply revenue loss. For example, Congressional Budget Office estimated that all tariff reductions and suspensions introduced in “United States Manufacturing Enhancement Act of 2010” (HR4380) alone will reduce tariff revenue by \$298 million in 10 years. This suggests that open-trade-for-sale occurs. If protection-for-sale is the primary political mechanism through which trade policy is determined as a result of lobbying, one should expect that firms would lobby for protecting domestic market from their foreign competitors. Table 5 shows, however, that many individual firms lobby for reducing tariff on specific products they are concerned with.

Note that all bills in the table target very specific products, e.g., noise reducing headphones. There were almost 2,000 miscellaneous tariff bills introduced in 112th Congress alone. Ludema *et al.* (2010) finds that about 79% of the miscellaneous bills introduced between 1999 and 2006 have become law. Given that only a verbal objection is needed to block the bill, however, they argue that “protection for free” occurs. Simply put, protection can be cheaply accomplished by expressing an objection rather than demanding it directly through lobbying. Nevertheless, it is worth noting that most miscellaneous tariff bills have encountered little objection from import-competing firms. This is consistent with the theoretical prediction of *absence* of the demands for protection for differentiated products. Furthermore, firms tend to lobby individually to reduce tariffs on specific products rather than lobbying jointly together at the industry level. This suggests

that each individual firm base their lobbying decision on their own cost-benefit analysis rather than lobbying together with other firms which requires them to overcome collective action problems. This is also consistent with the theoretical prediction.

This section finds that there exist political pressures from firms to reduce trade barriers of specific products. A close analysis of trade bills provides evidence that the contents of lobbied bills are consistent with the theoretical predictions from Section 3. Certainly, examining words focusing primarily on the sentences where they are used will not give a complete picture of the overarching theme of a given bill. A bill generally covers a large number of issues reflecting diverse political interests and topics. As such, it might be that one part of a bill is promoting trade while other parts are mainly focusing on introducing protective measures. To remedy this problem, I further my analysis by fitting unsupervised topic models on the texts of CRS summary of each bill. I find that a topic that characterized by a set of words such as **certain**, **duty**, **treatment**, and **specific** is associated with frequent lobbying suggesting product-specific lobbying. This adds evidence of product-specific lobbying. A detailed description of this analysis is available in Appendix 6.6.

4.5 Product Differentiation and Trade Liberalization

This section examines whether tariff policy varies across products with different degrees of substitutability. For the measure of product differentiation (σ), I use the widely used measure from Broda and Weinstein (2006).⁵⁸ They estimate the elasticity-of-substitution for each HS10 product. I take the average of their measure over each HS8 product category i in order to match the unit at the legal tariff line of the U.S. Each HS8 product is then categorized into three distinct levels of product differentiation: **low** (less than the 33th percentile), **medium** (between the 33th and the

⁵⁸ The Model in Section 3 assumes quasi-linear preferences with a variable elasticity of substitution. In contrast, Broda and Weinstein (2006) estimates elasticities under the assumption of CES (constant elasticity of substitution) preferences. The measure is estimated based on a simple model of import demand and supply equations. Although the functional form used in this paper is different from the CES utility function, the estimated σ captures the exact same idea of product differentiation and it is the best proxy measure available in the literature.

66th percentile) and **high**.⁵⁹

$$\begin{aligned}
\tau_{ijt} \mid \delta_j, \beta_t &\stackrel{\text{i.i.d.}}{\sim} \mathcal{N}(\delta_j + \lambda_t + T_i \beta_t + Z_i \zeta + M_{ijt} \eta + X_{jt} \xi, s_\tau^2) \\
\delta_j &\stackrel{\text{i.i.d.}}{\sim} \mathcal{N}(\delta + X_{jt} \gamma, s_\delta^2), \quad \lambda_t \stackrel{\text{i.i.d.}}{\sim} \mathcal{N}(\lambda, s_\lambda^2), \quad \beta_t \stackrel{\text{i.i.d.}}{\sim} \mathcal{N}(\beta, s_\beta^2), \\
\zeta &= (\zeta_1 \ \zeta_2)^\top, \quad \eta = (\eta_1 \ \eta_2)^\top, \quad \xi = (\xi_1, \ \xi_2, \ \xi_3, \ \xi_4, \ \xi_5)^\top, \\
T_i &= \begin{pmatrix} \text{low}_i & \text{high}_i \end{pmatrix}, \quad Z_i = \begin{pmatrix} AV_i & CVD_i \end{pmatrix}, \quad M_{ijt} = \begin{pmatrix} \text{value}_{ijt} & \text{cty}_{ijt} \end{pmatrix}, \\
X_{jt} &= \begin{pmatrix} \text{emp}_{jt} & \text{vadd}_{jt} & \text{tfp}_{jt} & \text{pay}_{jt} & \text{eng}_{jt} \end{pmatrix},
\end{aligned} \tag{12}$$

To determine if there are any systemic differences in trade policies across products, I run a multilevel model to estimate the average applied MFN tariff rate (τ_{ijt}) differences across products with different levels of differentiation. This model is given in equation (12). The unit of analysis is HS8 manufacturing product i in NAICS6 industry j at year t . In order to address the concern that non-tariff barriers can function either as substitutes or complements to tariff barriers, I include dummy variables indicating whether a given HS8 product i has ever been subject to an anti-dumping (AD) or countervailing duties (CVD) investigation using the TTBD database (Bown, 2012). I also control for the value of total imports (**value**) and the number of exporting nations (**cty**) for each product. Industry specific effects are modeled hierarchically by assuming that the mean of industry random effects is a function of several industry level (NAICS6) covariates such as employment, value-added, total-factor-productivity, payroll, and energy consumption using the information from Bartelsman *et al.* (2000). The analysis is based on 92,267 observations (HS8 product i —NAICS6 industry j —year t) from 1990 to 2005 with 7,670 unique manufacturing products and 373 NAICS6 industries.

