Investigating the Industry-Level Pattern of Dispute Behavior in International Trade Relations

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Abstract

This paper presents a novel theoretical and empirical approach to analyzing the industry-level foundations of trade disputes. The study of trade disputes is subject to several observational challenges and selection problems: Major determinants of trade disputes, especially industry-level government preferences over trade policy, are unobserved; systematic data on actual dispute events are unavailable for all but a few highly-escalated cases; and the eventual terms of agreement of most disputes are therefore equally unknown. These difficulties have impeded systematic industry-level investigations into trade disputes and have compelled analysts to focus on aggregate country- or dyad-level relationships instead. By overcoming such observational problems for the entire set of U.S. export relations, I am able to trace the underlying logic of trade disputes from their initial industry-level motivations to their eventual outcomes. Specifically, I demonstrate how the bilateral constellation of two governments' industry-specific policy preferences relates to the ensuing degree of dispute escalation between these governments and, ultimately, to the terms on which a dispute is settled. I discuss the implications of my results for dispute management and mitigation at the WTO.

Keywords: trade disputes, trade policy, escalation, government preferences, bargaining

1 Introduction

In times of heightened international tensions over trade policy, understanding how trade disputes arise, play out, and are ultimately settled is of substantial interest to researchers and policy-makers alike. The existing literature has uncovered various factors that are systematically related to the incidence of trade disputes (e.g., Allee 2008, Bown 2005, Busch and Reinhardt 2003, Davis 2012, Kim 2008). However, many of these factors, such as GDP, retaliatory capacity, regime type, insti-

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tutional quality, and aid dependence, are aggregate country- or dyad-level variables. Because these factors are identical across all industries within a dyad, they cannot explain why two countries have a dispute concerning some industries but not others. This applies equally to other factors, such as business cycle effects, bureaucratic experience, and government changes, which exhibit more time-variation but are nonetheless located at the country-level (Davis and Bermeo 2009, Davis and Pelc 2012, Lee 2012). As a result, it is at most possible to assess the *average* dispute proclivity of a country or dyad, but not the *detailed* pattern of the within-dyad variation in dispute activity across industries.

The limited emphasis on industry-level factors in the study of trade disputes is especially problematic because, empirically, within-dyad variation in dispute behavior across industries is huge. Most trade disputes concern industry-specific trade relations and policies on a fairly fine-grained scale. Although country pairs often engage in trade across many hundreds of different industries, only a handful of these relations may be seriously disputed. Yet the higher the within-dyad variation in dispute activity, the less informative are aggregate insights about individual cases. Consequently, the prevalent focus on aggregate relationships not only limits the ability of policy-makers to formulate targeted policy responses.[1] In a more fundamental sense, it also reveals that the deeper mechanism that drives trade disputes on the industry-level is not yet well understood.

A main reason for the aggregate focus in the literature simply lies in the difficulty of observing trade disputes in sufficient detail. Countries engage in millions of industry-specific bilateral trade interactions each year. However, the primary source of information on trade disputes consists of a few hundred cases that have been filed at the GATT/WTO over the last decades (see: Elsig et al. 2012 and Horn and Mavroidis 2006 for a critical discussion). Thus, in almost all cases, we know virtually nothing about the potentially significant bilateral interactions and discussions surrounding existing industry-level trade relations – other than the fact that they were not brought before the WTO. This is true for both the conduct of the negotiations and their results. Moreover, for all cases, including the ones we observe, we do not have any systematic information about the industry-specific policies and wider strategic rationales that ultimately drive the negotiations and the dispute behavior of the concerned governments.

In this article, I present empirical strategies that address these observational problems with regard to the entire set of bilateral industry-level U.S. export relations between 1988 and 2012. My approach allows me a) to observe industry-level bargaining and dispute behavior on an unprecedented scale and across the full spectrum of dispute intensity, and b) to trace all these interactions from their initial industry-level motivations to their eventual outcomes. Ultimately, this enables me to observe the detailed bargaining dynamics of trade disputes and, thus, to gain a better theoretical and empirical understanding of conflictive trade relations.

[1] Targeted policy responses require the ability to both accurately anticipate and correctly interpret relevant events. Policy-makers in national governments or the WTO may thus wish to perform targeted industry-specific risk assessments or set up early-warning systems for disputes arising either with immediate trade partners or between relevant third countries. Moreover, in any dispute, an understanding of the relevant economic and political processes helps policy-makers to efficiently allocate resources and set priorities.

Specifically, I propose and test a theory of dispute escalation, in which trade disputes of varying intensity gradually escalate from regular day-to-day bargaining. In this setup, trade disputes arise from a mutual selection process that unfolds as two governments deliberately select into increasingly costly bargaining situations. On the downstream side, this selection process is driven by the bilateral configuration of industry-level policy preferences of the concerned governments (where each governments' preferences reflect the respective political salience of the issue). On the upstream side, the selection process has implications for the agreed bargaining outcomes. The theory thus relates the bilateral constellation of preferences to both the ensuing degree of dispute escalation and to the terms on which a dispute is finally settled.

The bulk of my empirical work consists of three distinct parts, devoted to compiling data on dispute drivers (salience), dispute events (escalation), and dispute outcomes (agreement), respectively. First, I quantify the political salience of bilateral industry-level trade relations to the respective governments. To do so, I use a numeric trade policy simulation, which combines original data on industry-level trade barriers with data on current trade flows and trade elasticities. Based on this approach, I estimate how current trade flows *would* change following a possible agreement to reduce trade barriers after the resolution of a dispute. This procedure allows me to assess the *counterfactual* gains and losses from trade disputes for politically relevant domestic constituencies in the respective countries. In doing so, I approximate the political salience to the concerned governments in a way that captures the forward-looking assessments that governments necessarily make in strategic settings such as trade disputes.

Second, I compile an extensive new dataset on dispute events using a purpose-built automated text analysis routine to extract information on bargaining and dispute events from U.S. trade reports. The resulting data describe the interactions between the United States and its 80 most important trade partners. For each bilateral relationship, the data cover interactions over some 300 different products over 25 years. Because my data capture escalation and dispute behavior down to very low levels of intensity, they make it possible to reconstruct the complete dispute histories of tens of thousands of industry-level trade relations. Despite their exclusive focus on U.S. trade relations, my data constitute the most extensive and detailed resource on trade disputes currently available. Moreover, because my data are not biased towards highly-escalated cases, they evade the observational and selection problems associated with existing resources such as the WTO data.

Third, I use an indirect method to measure dispute outcomes and assess the terms on which disputes are eventually settled (i.e., which side has made the larger concessions). Specifically, I match changes in observed trade flows to the timing of dispute events from my U.S. trade disputes dataset. I use this strategy to capture the trade effects that result from the implementation of agreed settlements. I am thus able to infer the terms of these agreements (that are often difficult to observe directly) from their observable implications.

Based on these data, I then test the observable implications of my theory. I find that i) the degree of dispute escalation is limited by the lower of the two governments' salience levels, in line with theoretical expectations that low-salience parties are more willing to make concessions early on to avoid the costs of continued dispute escalation; ii) the variability (*variance*) in the terms of agreements decreases with the ultimately reached escalation level, in line with theoretical expectations that more highly escalated disputes tend to result in mid-range compromise agreements in which both sides make some concessions; iii) the dispute initiator manages, on average (*mean*), to secure more favorable terms of agreement at higher escalation levels, in line with theoretical expectations that there is strategic pre-selection into anticipated high-level disputes.

My work contributes in several ways to the study of trade relations and trade disputes. First, I present new theory and evidence that our understanding of trade disputes by zooming in on the detailed logic of industry-level bargaining and dispute dynamics. Second, I provide extensive new data on various aspects of trade disputes and thereby solve long-standing observational challenges. Third, I introduce new methods to the study of trade disputes that, along with extensive documentation and code, allow researchers to adapt and extend my empirical strategies. Lastly, my results have broad implications for policy-making and dispute resolution.

I proceed as follows. The next section presents the observational challenges to the study of trade disputes and discusses the extant literature in light of these difficulties. In Section 3, I present the theoretical considerations underlying my work. The discussion in this section serves two purposes: It is, in part, necessary for my measurement strategy and, in part, serves to derive hypotheses that will subsequently be tested. I discuss these issues together because they reflect the domestic political process (preference formation; measurement) and the international political process (strategic dispute behavior; hypothesis testing), respectively, and thus constitute a single theoretical account. Section 4 then describes all aspects related to data and measurement. Sections 5 and 6 present the methodology and results of my primary analyses. The final section concludes and discusses the policy implications of my findings.

2 Observational Challenges to the Study of Trade Disputes

The fact that trade disputes have been studied extensively, at first glance, masks the substantial observational difficulties associated with observing key aspects of these phenomena. These difficulties start with the limited observability of the dispute events themselves: Existing data on trade disputes is strongly biased towards the most visible, highly-escalated cases. The by far most-studied disputes are the GATT/WTO dispute settlement cases. A focus on these cases dominates both the case study literature (e.g., Baron 1997, Hufbauer et al. 2006, Perdikis and Read 2005, Petersmann and Pollack 2003, Room and West 1998, Thies 2013, Zeng 2013) and the quantitative literature (e.g., Allee 2008, Bown 2005, Busch and Reinhardt 2003, Francois et al. 2008, Kim 2008). A handful of studies examine the smaller sets of NAFTA disputes or unilateral U.S. disputes based on the Section 301 legislation (Bayard and Elliot 1994, Hoberg and Howe 1999, Taylor 1997), while others compare WTO disputes and U.S. Section 301 cases (Grinols and Perrelli 2006, Pelc 2010).[2]

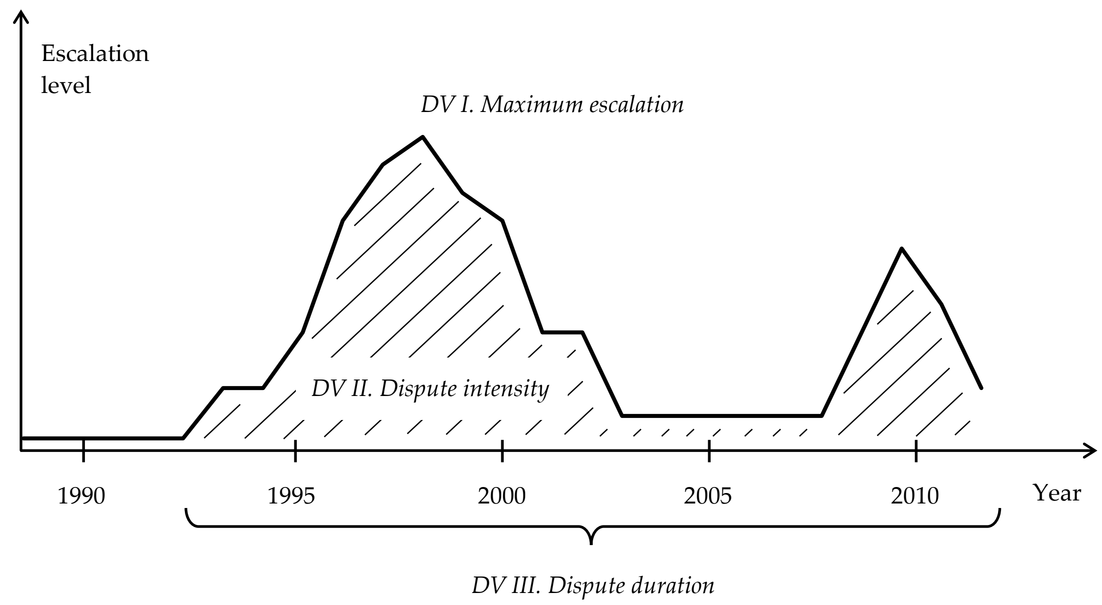
While studying these major disputes is unquestionably important, the lack of comparison cases and their features constrains what can be learned from investigating high-profile cases alone. To see

[2] Section 301 of the Trade Act of 1974 is among the more controversial parts of U.S. trade law. The legislation provides the basis for unilateral retaliatory action against foreign trade barriers by the U.S. government.

what remains unobserved when focusing exclusively on available data sources, consider Figure 1. The figure exemplarily displays the dispute history of the U.S.–Argentina footwear dispute over the time period from 1988 to 2012. The dispute has been swelling for years when the U.S. took it before the WTO, where it was discussed between October 1996 and March 1999. The dispute went through the arbitration procedure and climaxed in 1998. In this year it was taken before the Appellate Body before initial agreement was reached and discussions over the implementation of the agreement began. However, the dispute was never fully resolved and resurfaced around 2010.

The data shown in Figure 1 are taken from my dispute events dataset, which I present in more detail in Section 4.2. The figure also depicts the three measures I derive from the raw data to serve as dependent variables in my primary analysis. The *maximum escalation* measure reflects the highest escalation level of a dispute over the 1988–2012 period. The *dispute intensity* measure sums the escalation levels over all twenty-five years. It can be thought of as the discrete version of the 'area under the curve' and provides a more holistic summary of the overall dispute history by taking the entire information into account. Lastly, the *dispute duration* measure captures the length of dispute activity.

Figure 1: The U.S.–Argentina Footwear Dispute, 1988–2012



Note that the available information on this dispute would be much more limited, if one had to rely on the WTO data. In this case only the years 1996-1999 would be observed. In this case, the maximum escalation measure could still be computed, but there would be insufficient information to compute either the dispute duration nor the dispute intensity. After all, only 4 out of 25 data points concerning this dispute are observed in the WTO data. More importantly, footwear is just one of a large number of products countries produce and trade. My data provide dispute histories for close to 300 products per dyad (for the detailed product classification, see: Appendix A). Yet the U.S. has taken Argentina before GATT/WTO dispute settlement only over footwear, textiles, pharmaceuticals, and agricultural chemicals since 1988. The WTO data thus provide essentially no information (other than that they were not taken before the WTO) about the dispute histories of almost 99 percent of U.S.–Argentinian trade relations. For all these cases, none of the measures shown in Figure 1 can be calculated.