Figure 15 presents a quasi-Bayesian simulation result based on the prediction of the model. It shows that changing the level of product differentiation from **low** (less than the 33th percentile) to **high** (higher than the 66th percentile) category is associated with 0.4 percentage point decrease in the applied MFN tariff rate. This is equivalent to \$124 million decrease in tariff revenue.

The result provides empirical evidence that the U.S. had reduced tariff barriers during the course of the Uruguay Round negotiation, especially those of differentiated products holding industry level variation constant. That is, the stark increase in the within-industry variation in tariffs after the Uruguay Round negotiation shown in Figure 1 is attributable to the tariff reduction of differentiated products. This confirms the theoretical prediction. Specifically, the multilateral negotiation provided an opportunity for productive exporting firms to inform the government of

⁵⁹ Broda and Weinstein (2006) uses the same strategy in order to address the potential measurement error in estimating the level of product differentiation. Different cut-off decisions do not change the result.

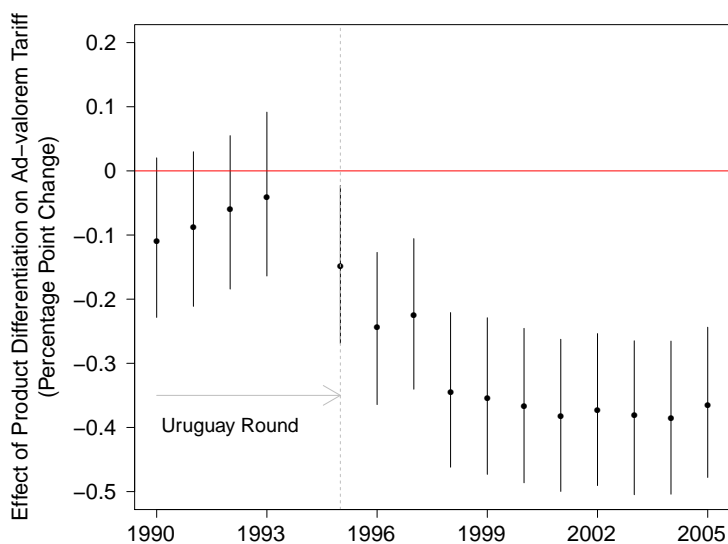


Figure 15: **Lower Tariffs on Differentiated Products:** This figure presents a quasi-Bayesian simulation result based on the prediction of the model. It shows that changing the level of product differentiation from *low* to *high* category predicts that the applied MFN tariff rate of the product would decrease by 0.4 percentage point. Note that the time varying effect becomes more or less constant since 1999 which is consistent with the phase-in period after the Uruguay Round.

their product-specific preferences. As a result, products with high levels of differentiation received larger tariff reduction. It also suggests that counteracting demands for protection by import-competing firms were not as strong as those on products that can be easily substitutable by cheap foreign goods.

5 Concluding Remarks

In this paper, I have shown that product differentiation in economic market induces different political incentives among firms within industry. My theory predicts that demand for trade liberalization will increase because high product differentiation eliminates the collective action problem exporting firms confront. On the other hand, political objections by import-competing firms to product-specific liberalization will decline due to less substitutability and the possibility of serving foreign markets based on the norms of reciprocity. With a new dataset on lobbying and trade bills, I show that productive firms actively lobby on trade policy only when they produce differentiated products. I find that goods that cannot be easily substitutable get lower applied tariffs on average.

Of course, the lobbying data cannot be used to directly test the causal mechanisms of this theory. Successfully answering this question is likely to require survey methodologies that directly

measure firm-level preferences or exploiting technological shocks on product differentiation and productivity at the firm-level. I leave for future research this challenging task of investigating how exactly firm-level preferences translate into trade policy outcome.

The existence of political heterogeneity as well as tariffs differences within industry may mean that we need to call into question some of assumptions about what makes trade liberalization possible. A vast majority of research on domestic politics of international trade is based on the assumption that individual trade preferences are shaped by how trade affects their income, which is tied directly to the industry they serve. However, recent research has found that most wage inequality dispersion occurs within occupations and sectors rather than between occupations and sectors (Helpman *et al.*, 2010, 2012). A better understanding of firm's preferences on trade policy may alter our view on political forces behind trade liberalization.

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6 Appendix

6.1 Demand and Price under Oligopoly

- Taking first order conditions of firms' problem in equation (4) gives

$$\begin{aligned}
 q_1 &= \frac{1}{2}(\alpha_D - \sigma q_2 - \sigma q_3 - c_1) \\
 q_2 &= \frac{1}{2}(\alpha_D - \sigma q_1 - \sigma q_3 - c_2) \\
 q_3 &= \frac{1}{2}(\alpha_D - \sigma q_1 - \sigma q_2 - c_3 - \tau) \\
 q_1^* &= \frac{1}{2}(\alpha_F - \sigma q_3^* - \sigma q_4^* - c_1 - \tau) \\
 q_3^* &= \frac{1}{2}(\alpha_F - \sigma q_1^* - \sigma q_4^* - c_3) \\
 q_4^* &= \frac{1}{2}(\alpha_F - \sigma q_1^* - \sigma q_3^* - c_4).
 \end{aligned} \tag{13}$$

- Solving the above systems of equations gives optimal quantity of each product in respective market.

$$\begin{aligned}
 q_1 &= \frac{\alpha_D(2 - \sigma) + \sigma(\tau + c_2 + c_3 - c_1) - 2c_1}{2(2 - \sigma)(1 + \sigma)} \\
 q_2 &= \frac{\alpha_D(2 - \sigma) + \sigma(\tau + c_1 + c_3 - c_2) - 2c_2}{2(2 - \sigma)(1 + \sigma)} \\
 q_3 &= \frac{\alpha_D(2 - \sigma) + \sigma(c_1 + c_2 - c_3 - \tau) - 2(c_3 + \tau)}{2(2 - \sigma)(1 + \sigma)} \\
 q_1^* &= \frac{\alpha_F(2 - \sigma) + \sigma(c_3 + c_4 - c_1 - \tau) - 2(c_1 + \tau)}{2(2 - \sigma)(1 + \sigma)} \\
 q_3^* &= \frac{\alpha_F(2 - \sigma) + \sigma(\tau + c_4 + c_1 - c_3) - 2c_3}{2(2 - \sigma)(1 + \sigma)} \\
 q_4^* &= \frac{\alpha_F(2 - \sigma) + \sigma(\tau + c_1 + c_3 - c_4) - 2c_4}{2(2 - \sigma)(1 + \sigma)}
 \end{aligned} \tag{14}$$

- Finally, combining equations (3) and (14), we have

$$\begin{aligned}
 p_1 &= \frac{\alpha_D(\sigma - 2) + c_1(2\sigma^2 - \sigma - 2) - \sigma(c_2 + c_3 + \tau)}{2(2 - \sigma)(1 + \sigma)} \\
 p_2 &= \frac{\alpha_D(\sigma - 2) + c_2(2\sigma^2 - \sigma - 2) - \sigma(c_1 + c_3 + \tau)}{2(2 - \sigma)(1 + \sigma)} \\
 p_3 &= \frac{\alpha_D(2 - \sigma) + c_3(2 + \sigma - 2\sigma^2) + \sigma(c_1 + c_2 + \tau - 2\sigma\tau) + 2\tau}{2(2 - \sigma)(1 + \sigma)} \\
 p_1^* &= \frac{\alpha_F(2 - \sigma) + c_1(2 + \sigma - 2\sigma^2) + \sigma(c_3 + c_4 + \tau - 2\sigma\tau) + 2\tau}{2(2 - \sigma)(1 + \sigma)} \\
 p_3^* &= \frac{\alpha_F(\sigma - 2) + c_3(2\sigma^2 - \sigma - 2) - \sigma(c_1 + c_4 + \tau)}{2(2 - \sigma)(1 + \sigma)} \\
 p_4^* &= \frac{\alpha_F(\sigma - 2) + c_4(2\sigma^2 - \sigma - 2) - \sigma(c_1 + c_3 + \tau)}{2(2 - \sigma)(1 + \sigma)}
 \end{aligned} \tag{15}$$

6.2 Proof of Proposition 1

Proof Intra-industry trade in physical quantity is

$$\begin{aligned} IIT(\cdot) &= q_3 + q_1^* \\ &= \frac{2(c_1 + c_3 + 2\tau) + (\sigma - 2)(\alpha_D + \alpha_F) - \sigma(c_2 + c_4 - 2\tau)}{2(\sigma - 2)(\sigma + 1)} \end{aligned}$$

Suppose $0 \leq \sigma_1 < \sigma_2 < \frac{1}{2}$, and let $\chi_1 = (\sigma_1 - 2)(\sigma_1 + 1)$ and $\chi_2 = (\sigma_2 - 2)(\sigma_2 + 1)$. First, we show that $\chi_2 - \chi_1 < 0$.

$$\begin{aligned} \chi_2 - \chi_1 &= (\sigma_2 - 2)(\sigma_2 + 1) - (\sigma_1 - 2)(\sigma_1 + 1) \\ &= (\sigma_2 - \sigma_1)(\sigma_2 + \sigma_1) - (\sigma_2 - \sigma_1) \\ &= \underbrace{(\sigma_2 - \sigma_1)}_{>0} \underbrace{(\sigma_1 + \sigma_2 - 1)}_{<0} < 0 \end{aligned} \tag{16}$$

Second, we show $\sigma_1\chi_2 - \sigma_2\chi_1 > 0$.

$$\begin{aligned} \sigma_1\chi_2 - \sigma_2\chi_1 &= \sigma_1(\sigma_2^2 - \sigma_2 - 2) - \sigma_2(\sigma_1^2 - \sigma_1 - 2) \\ &= \sigma_1\sigma_2(\sigma_2 - \sigma_1) + 2(\sigma_2 - \sigma_1) > 0 \end{aligned} \tag{17}$$

Finally, it is sufficient to show that $IIT(\cdot)$ is monotonically decreasing for any σ_1 and σ_2 such that $0 \leq \sigma_1 < \sigma_2 < \frac{1}{2}$.

$$\begin{aligned} &IIT(\sigma_1) - IIT(\sigma_2) \\ &= \frac{2(c_1 + c_3 + 2\tau) + (\sigma_1 - 2)(\alpha_D + \alpha_F) - \sigma_1(c_2 + c_4 - 2\tau)}{2(\sigma_1 - 2)(\sigma_1 + 1)} - \frac{2(c_1 + c_3 + 2\tau) + (\sigma_2 - 2)(\alpha_D + \alpha_F) - \sigma_2(c_2 + c_4 - 2\tau)}{2(\sigma_2 - 2)(\sigma_2 + 1)} \\ &= \frac{(\chi_2 - \chi_1)(c_1 + c_3 + 2\tau - \alpha_D - \alpha_F)}{\chi_1\chi_2} + \frac{(\sigma_1\chi_2 - \sigma_2\chi_1)(\alpha_D + \alpha_F - c_2 - c_4 + 2\tau)}{2\chi_1\chi_2} \\ &> 0 \end{aligned} \tag{18}$$

, where the last inequality follows from equations (16), (17), and Assumption 1. This proves the result. \square

6.3 Proof of Proposition 2

Proof

First, Grossman and Helpman (1994) provide a useful methodology to characterize optimal tariff schedules of our game using the original result from Bernheim and Whinston (1986). Proof for this well-known lemma is omitted.