These problems are even more pronounced on a worldwide level because the U.S.–Argentina dyad ranges well above the global average in its use of the WTO dispute settlement system: Since the inception of the WTO in 1995, some 540 cases have been brought before the WTO. This yields an average of 23 cases per year. However, the WTO has by now more than 160 members, which means that there are more than 25,440 (160 times 159) directed dyads. With up to hundreds of traded products per dyad, this implies that there are millions of bilateral industry-level trade relations at any given point in time, only 23 of which are taken before at the WTO each year. Based on the readily available data on trade disputes, we are therefore blind to almost the entire variation in the conflictiveness of trade relations.

The uneven picture of trade disputes that arises from existing data sources means that, comparatively speaking, we do not know what cases we are actually looking at and how these cases differ from the ones we do not observe. This is true, in particular, concerning the questions of how less escalated disputes differ from major ones in their pattern of dispute outcomes and in the conditions that motivate these disputes in the first place.

In terms of dispute outcomes, for instance, the traditional information on trade disputes only allows comparisons *within* the small number of highly escalated disputes. This is reflected, for instance, in Busch and Reinhardt (2003) who investigate the negotiated solutions of GATT/WTO cases and find that early settlements tend to yield larger concessions for the complainant. Similarly, Bayard and Elliot (1994), Taylor (1997), and Pelc (2010) compare the outcomes of unilateral U.S. trade enforcement under Section 301 and multilateral action under the GATT/WTO. The studies report a lower effectiveness of unilateral enforcement relative to multilateral action, arguing that the former is seen as relatively less legitimate by concerned trade partners.

While these insights are important, they do not illuminate a) what the distribution of outcomes is below the set of high-profile cases, and b) how the outcomes of highly escalated disputes compare to the outcomes of the large number of less escalated cases. Existing data simply do not provide the full picture and therefore cannot provide answers to how the majority of disputes are resolved. They only provide a snapshot of a non-representative set of cases. Insights gained from these data therefore do not generalize to larger set of disputes and, importantly, cannot reveal the overall mechanism that produces dispute events and outcomes.

This challenge is even more evident with respect to the initial dispute motivations. In large part because of the sparse information on disputes events and the resulting low 'positive-case' to 'negative-case' ratio, most scholars have tended to study aggregate measures of dispute activity – usually counts per country or dyad. By necessity, this has resulted in a focus on aggregate predictors as well. Here, a substantial additional complication is that, in addition to dispute events, applied trade barriers and the resulting motivational drivers of trade disputes (i.e., the political salience of bilateral industry-level trade relations) are unobserved as well.

Broadly speaking, the findings in the literature fall into two categories. A first category concerns classic country- and dyad-level factors. Here, research has shown that countries tend to be involved in a larger number of GATT/WTO disputes if they have higher aggregate export volumes (Sattler and Bernauer 2011) as well as larger economies (Francois et al. 2008). Retaliatory capacity in terms of import market size or development aid relationships has also been shown to affect dispute participation (Bown 2005). Relative economic size is also reported to play a role, favoring the larger, more powerful side (Guzman and Simmons 2005, Sattler and Bernauer 2011). There is also evidence that countries with more effective legal and political institutions are engaged in larger numbers of disputes (Busch and Reinhardt 2003, Horn et al. 1999).

A second category of findings concerns monadic, dyadic or aggregate factors that have a dynamic or temporal dimension. Lee (2012) as well as Davis and Pelc (2012) present evidence suggesting that macro-economic conditions influence countries' propensities to seek WTO arbitration. Davis and Bermeo (2009) hold that earlier dispute experience increases the participation rates of countries in later cases, suggesting a learning mechanism. Pelc (2014) presents an argument that countries occasionally initiate disputes at the WTO to set (informal) precedents. Reinhardt (2000) and Bown (2002, 2004a, 2004b) suggest that countries file retaliatory disputes. That is, dyads with a dispute are prone to experiencing a second dispute in the reverse direction (Busch and Reinhardt 2002, p. 464, present a list of cases they suspect to be retaliatory in nature).

All these findings are important and further our understanding of trade disputes. Importantly, however, they further our understanding of trade disputes on an aggregate level by highlighting general tendencies. Thus, the above results enable us to anticipate that larger countries will, on overage, be involved in a larger number of high-level trade disputes. They do not, however, enable us to anticipate what products are likely to be subject of these disputes. Put differently, one might expect that, based on their economic size and trade volumes, the U.S. and Argentina are likely to experience a handful of WTO disputes over a 25 year period. But it remains entirely unclear whether these disputes arise over footwear and pharmaceuticals or over beef and automobile parts.

Making these assessments requires more information. In particular, it requires knowledge about the industry-level drivers of individual disputes and, therefore, mandates an analysis on the disaggregate industry-level rather than on the aggregate country/dyad-level. The key point is that trade disputes are industry-level phenomena (i.e., they usually arise because countries disagree over the effects of trade policies for specific products). For this reason, variations in industry-level preferences can explain variations in dispute escalation. By contrast, country/dyad-level concepts such as market size or relative economic power cannot explain within-dyad variation in dispute activity. Since these factors are constant across all product-related policies two countries may disagree over, they cannot explain why countries enter into a dispute over one product but not over another.

To move in this direction, some analysts, notably Bown (2005) and Allee (2008), have opted for a more strongly design-based approach to study dispute initiation. Bown (2005) focuses on a small number of discriminatory policies that were ruled as being illegal by the WTO. He then compares the characteristics of the actual complainants to characteristics of countries that Bown identifies as potential complainants (that were also affected by the policies) but only participated in the dispute as interested third parties, or not at all. This strategy is aimed at identifying meaningful non-cases by design. Allee (2008), in turn, focuses on anti-dumping (AD) measures and countervailing duties

(CVD) because, in contrast to other non-tariff barriers, such trade contingency measures are governed by relatively strict reporting standards under the GATT/WTO. He then examines whether these measures were challenged at the WTO.

The fact that Bown (2005) and Allee (2008) are essentially alone in making an effort to take trade barriers into account when studying the determinants of trade disputes exemplifies the observational difficulties associated with trade disputes. Despite their thoughtful approach, however, these studies can only alleviate these difficulties to a degree. First, both studies, by design, only consider a small number of cases. Second, their design restricts attention to a non-complete set of barriers for the given set of cases (given that many other forms of tariff and non-tariff barriers may or may not affect the trade flows under consideration). Lastly, the data used by the authors indicates merely the presence of certain barriers but does not allow a quantitative assessment of the economic effects of these barriers on trade flows.