LEMMA 1 (G-H: EQUILIBRIUM TARIFF POLICY) ($\{L_i^o\}, \tau^o$) is a subgame-perfect Nash equilibrium if and only if

1. L_i^o is feasible for all i ⁶⁰
2. τ^o maximizes $(\sum_i L_i(\tau)) + aW(\tau)$

⁶⁰Here feasibility requires that each firm does not promise nonnegative offers that exceed their revenue

3. τ^o maximizes

$$\Pi_i(\tau) - L_i(\tau) + \sum_i L_i(\tau) + aW(\tau)$$

4. for every j there exists $\tau \in$ that maximizes $(\sum_i L_i(\tau)) + aW(\tau)$ such that $L_j^o(\tau) = 0$

Now, we characterize the optimal tariff schedule. From Condition 2 of Lemma(1),

$$\sum_i \frac{\partial L_i}{\partial \tau}(\tau^o) + a \frac{\partial W}{\partial \tau}(\tau^o) = 0 \quad (19)$$

Likewise, the government's maximization problem from Condition 3 of Lemma(1) gives,

$$\frac{\partial \Pi_i}{\partial \tau}(\tau^o) - \frac{\partial L_i}{\partial \tau}(\tau^o) + \sum_i \frac{\partial L_i}{\partial \tau}(\tau^o) + a \frac{\partial W}{\partial \tau}(\tau^o) = 0 \quad (20)$$

Combining equations (19) and (20) and summing over i gives the following equality.

$$\sum_i \frac{\partial \Pi_i}{\partial \tau}(\tau^o) = \sum_i \frac{\partial L_i}{\partial \tau}(\tau^o) \quad (21)$$

Substituting Equation(21) to Equation(19), we get

$$\sum_i \frac{\partial \Pi_i}{\partial \tau}(\tau^o) + a \frac{\partial W}{\partial \tau}(\tau^o) = 0 \quad (22)$$

Now, calculate each side of equation (22) from the profit functions of each firm and government.

$$\frac{\partial \Pi_1}{\partial \tau}(\tau^o) = \frac{(\alpha_F - \alpha_D + c_2 - c_4 + 2\tau)\sigma^2 + 2(\alpha_D - c_3 - c_4 + 2\tau)\sigma + 4(c_1 + \tau - \alpha_F)}{2(-2 + \sigma)^2(1 + \sigma)^2} \quad (23)$$

$$\frac{\partial \Pi_2}{\partial \tau}(\tau^o) = \frac{(c_1 + c_3 - c_2 - \alpha_D + \tau)\sigma^2 - 2(c_2 - \alpha_D)\sigma}{2(-2 + \sigma)^2(1 + \sigma)^2} \quad (24)$$

$$\frac{\partial \Pi_3}{\partial \tau}(\tau^o) = \frac{(\alpha_D - \alpha_F + c_4 - c_2 + 2\tau)\sigma^2 + 2(c_3 - c_1 - c_2 + 2\tau - \alpha_F)\sigma + 4(c_3 + \tau - \alpha_D)}{2(-2 + \sigma)^2(1 + \sigma)^2} \quad (25)$$

$$\begin{aligned} \frac{\partial W}{\partial \tau}(\tau^o) &= \frac{(4\alpha_D + 10\tau + 8c_3 - 4c_1 - 8c_2)\sigma^3}{4(-2 + \sigma)^2(1 + \sigma)^2} + \frac{(2\alpha_F - 15\alpha_D + 7c_1 + c_2 + 15c_3 - 2c_4 + 21\tau)\sigma^2}{4(-2 + \sigma)^2(1 + \sigma)^2} \\ &+ \frac{(3\alpha_D + 2c_1 - 6c_3 - c_4 - 5\tau)\sigma}{(-2 + \sigma)^2(1 + \sigma)^2} + \frac{(\alpha_D - 2\alpha_F - 5\tau + 2c_1 - 5c_3)}{(-2 + \sigma)^2(1 + \sigma)^2} \end{aligned} \quad (26)$$

Therefore, plugging the results from equations (23), (24), (25), and (26) into equation (22) and solve for τ^o gives the optimal tariff τ^o .

$$\tau^o = \frac{\zeta\sigma^3 + \eta\sigma^2 + \xi\sigma + \kappa}{10a\sigma^3 + (10 + 21a)\sigma^2 + (16 - 20a)\sigma + 16 - 20a}$$

□

6.4 LASSO regression on CRS summary of Trade Bills

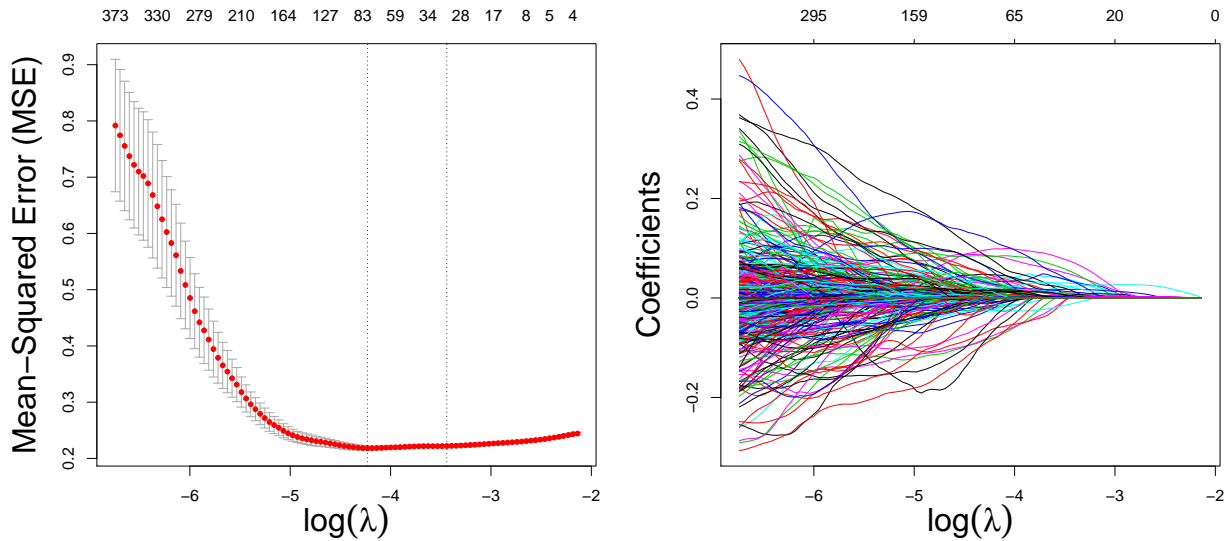
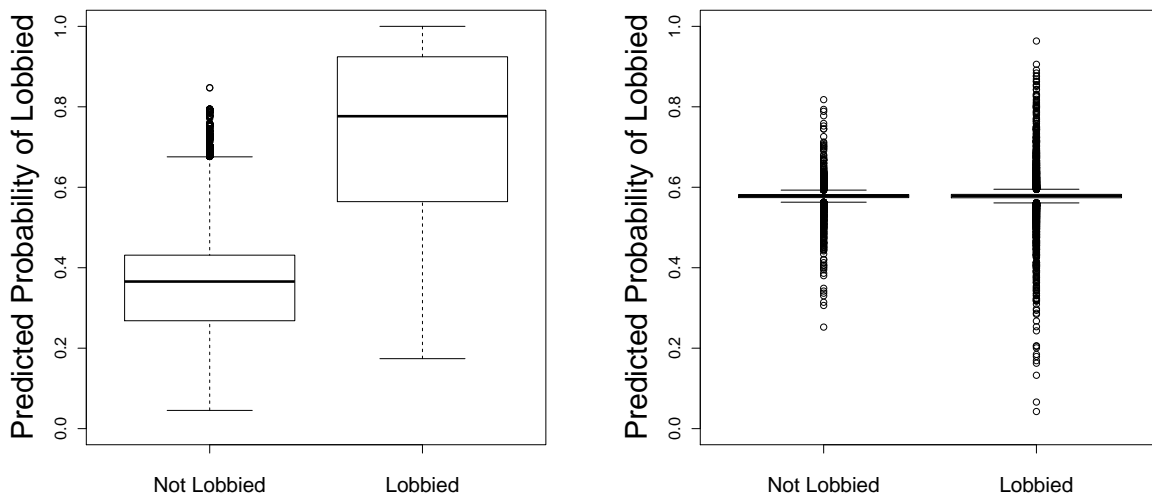


Figure 16: **cross validation:** The left panel shows that $\log(\lambda) \approx -4$ is found to minimize the MSE. As shown in the right panel, most coefficients are constrained to be zero around the value of the chosen λ .



(a) Cross-validation Sample Prediction

(b) Placebo Test

Figure 17: **Predicting the likelihood of Trade Bills Lobbied:** Panel (a) presents the result from the LASSO (Least Absolute Shrinkage and Selection Operator) method. It shows that there exists distinct patterns in the frequency of words appearing in the CRS summaries that distinguish bills that are not-lobbied and lobbied. Panel (b) shows the result from a placebo test whereby such distinction disappears by reordering the bill-to-term matrix such that terms that are originally from bill m becomes *as if* from bill $n \neq m$.

6.5 Measures of Productivity

I measure productivity of firms after taking into account two important biases: Olley and Pakes (1996) (O&P hereafter) point out simultaneity and selection biases. To begin, consider the following production function for output y for firm i at year t , where K , L , M , and Z denotes capital, labor, material, and a vector of control variables, respectively.

$$y_{it} = \beta_0 + \beta_k K_{it} + \beta_l L_{it} + \beta_m M_{it} + \gamma^T Z_{it} + \epsilon_{it}. \quad (27)$$

$$\epsilon_{it} = \varphi_{it} + \nu_{it} \quad (28)$$

First, a simultaneity bias may plague simple OLS regression to estimate productivity. Suppose that firm level productivity φ_{it} is known to each firm, and yet it is unobservable to a researcher. It is reasonable to expect that any profit-maximizing firm will make input choices such as labor (L) and material (M) according to their productivity level. That is, $L_{it} = f(\varphi_{it})$ and $M_{it} = g(\varphi_{it})$ with some arbitrary function f and g . It becomes clear that a OLS regression will introduce simultaneity biases due to the correlation between firms' unobserved productivity level and their input choices. Specifically, the correlation between input choices and productivity are positive, which creates an upward biases to the coefficients for input choices.

O&P also raise the issue of selection bias. Given that each firm makes a choice between exiting or staying in operation, it is important to take into account that firms in the market fundamentally differ from others. In particular, they may be inherently more productive than other firms who have already exited or have not been able to enter at all. Assuming that firm's future profit is increasing in its capital K , therefore, firms with little capital will stay in market only when they are productive enough. This suggests that $Corr(\varphi_{it}, K_{it})$ is negative, and therefore a simple OLS estimates will underestimate the coefficient of capital.

Following Olley and Pakes (1996), I estimated productivity of each firm in three steps. First, I assume that input choices such as labor and material are affected by productivity φ_{it} , while the decision on capital is based only on past productivity. I also assume that a proxy variable i_{it} such as investment is strictly increasing in K_{it} .⁶¹ These two assumptions imply that one can invert the investment and input choice functions to get the following.

$$\varphi_{it} = \psi_{it}(i_{it}, K_{it}). \quad (29)$$

Substituting equation (29) into equation (27) gives,

$$\begin{aligned} y_{it} &= \beta_0 + \beta_k K_{it} + \beta_l L_{it} + \beta_m M_{it} + \gamma^T Z_{it} + \psi_{it}(i_{it}, K_{it}) + \nu_{it} \\ &= \beta_0 + \beta_l L_{it} + \beta_m M_{it} + \gamma^T Z_{it} + \Phi_{it}(i_{it}, K_{it}) + \nu_{it}. \end{aligned} \quad (30)$$

Now, equation (30) can be estimated with consistent estimates of β_l , β_m and γ^T , where $\Phi(\cdot)$ is estimated with a second order polynomial in investment and capital.

The second step estimates survival probability in order to address the selection issue. That is, I assume that a rational firm chooses to be in the market only when its productivity is high enough.⁶² The survival probability is estimated by running a probit model of a binary indicator of being in the market in year t on i_{it-1} , and K_{it-1} with their cross products. Denote the predicted probability from the second step by $\hat{\pi}_{it}$.

⁶¹ A detailed discussion of the estimation is quite involved. Interested reader is advised to read the original paper of O&P.

⁶² The decision to exit is assumed to follow a first-order Markov process.