These limitations preclude an assessment of the concerned governments' political salience levels associated with the respective cases. This means that the key motivations of trade disputes are unobserved. Together with the limited information on disputes escalation, especially at the lower and of the spectrum, and the limited information on eventual dispute outcomes, these limitations pose a substantial challenge to the study of trade disputes. Ultimately, this hampers efforts to uncovering the mechanism that governs trade disputes more generally.

3 Theory and Hypotheses: The Political Salience of Trade Relations, Dispute Escalation, and Dispute Outcomes

Given the foregoing considerations, gaining deeper insights into trade disputes requires two things. First, we need better information on the political salience of trade relations as a key dispute determinant, as well as better information on actual dispute events, and eventual dispute outcomes. Second, we need an understanding of how these factors interrelate to produce the empirical pattern of disputes that characterizes international trade relations. On the surface, the first step is essentially a data requirement, while the second is a requirement for theoretical specification. On closer inspection, however, both steps require considerable theoretical reasoning, in particular, because assessing the political salience of trade relations heavily depends on existing theoretical knowledge of international trade and trade policy.

Below, I lay out the theory for both steps. I begin with discussing the political origins of government preferences toward industry-level trade relations. Here, the emphasis is on the domestic political level (in both exporter and importer countries). The discussion provides the basis for my empirical strategy to measure the political salience of trade relations in Section 4.1. It presents a 'measurement theory' for assessing government preferences that is based on the counterfactual gains and losses that result from the potential trade policy reforms for politically relevant constituencies. I then describe how bilateral preference constellations affect the strategic interactions of governments, and thus produce the empirical pattern of dispute escalation and outcomes. Here, the focus is on the international level. I also derive hypotheses that are tested in Sections 5 and 6.

3.1 How the Political Salience of Trade Relations Arises

Government preferences over trade policy result from a domestic preference aggregation process. In the domestic political struggle over trade policy formulation, there are three main sets of actors: consumers, producers, and the government. In the relationship between these groups, the influence of producers on government trade policy exceeds that of consumers – both in importer and exporter countries (Corden 1997, Destler 2005, Grossman and Helpman 2002). This situation arises for well-known reasons. Olson (1965) has first pointed out that large, dispersed groups (consumers) are in a worse situation to effectively exert pressure on the government than small, well-organized groups (producers). Because consumers are a large group, each individual's gain from organizing pressure on the government is too small to justify the necessary personal effort. Moreover, consumers are simultaneously interested in the whole set of products they purchase. Producers, in contrast, only care about a single industry.[3] These circumstances allow producers to dominate the domestic preference aggregation process over trade policy issues.

In the importing country, government preferences will thus be biased toward the protection of import competing industries. While the resulting protectionist policies can take different forms (e.g., tariffs, quotas, taxes, or other non-tariff barriers), they all drive a wedge between the prices of domestic and imported products. Trade barriers are thus government manipulations of the market mechanism. By making imports more expensive, these barriers induce consumers to buy a larger share of domestically produced products than they otherwise would. As a result, domestic producers can not only sell larger quantities, but also charge higher prices.

Through protectionist policies, governments revoke or forestall the 'gains from trade' that result from trade liberalization. A direct implication of the large economic literature on trade is that, on an economy-wide scale, reciprocal trade liberalization increases aggregate national welfare (Jones 1956; 1965, Krugman 1980, Melitz 2003, Ohlin 1933, Ricardo 1817, Samuelson 1948; 1971). For each country, this aggregate welfare increase arises, in particular, because consumer gains from trade liberalization (through lower prices) outweigh producer losses from increased import competition. Trade barriers inhibit these effects. Domestically, these measures thus result in an inefficient redistribution of income from consumers to producers that reflects the unequal political weight of the two groups in shaping government policy.

By imposing trade barriers, however, governments not only affect the domestic distribution of income. They also affect the distribution of income between domestic producers and the export industries of their trade partners. Trade barriers by definition restrict market access and so result in lost sales for foreign producers – and therefore directly hurt the politically relevant constituencies in the trade partner's polity. In effect, the imposition of trade barriers implies a unilateral revocation of the linkage agreements that are at the heart of larger bilateral and multilateral efforts to increase aggregate welfare through trade liberalization. These linkage agreements envisage that each side bears some of the hardship from trade-induced structural change – in return for lower prices (on

[3] Grossman and Helpman (1994) further refine this argument by highlighting the deeper political process by which producers exert influence in political systems where successful electoral competition is dependent on campaign contributions.

the consumer side) and larger export markets for competitive industries (on the producer side).

In terms of domestic political currency, a government that reneges on earlier agreements by pursuing protectionist policies thus benefits twice – once by opening foreign markets for competitive domestic industries, and a second time by subsequently closing its domestic market to protect less competitive domestic producers from foreign imports. In the exporting country, by contrast, the government of an affected trade partner loses twice – once by exposing domestic industries to increased foreign competition by concluding the initial agreements, and a second time by seeing its competitive export industries unable to reap the promised benefits of increased access to foreign markets. Unilateral protectionist policies thus lead to pronounced imbalances in the distribution of politically relevant costs and benefits between importer and exporter governments. It is not surprising, therefore, that 'unfair' trade practices have the potential to result in trade disputes.

To assess how such disputes play out, the crucial question is how to properly quantify these interests for all bilateral product-level trade relations. It is intuitively clear that the salience of a trade relationship is related to the monetary value of the trade flow concerned. Higher trade volumes are, all else equal, likely to be more relevant for producers, and thus more important to national governments, than lower trade volumes. However, my goal is to go beyond this intuitive but crude understanding of salience by quantifying the actual stakes politically relevant constituencies have in the observed trade relationships.

Essentially, I wish to assess the effect of trade policies on the sales *potential* for domestic and foreign producers. This involves relating sales opportunities under given levels of protection to the potential sales opportunities that *would* materialize under lower levels of protection. The crucial point is that trade disputes are not actually about existing trade flows but about the *additional* trade flows inhibited by trade barriers. This implies that the monetary value at stake in a dispute is not the value of the actually existing trade flow but the difference in value between the existing trade flow and the counterfactual trade flow that would materialize if current trade barriers were to be reduced or removed. Importantly, the same observable trade value can be associated with very different potential sales opportunities (and resulting salience levels) for both the importing and the exporting sides.

On the importer side, the political salience of industry-level trade flows depend on two factors beyond the observed trade value. First, it depends on the size of currently applied trade barriers because higher existing barriers imply larger increases in imports if abolished or reduced. Second, it depends on the price-sensitivity of domestic consumers with regard to the product in question (i.e., elasticities). Given information on trades barriers and trade elasticities, it is then possible to calculate the expected increase in total industry-level imports that would result from a hypothetical reduction of existing barriers. This estimate can in turn be used to calculate the ratio of the expected increase in imports to the current level of imports. I define this *counterfactual loss share* as my salience measure for the importer government. It is equivalent to the percentage increase in import competition for domestic producers resulting from the reduction of trade barriers.