Variable	O&P	OLS
capital	0.092** (0.028)	0.078** (0.004)
labor	0.210** (0.015)	0.224** (0.006)
material	0.851** (0.017)	0.812** (0.005)
year	0.004** (0.001)	0.000** (0.000)
foreign	0.003 (0.020)	-0.034** (0.010)
N	23487	

Table 6: **Production function estimation:** The first column summarizes the estimates of production function based on the method proposed by Olley & Pakes (O&P). This corrects the (1) simultaneity and (2) selection biases in firm level input choices and exiting decision. As expected, the coefficient of capital is underestimated in OLS while labor input choice is overestimated. Standard errors are in parenthesis. Note: Standard errors in O&P model are bootstrapped using 250 replications. **Significant at 1% level.

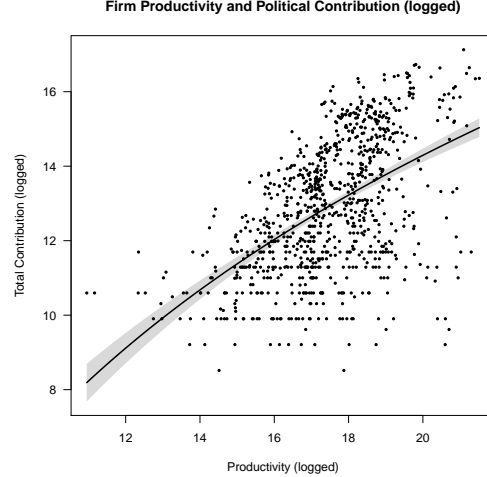


Figure 18: **Productivity on Lobbying:** there exists a positive correlation between productivity of firms and their political contribution. Political contribution at the y-axis is measured by logged total lobbying expenditure by each firm. This is an important finding on firm-level political behavior consistent with the new-new trade theory of heterogeneous firms.

The final step fits the following equation to get the consistent estimates of the production function, where ξ is approximated by a second order polynomial function.

$$y_{it} - \hat{\beta}_l L_{it} - \hat{\beta}_m M_{it} = \beta_k K_{it} + \hat{\gamma}^T Z_{it} + \xi(\hat{\Phi}_{it-1} - \beta_k K_{it-1}, \hat{\pi}_{it}) + \varphi_{it} - \varphi_{it-1} + \nu_{it}. \quad (31)$$

Using the estimated coefficient, we get the estimated total factor productivity of each firm by

$$tfp_{it} = y_{it} - \hat{\beta}_k K_{it} - \hat{\beta}_l L_{it} - \hat{\beta}_m M_{it} - \hat{\gamma}^T Z_{it}. \quad (32)$$

Table 6 compares the results from two production function estimation, where we use net sale for y_{it} , and year and foreign firm indicator as Z_{it} .⁶³ As expected, OLS underestimates the coefficient for capital, while it overestimates the effect of labor inputs than the ones based on Olley & Pakes (O&P) method.⁶⁴

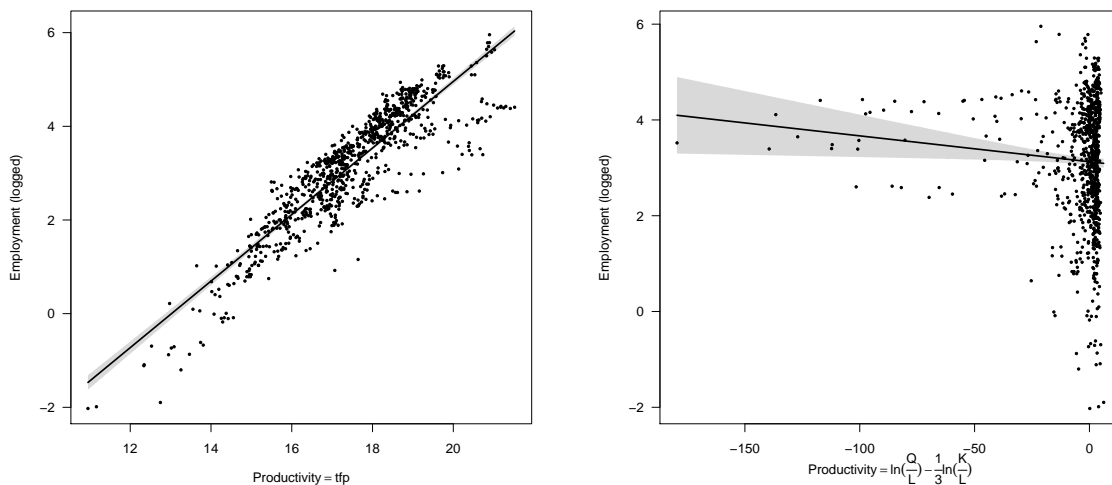
In order to test the validity of the productivity measure used in this paper, I compare how two alternative measures of productivity used in the literature explain the employment level of each manufacturing firm in the U.S. market. Panel (a) of Figure 19 is based on a measure defined in equation (32), while that of Panel (b) is based on an alternative productivity measure used in the current literature.⁶⁵ We expect a positive relationship between the employment level and productivity of each firm. In fact, as Bernard *et al.* (2007a) empirically shows, more productive firms are more likely to export, be bigger, pay higher wages to their employees, and make larger profits. As it clearly shows, the measure correcting for the two biases in Panel (a) explains the

⁶³ I used STATA's `opreg` package to estimate the production function.

⁶⁴ I get higher estimates for material input. This is due in large part to the lack of data on firm level wages. Currently, I use estimates from Bartelsman *et al.* (2000) for industry level average wages. I define material as "cost of goods" plus "administrative and selling expenses" less "depreciation" less "employment expenses".

⁶⁵ I take the productivity measure used in Kuno and Naoi (2012) and Plouffe (2012) because these are only empirical works using firm level productivity in IPE to the best of my knowledge. The measure is defined as $ATFP = \ln \frac{Q}{L} - s \ln \frac{K}{L}$ following Head and Ries (2003), where Q is total revenue, L is number of employees, and K is a proxy for capital. s is arbitrarily set to 1/3.

employment level better than the other measure in Panel (b). Moreover, higher productivity is associated positively with bigger lobbying expenditure as Figure 18 shows. The next section will further investigate whether productive exporting firms are in fact more likely to lobby.



(a) Productivity Measure based on O&P (b) Alternative Productivity Measure

Figure 19: Productivity and Employment Level: This figure illustrates the validity of the productivity measure used in this paper. The productivity used in Panel (a) is defined in equation (32). The alternative measure in Panel (b) is defined as $\ln(Q/L) - \frac{1}{3}\ln(K/L)$. Note that the recent development of new-new trade theory suggests a strong positive relationship between productivity and employment level. However, the alternative measure used in the literature is unable to explain the employment level of each firm compared to the one in Panel (a).

6.6 Topic Models Applied to Trade Bills

I assume that a given bill has a probability distribution over “topics”, where each topic can be characterized as a distribution over words. For example, suppose that there are five topics that generally describe the universe of trade bills: 1) free trade agreement, 2) miscellaneous tariff bill, 3) fast-track authority for president, 4) appropriations bill, and 5) protection bill. To the extent that a single bill contains one or more than one of these topics, a bill can be characterized as a probability distribution over these topics, e.g., 70% free trade agreement with 30% protection where the latter reflects the concerns of import-competing industries in the face of free trade agreement. Secondly, a topic is a probability distribution over words because free trade agreement topic might have more frequent use of words such as agreement, tariff, president, import and export, etc than appropriations topic.⁶⁶ This will help us characterize each bill in terms of the distribution over topics, which will be subsequently used to link to the occurrence of lobbying.

I fit topic models with 5 to 20 topics. Using the one topic model as a baseline, I chose a model with highest Bayes factor to determine the number of topics.⁶⁷ This gives the 8 topic model. Figure 20 graphically summarizes the distribution over the 8 topics for each bill categorizing non-

⁶⁶See Blei *et al.* (2003) for a more formal description of Latent dirichlet allocation topic models used in this section.

⁶⁷ For N topic model M_N , Bayes factor is calculated based by computing the following quantity $\frac{\Pr(D|M_N)}{\Pr(D|M_1)} = \frac{\int \Pr(\theta_N|M_N) \Pr(D|\theta_N, M_N) d\theta_N}{\int \Pr(\theta_1|M_1) \Pr(D|\theta_1, M_1) d\theta_1}$, where D is observed data, θ is model parameters.

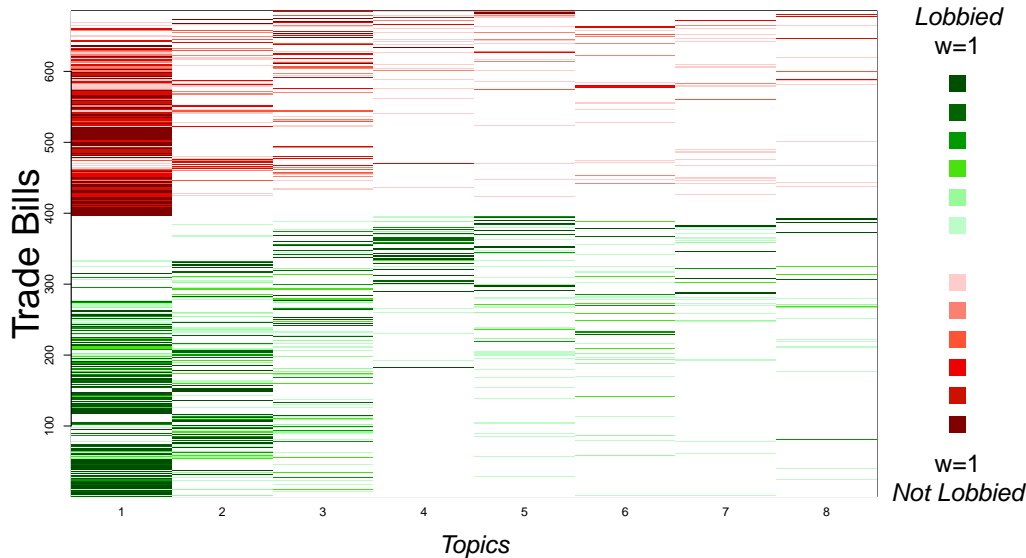


Figure 20: **Distribution over Topics and Lobbying:** This figure summarizes the distribution over 8 trade-related topics for each bill. Lines with darker shade in each column implies that a given bill is highly associated with the given topic. It shows that Topic 2 and Topic 4 are useful in distinguishing lobbied (green) and non-lobbied bills (red).

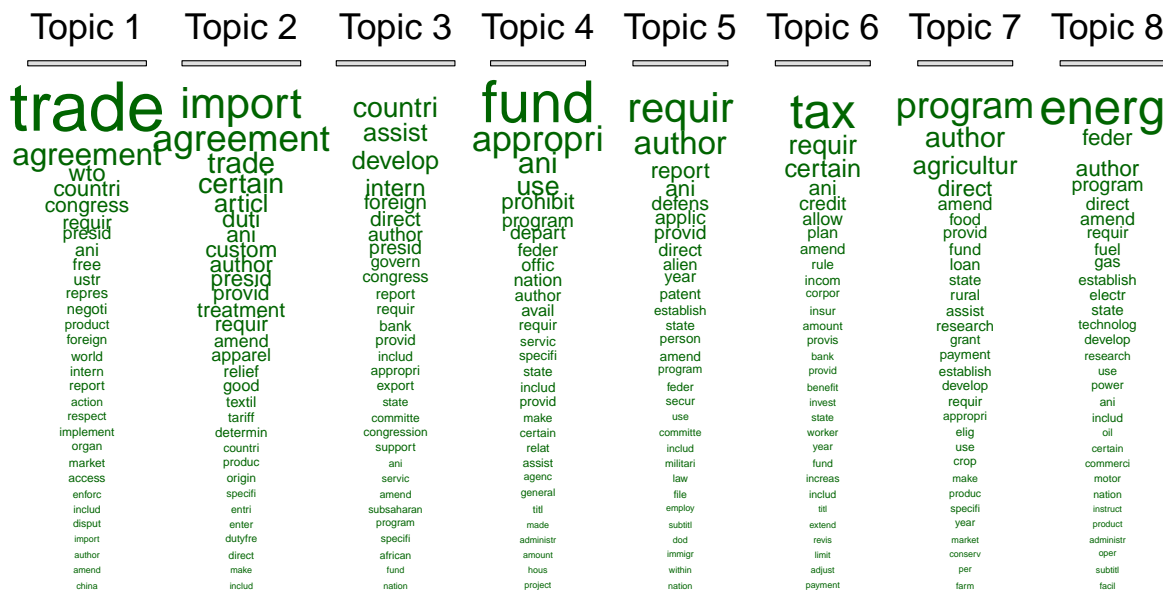


Figure 21: **Distribution over Words in 8 Topics:** This figure presents top 30 words associated with each of the 8 topics. The size is proportional to the loading sizes of each word.