On the exporter side, the political salience of a trade relationship depends on two factors as well. First, it depends on the size of the importer's counterfactual losses, as defined above, because these losses define the range in which the growth potential for export sales can lie. Second, it depends on the exporter's current position in the import market relative to other exporter. This is because the majority of trade barriers are applied on an MFN basis so that the importer's trade barriers affect *all* exporters (this holds, in particular, for non-tariff barriers; see: Bacchetta et al. 2012). Similarly, trade barrier reductions should be expected to benefit *all* exporters because selective reductions for individual exporters are usually inconsistent with international trade law. I therefore define the fraction of the importer's losses that would accrue to the exporter's producers, the *counterfactual gain share*, as my salience measure for the exporter government. This definition of the exporter's salience implies that the importer typically has a 'defender advantage', an issue I discuss further below.

Defining the salience measures as described is not only consistent with existing theories of trade and trade policy. It has other important advantages as well. For one, note that by incorporating current levels of trade protection, the importer's salience measure implicitly reflects factors such as the strength of domestic lobbies for different industries or the government's susceptibility to these lobbies. Similarly, exporting producer's current success in the importer's market reflect factors such as geographic distance or the relative competitiveness of the industry. Most importantly, my focus on counterfactual quantities captures the forward-looking assessments that feeds into the strategic decision-making calculus of governments.

3.2 How Bilateral Salience Constellations Affect Dispute Behavior and Outcomes

Given an appreciation of how the domestic political salience of industry-level trade relations arises for individual governments, the next step is to ask how bilateral *constellations* of different salience levels affect dispute behavior and, ultimately, dispute outcomes. For this purpose, I take a closer look at the bargaining process that accompanies trade disputes. I begin by noting that this bargaining process has a coercive component: Trade disputes are costly and dispute escalation, which increases the costliness of a dispute, is a strategic move at the hands of the concerned governments.

It has long been known that the creation of costs can be used to secure concessions (e.g., Schelling 1966, Snyder and Diesing 1977). Specifically, Cramton (1991) has shown how, in a bargaining situation in which two parties incur non-zero fixed-costs, the side with the lower costs can secure better agreements compared to a situation in which neither side incurs fixed-costs (assuming identical issue-valuations). Given that I am primarily interested in the role of parties' salience, I recast these results to analyze varying issue-valuations (see: Appendix B, for a more detailed derivation of the following argument). If the bargaining parties have identical costs but differ in their issue-valuations, then the party with the higher valuations has an advantage. This follows because higher issue-valuations make parties more cost-tolerant. As a result, high-valuation (or high-salience) parties are in a better bargaining position than low-valuation parties.

In real-world situations, however, parties are uncertain about their opponent's exact bargaining power. As a result, the parties cannot simply reach the agreement that reflects their relative bargaining power. Grossman and Perry (1986) analyze this problem in the relatively simple context of bargaining under one-sided uncertainty. They show how, under uncertainty, the uninformed party gradually screens the opponent for its strength. This process involves a sequence of offers over time. Initial offers favor the uninformed party in the hope that the opponent is in a weak bargaining position. By accepting costly delay, strong types of the opponent credibly signal their strength. Bargaining thus results in a string of concessions over time until agreement is reached. Similar analyses have subsequently been applied to variety of bargaining situations (e.g. Cramton and Tracy 1992; 2003, Powell 2004, Slantchev 2003, Spier 1992; 2007).

To derive valid expectations about bargaining behavior in trade disputes, I extend on the above logic by introducing two crucial aspects: I allow for mutual (i.e., two-sided) uncertainty; and I allow for non-constant bargaining intensity and dispute costs (i.e., dispute escalation). First, acknowledging mutual uncertainty is important for formulating accurate expectations about dispute behavior because it reflects real-world conditions and affects theoretical predictions. Importantly, under mutual uncertainty, *both* sides screen each other. Both sides therefore initially make offers favoring themselves and gradually lower their demands. Bargaining then no longer consists of a one-sided sequence of concessions but approximates the back and forth of typical negotiations. Bargaining under mutual uncertainty also implies that high-salience types of both sides signal their strength by accepting costly delays to agreement, while low-salience types select out earlier by accepting less attractive deals.

Second, I expect this bargaining process to be directly linked to dispute escalation. In particular, I expect that disputes constantly intensify as bargaining continues. This follows from two opposing considerations. On the one hand, parties have an incentive to escalate. This is because the differences in the parties' cost-tolerances, which are induced by their varying issue-valuations, become more relevant as the overall bargaining costs increase. A rise in bargaining costs, therefore, implies a more attractive agreement for the high-salience party. In addition, weak opponents select out faster if costs are higher. Thus, because escalation promises larger gains while selecting out weak opponents at a higher rate, it promises *better deals earlier on*. On the other hand, escalating quickly can be unnecessarily costly if the opponent has low salience and would already have made substantial concessions in the presence of much lower costs. Parties thus need to strike a balance in their escalation strategy. This balance results in gradual and continuous dispute escalation during bargaining.

The discussion so far implies that low-salience types of both sides select out earlier at lower levels of escalation. It also implies that high-salience types of both sides stay in the game longer while disputes escalate further. Thus, disputes end at low levels of escalation as long as at least one side has low salience and escalate only if both sides have high salience. This implies the following interaction hypothesis about the relationship between the parties' salience constellation and dispute escalation:

> *H1: The interaction of the exporter government's salience level and the importer government's salience level should be associated with longer dispute durations and higher levels of dispute escalation.*

Given an expectation of how the combination of parties' salience levels are related to dispute escalation, it is natural to ask how the agreed outcomes of disputes vary with their level of escalation. This question addresses a more subtle aspect of the conflictive bargaining process. In particular, the presence of uncertainty makes point predictions for individual cases impossible (if point predictions were possible, the concerned governments would be able to produce them as well and would therefore be able to avoid the costly bargaining process). However, it is possible to derive expectations over the summary statistics of these outcomes. In the following, I therefore focus on both the *mean* and the *variance* of bargaining outcomes as a function of observed escalation levels.

To begin with, note that dispute outcomes are not determined in a vacuum. Rather they depend on a pre-existing status quo. The outcomes of interest, therefore, are not the terms of an initial agreement (be it explicit or implicit) but the *changes* in an existing agreement.[4] Trade disputes thus typically serve to re-negotiate an existing agreement. This implies an additional role of the parties' salience in determining the eventual bargaining outcome. What counts for the *change* in agreement is not the *level* of parties' political salience but the *change* in this salience (this contrasts with the absolute levels of dispute escalation, as discussed above, which does depend on the parties' absolute salience levels). Irrespective of the level, the change in the parties' salience can increase or decrease. In other words, a weak initial bargaining position does not preclude an improvement over time, and vice versa.

These consideration have implications for the relation between the *mean* in the change in dispute outcomes and dispute escalation. To see this, first note that, in disagreements over import policies, the exporter chooses whether to initiate a dispute episode. This means that the exporter can abstain from doing so if the endeavor appears fruitless and overly costly. Consequently, the exporter has an *initiator advantage*. Essentially, the fact that the exporter can pick its fights induces a second selection effect *prior to* any observable interaction, which might tilt the bargaining position in observable disputes in the exporters favor. More specifically, I expect this selection effect to be prevalent, in particular, in situations where the exporter anticipates high dispute costs in combination with insufficient improvements in the eventual agreement.[5]

From the preceding discussion, it follows that high levels of escalation, and therefore high dispute costs, are expected only if both sides' salience levels are high. High-salience exporters should therefore be particularly cautious in initiating disputes with high salience importers. The logic is this: If high-salience exporters were to always initiate disputes with high-salience importers, there would be as many exporters whose salience has increased since the status quo agreement was reached as there are exporters whose salience has decreased. The same holds for the importer. The average change in outcome the exporter can expect is therefore equal to zero. When accounting for the substantial costs of highly escalated disputes, the exporter ends up with a net loss.

However, the exporter can boost the chances of success by initiating only if its own salience has increased. Alternatively or complementarily, the exporter may invest in finding out whether the importers salience levels have decreased and initiate accordingly. This situation looks different if at least one party has low salience so that dispute costs will be low. Here, self-selection is much less relevant. A low-salience exporter, for instance, may utter a complaint toward a trade partner with-

[4] This is also reflected in my measurement strategy for *implied trade policy changes* discussed below.
[5] This is also why, in re-negotiation contexts, *observationally* the exporter's initiator advantage can be expected to trump the importer's defender advantage (that plays into determining the nature of the initial status quo).

out larger consideration of both sides' exact changes in salience. Because the cost of a complaint is near zero, the self-selection pressure is low in low-profile contexts. Therefore, exporters should be expected to act more prudently in initiating disputes that are expected to escalate further. This suggests the following hypothesis[6]:

> *H2: The exporter should, on average* (mean)*, secure larger reductions in trade barriers and thus larger relative increases in trade flows in disputes that have escalated further, due to strategic pre-selection.*

Next, it is also possible to derive an expectation about the *variance* in the change in dispute outcomes as a function of dispute escalation. Recall that high escalation levels imply the interaction of two high-salience parties. From the preceding discussion it is also clear that both sides shift from making offers favoring themselves to gradually lowering their demands over the course of their interaction. This happens as both sides learn about their respective opponent's high salience as signaled by the continued bearing of dispute costs. The longer the parties bargain and the further the dispute escalates, the more the parties' offers converge from opposite directions. The resulting compromise agreement, therefore, constrains the range of possible outcomes. Consequently there should be low variation in agreed outcomes after highly escalated disputes.

By contrast, at low levels of escalation, the variation in outcomes should be considerably larger. This is the case because a larger set of bilateral type combinations is consistent with low level disputes. While high-level disputes require both sides to have high salience, low-level disputes are observed as soon as one side has low salience. Thus, only a single combination of the salience combinations is consistent with maximum escalation (high-high), while several salience combinations are consistent with minimal escalation (high-low, low-low, low-high). Yet while all these combinations are associated with low escalation levels, they result in very different bargaining outcomes. A high-salience exporter that is bargaining with a low-salience importer obtains a favorable agreement, and vice versa. Intermediate combinations result in outcomes between these extremes.

This relationship directly extends to the variability in *changes* that can be expected in a renegotiation setting. In mutually high-salience scenarios, both parties will be more resistant not only to initial concessions but to changes from the status quo as well. So even small changes in the status quo are strongly resisted. At the same time, salience combinations resulting in low levels of escalation involve at least one side with low levels of salience, which therefore does not resist very strongly to changes in the status quo. Consequently, low escalation scenarios should be associated with larger variability in trade policy changes in either direction. This suggests the following hypothesis:

> *H3: The variability* (variance) *in agreed changes in trade policies, and thus changes in trade flows, should be lower in more highly escalated disputes.*

[6] Note that Hypothesis 2 is consistent with the observation that WTO disputes are disproportionately won by complainants (Davis 2012), as well as with evidence from domestic law suits, which points in the same direction (Waldfogel 1998).

Together, Hypotheses 2 and 3 state that higher levels of escalation should be associated with an increase in the *mean* and a decrease in the *variance* of observable changes in trade flows.

4 Data and Empirical Strategy: Measuring Salience, Escalation, and Outcomes

This section presents the empirical strategies I employ to compile previously unavailable data on government preferences, dispute events, and bargaining outcomes. It introduces both the methodology and the key results.

4.1 Salience: Expected Gains and Losses from Potential Trade Barrier Reductions

Measuring the importance of policy issues for national governments is challenging because government preferences cannot be directly observed. In Section 3.1, I presented a *theory of preference formation* that provides the basis for my measurement strategy. This theory outlined how the counterfactual gains and losses from the potential trade policy changes, which may result from a dispute, form the basis for my measure of political salience. To calculate this measure, I need to quantify these gains and losses. To do so, I employ a trade policy simulation model that allows me to approximate the total change in industry-level imports that *would* result from a given trade barrier reduction by an importing country in a given industry. I begin by describing the actual calculation of my salience measure and then move backwards by describing the auxiliary information I need for this calculation and how I collect it.

Figure 2 graphically depicts the idea behind my salience measure. Panels (a) and (b) represent the *before* and *after* scenarios of the simulated barrier reduction. Panel (a) reflects the initial situation. M_{jk} indicates the status quo level of imports of product k into country j in the presence of currently applied trade barriers. $P_{jk} - X_{jk}$ indicates domestic production minus exports. The area of the entire square $M_{jk} + P_{jk} - X_{jk}$ is domestic consumption, i.e., the total size of the domestic market for the given product. Panel (b) shows the result from simulating a reduction of the current trade barrier whilst taking into account the product-specific elasticity. [7]

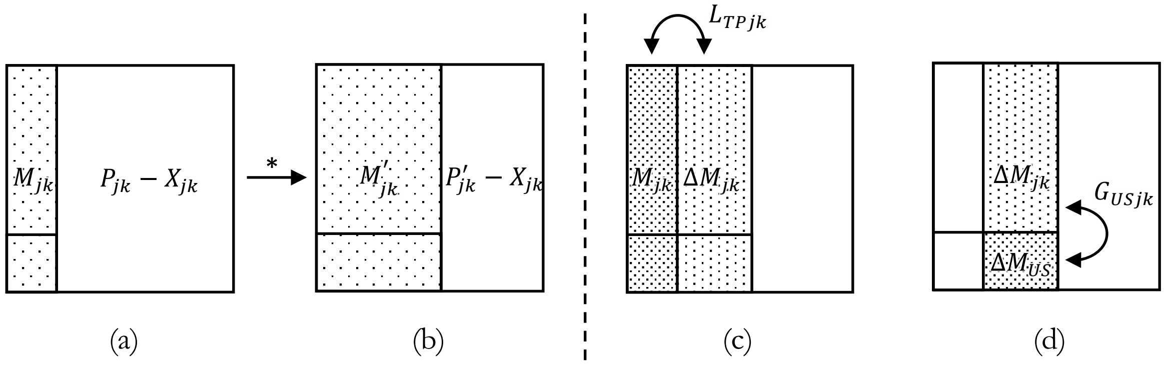
The asterisk (*) in Figure 2 indicates the theoretical mechanism, described mathematically below, that translates the hypothetical change in the trade barrier into a predicted increase in imports, from M_{jk} to M'_{jk} (I assume a barrier reduction by 25 percent)[8]. This change depends on both the size of the barrier and the price-sensitivity of consumers. Essentially, the higher the initial barrier before the reduction, and the more price-sensitive (elastic) demand for the product in question, the larger this increase will be. The predicted increase in imports simultaneously implies a decrease in the size