lobbied (red & above 400) and lobbied bills (green & below 400) separately. I check whether there exists differences between lobbied and non-lobbied bills. It shows that both kinds of bills are heavily loaded with Topic 1. This is not surprising in that each bill is trade-related and the first topic concerns general “trade” as a topic. Compared to Topic 1, Topic 2 and Topic 4 jointly separate the occurrence of lobbying better. In other words, bills with more weights on the two topics tend to get lobbied more.

Figure 21 displays top 30 words associated with each topic. A close examination of Topic 2 and the bills that have the highest loading on the topic suggests that this topic is related to either the fast-track authority bills that grant president an authority to negotiate trade agreements or various bilateral trade agreements themselves, e.g., “United States-Korea Free Trade Agreement Implementation Act” (HR3080). Note that countries negotiate over tariff and non-tariff barriers on highly differentiated products during the course of trade agreements. Topic 4 is related to appropriation bill that authorizes the government to spend money. Most frequent examples include appropriation bills to fund Export-Import Bank of the U.S. and their export financing program to promote U.S. exports abroad, e.g., “Export-Import Bank Reauthorization Act of 2006” (S3938).

To be sure, this is not to argue that all lobbying activities associated with the bills can be considered as pro-trade lobbying. Admittedly, lobbying on liberal trade bills may occur as much to oppose as to support it to be passed. However, the evidence provided in this section strongly suggests that 1) firms are important political actors, 2) they often lobby on specific products, and 3) there exists a pattern that distinguishes between lobbied and non-lobbied trade bills.

6.7 An Example of Lobbying Report

Clerk of the House of Representatives Legislative Resource Center B-106 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 <input checked="" type="checkbox"/> Organization/Lobbying Firm <input type="checkbox"/> Self Employed Individual <u>Chrysler Group, LLC</u>			
2. Address <input type="checkbox"/> Check if different than previously reported Address1 <u>1401 H Street NW, Suite 700</u> Address2 _____ City <u>Washington</u> State <u>DC</u> Zip Code <u>20005</u> - Country <u>USA</u>			
3. Principal place of business (if different than line 2) City _____ State _____ Zip Code _____ - Country _____			
4a. Contact Name <u>NANCY BELL</u>	b. Telephone Number <input type="checkbox"/> International Number (202) 414-6798	c. E-mail <u>neb14@chrysler.com</u>	5. Senate ID# <u>400460283-12</u>
7. Client Name <input checked="" type="checkbox"/> Self <input type="checkbox"/> Check if client is a state or local government or instrumentality <u>Chrysler Group, LLC</u>			6. House ID# <u>408810000</u>
TYPE OF REPORT 8. Year <u>2011</u> Q1 (1/1 - 3/31) <input type="checkbox"/> Q2 (4/1 - 6/30) <input type="checkbox"/> Q3 (7/1-9/30) <input type="checkbox"/> Q4 (10/1 - 12/31) <input checked="" type="checkbox"/>			
9. Check if this filing amends a previously filed version of this report <input type="checkbox"/>			
10. Check if this is a Termination Report <input type="checkbox"/> Termination Date _____ 11. No Lobbying Issue Activity <input type="checkbox"/>			
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 <input type="checkbox"/> \$5,000 or more <input type="checkbox"/> \$ _____ Provide a good faith estimate, rounded to the nearest \$10,000, of all lobbying related income from 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 <input type="checkbox"/> \$5,000 or more <input checked="" type="checkbox"/> \$ <u>\$1,131,245.00</u> 14. REPORTING Check box to indicate expense accounting method. See instructions for description of options. <input type="checkbox"/> Method A. Reporting amounts using LDA definitions only <input type="checkbox"/> Method B. Reporting amounts under section 6033(b)(8) of the Internal Revenue Code <input checked="" type="checkbox"/> Method C. Reporting amounts under section 162(e) of the Internal Revenue Code	
Signature <u>Filed Electronically</u>		Date <u>01/20/2012</u>	
Printed Name and Title <u>Nancy Bell, Senior Manager</u>			
v6.0.1f		Page <u>1</u> of <u>32</u>	

Registrant Chrysler Group, LLC

Client Name Chrysler Group, LLC

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 (one per page)

16. Specific lobbying issues

Free Trade Agreements with South Korea, Panama and Colombia. Trade agreement negotiations on the Trans Pacific Partnership FTA. Possible future FTA with Egypt.

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

U.S. SENATE, U.S. HOUSE OF REPRESENTATIVES, U.S. Trade Representative (USTR)

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
Jody	Trapasso			<input type="checkbox"/>
Jordan	Moon		Deputy Chief of Staff and LD, Rep. Sue Myrick	<input checked="" type="checkbox"/>
Kristina	Pisanelli			<input type="checkbox"/>
Jennifer	Fox			<input type="checkbox"/>
				<input type="checkbox"/>
				<input type="checkbox"/>
				<input type="checkbox"/>
				<input type="checkbox"/>
				<input type="checkbox"/>

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

Fiat S.p.A.
Fiat Automobiles S.p.A.
Fiat North America LLC

Printed Name and Title Nancy Bell, Senior Manager

Figure 22: 4th Quarter Lobbying Report by Chrysler in 2011