[7] Note that I omit time subscripts throughout the discussion. This is because both the estimation of elasticities and the estimation of trade barriers require the time-variation in the input data. The resulting estimates are thus time-averaged quantities in a cross-sectional format.

[8] The value of 25 percent is arbitrary but inconsequential because the predicted changes in imports are proportional to the percentage reduction of the barrier. The overall pattern of gains and losses therefore remains the same.

of the domestic market controlled by domestic producers ($P'_{jk} - X_{jk}$).

Figure 2: Measuring Salience – Hypothetical Trade Barrier Reductions and the Resulting Gains and Losses



These predicted changes form the basis for the calculation of the political salience measure for the importer and exporter governments. To see this consider panels (c) and (d) of Figure 2. These panels stack panels (a) and (b) on top of each other to make the predicted changes more explicit. ΔM_{jk} is the predicted increase in imports resulting from the hypothetical trade barrier reduction. By relating the predicted increase in imports *following* the barrier reduction to the observed value of imports *prior* to the barrier reduction (i.e., $\Delta M_{jk}/M_{jk}$) as shown in panel (c), it is possible to arrive at an estimate of the importer's counterfactual losses (in terms of increased foreign competition) relative to the status quo. The quantity $\Delta M_{jk}/M_{jk}$ can be seen as the importer's loss share and thus a measure of the political salience of the trade relationship to the importer government. I denote this loss share by L_{jk}.[9] In the application at hand it will always concern a U.S. trade partner.

To calculate the exporter's (i.e. the United States') gain share another step is required. Note that L_{jk} concerns the importer's total imports of a product from *all* exporters. The setup assumes that any trade barrier reduction implemented by the traded partner will apply to all exporters – in conformity with the Most-Favored-Nation (MFN) non-discrimination clause of international trade law and the importer's resulting defender advantage discussed above. Zooming in and following a similar logic on the exporter-specific level, it is possible to arrive at an estimate of the United States' predicted gains relative to the gains of all other exporters (i.e., $\Delta M_{USjk}/\Delta M_{jk}$) as shown in panel (d). This quantity reflects how much of the trade partner's losses from trade liberalization the United States is likely to capture. This quantity, which for an MFN-style barrier reduction is proportional to the U.S. market share prior to the reduction, can be seen as the United States' gain share, G_{USjk}. It is thus as a measure of the political salience of the trade relationship to the U.S. government.

To actually calculate L_{jk} and G_{USjk}, I need to know the expected change in imports, ΔM_{jk}. I assess ΔM_{jk} using the aforementioned trade policy simulation[10]. The idea underlying the simulation is based directly on the definition of the import demand elasticity, which reflects how sensitive import

[9] Appendix C shows that this quantity equals the percent change in import competition faced by the trade partner that results from the barrier reduction.
[10] In implementing the procedure, I closely follow the methodology presented by Jammes and Olarreaga (2005; also see: WTO 2012).

demand for a given product k in country j is to changes in the price for this product (which is affected by the presence of trade barriers). The import demand elasticity reflects the price-sensitivity of consumers by capturing how much imports change as prices change by a certain amount. This price-sensitivity, in turn, depends on the degree to which the product is homogeneous or differentiated, which makes them more or less easily substitutable. Consumers are less price-sensitive towards differentiated products, which are specialized and/or branded and thus difficult to substitute with other varieties of the same product (e.g., cosmetics). The reverse holds for homogenous products, which are similar across suppliers and therefore easy to substitute (e.g., palm oil). For any given increase in import prices, the corresponding decrease in imports will be smaller for differentiated than for homogeneous products. Differentiated products thus tend to be less price-elastic and have lower elasticities.

Formally, the import demand elasticity is defined as the percent change in imports relative to the percent change in price as given by

$$\sigma_{jk}^{D} = \frac{\%\Delta M_{jk}}{\%\Delta P_{jk}} = \frac{\Delta M_{jk}/M_{jk}}{\Delta P_{jk}/P_{jk}}, \tag{1}$$

where the superscript D signifies the total domestic demand for imported goods, M_{jk} are aggregate imports by j of all national varieties of product k, and P_{jk} are domestic prices inclusive of the tariff-equivalent effect of policy barriers to trade[11]. Thus,

$$P_{jk} = P_{k}^{*}(1 + t_{jk}), \tag{2}$$

where

$$t_{jk} = barrier_{jk}/100, \tag{3}$$

P_{k}^{*} reflects international prices, and $barrier_{jk}$ is the sum of non-tariff barriers (NTBs) and tariffs in percentage terms (i.e., a barrier of 100 percent implies a doubling of the products price). P_{k}^{*} should be interpreted as the world price of product k in case that this good is perfectly homogenous. Likewise, if product k is differentiated, P_{k}^{*} should be interpreted as the weighted average price of the different imported varieties. The import demand elasticity thus captures the percent change in imports in response to a percent change in domestic prices due to changes in policy barriers.

Note that quantity of interest – the expected change in imports resulting from a given reduction in policy barriers – can be computed directly from equation (1) by solving for ΔM_{jk}:

$$\Delta M_{jk} = \sigma_{jk}^{D} M_{jk} \frac{\Delta P_{jk}}{P_{jk}}. \tag{4}$$

In order to compute ΔM_{jk}, however, more information is needed because both ΔP_{jk} and P_{jk} de-

[11] For notational simplicity, the following discussion focuses on aggregate imports from all exporters thus omitting an additional subscript i for different exporters.

pend on P_k^*, which is unknown. To solve this issue assume, for now, that the international price P_k^* is unaffected by changes in P_{jk}. This is the so-called 'small country assumption', since small countries have little market power and are thus unable to influence international prices. This assumption implies that the export supply facing importer j is infinitely elastic (for brevity, I relegate the discussion of how this assumption can be relaxed as well as various other details of the procedure to Appendix D; note that the actual simulations I perform are based on this more general model).

Given infinitely elastic export supply, ΔP_{jk} is simply determined by the change in t_{jk}. Concretely, because $P_{jk} = P_k^*(1 + t_{jk}) = P_k^* + P_k^* t_{jk}$, we have $\Delta P_{jk} = (P_k^* + P_k^*(t_{jk} + \Delta t_{jk})) - (P_k^* + P_k^* t_{jk}) = P_k^* \Delta t_{jk}$. Using this result and the definition of P_{jk} from equation (2) and plugging both into equation (4), one gets

$$\Delta M_{jk} = \sigma_{jk}^D M_{jk} \frac{P_k^* \Delta t_{jk}}{P_k^*(1 + t_{jk})}, \tag{5}$$

which simplifies to

$$\Delta M_{jk} = \sigma_{jk}^D M_{jk} \frac{\Delta t_{jk}}{(1 + t_{jk})}. \tag{6}$$

Note that the international price, P_k^*, cancels and the entire right-hand side of equation (6) is now expressed in terms of quantities that are either known or can be estimated. Specifically, current imports M_{jk} are directly observed in international trade data (UN Comtrade). Data on policy barriers t_{jk} are taken from Martini (2018a). The change in trade barriers Δt_{jk} is specified as part of the policy simulation. This leaves the elasticities σ_{jk}^D to be estimated.

To estimate σ_{jk}^D I need to relate changes in prices to changes in imported quantities. In practice, this procedure is complicated by the fact that prices and quantities are interrelated. Because prices rise as quantity demanded increases and quantity demanded falls as prices rise, these quantities are subject to reverse causality. I therefore use the structural estimation procedure following Feenstra (1994) and Broda and Weinstein (2006), where the relationship between prices and quantities is estimated in a system of simultaneous equations. Importantly, because identification in this approach is achieved through the effects of supply shocks from the set of exporters to a given market, the method works in the absence of information on trade barriers.[12]

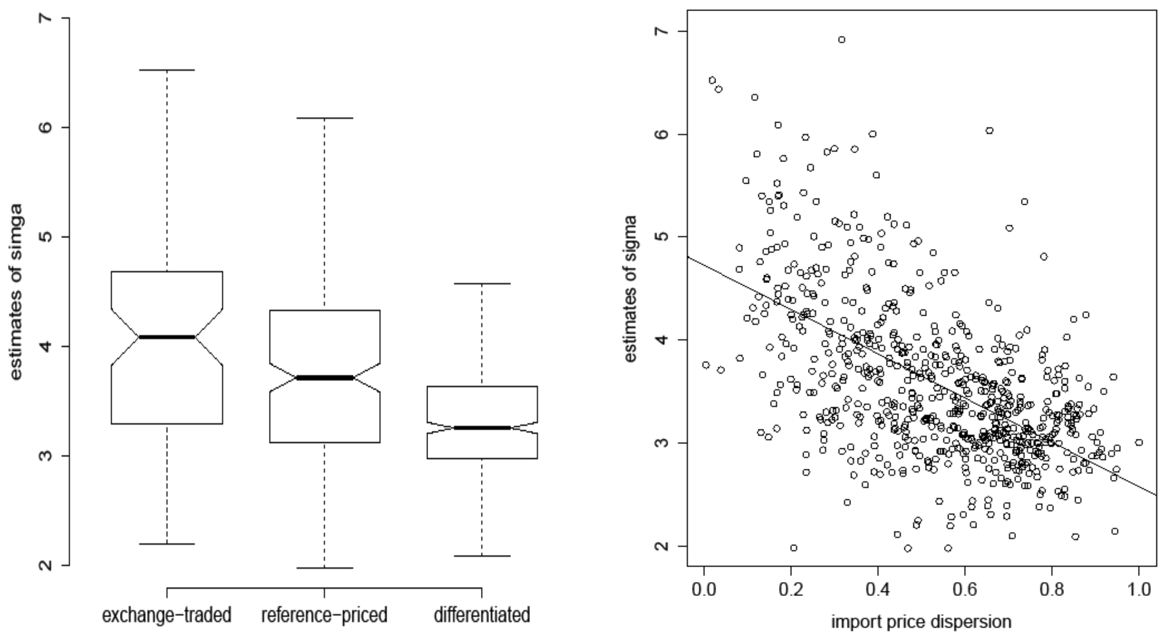
The implementation of the procedure is complex and discussed in full length in the appendix, along with extensive information on data sources and detailed results. Here, I limit myself to establishing the plausibility of the results. Figure 3 presents plots of the estimated elasticities against two different measures of product differentiation. As noted above, differentiated products should have lower elasticities. The figure suggests that the estimated elasticities conform with this expectation.

The left panel of Figure 3 shows boxplots of the product-wise elasticity estimates against the product categories defined by Rauch (1999), which have become the standard measure for product differentiation in the literature. Rauch divided goods into three broad groups depending on wheth-

[12] Note that I average all elasticities across countries j, resulting in a single elasticity for each product k, i.e., σ_k^D. I do so because there is a clear theoretical reason to expect elasticities to vary across products, while there is no theoretical reason to expect variation across countries.

er they are exchange-traded, reference-priced, or differentiated (with product differentiation increasing from the first to the last). The right plot of Figure 3 plots the elasticity estimates against a measure of import price dispersion across countries. The idea here is that price dispersion across different markets should be lower, the more homogenous a product is and the more it therefore has a single world price. By contrast, higher price dispersion should be seen for more differentiated products. In line with expectations, these products have lower estimated elasticities. Formal statistical tests supporting these visual results are reported in the appendix including all relevant details on definitions and calculations.

Figure 3: Estimated Elasticities Plotted Against Rauch Categories and Import Price Dispersion



With the data on elasticities in hand, I am finally able to calculate my political salience measures L_{jk} and G_{USjk} as defined above and move on to dispute events and outcomes.

4.2 Dispute Escalation: U.S. Trade Bargaining and Enforcement Histories

This section presents a more detailed overview of how I collect my data on dispute events as previewed in Section 2. My data collection strategy centers on an automated content analysis (ACA) of the United States' National Trade Estimate (NTE) reports. These reports are compiled and submitted to Congress each year by the Office of the United States Trade Representative (USTR), the primary U.S. government agency responsible for formulating and implementing U.S. trade policy. They contain extensive information on the actions taken by the U.S. government to reduce or eliminate foreign barriers that hamper U.S. exports.

The NTE reports are thus a rich source of information on the bargaining and escalation behavior of international trade relations. However, the verbal nature of the NTE reports has so far hindered quantitative researchers from accessing this wealth of information. The ACA routine I develop allows me to systematically extract the verbal information from the reports and to translate it into machine-readable data. These data capture the U.S. trade bargaining and enforcement histories across some eighty trade partners and three-hundred industries (or products) over the 1988–2012 period. By covering the entire range of escalation levels from inaction and passive complaints, to active diplomatic exchanges at various levels of intensity, to sanctions and retaliatory action, the data provide a nuanced picture of the pattern of conflictiveness surrounding U.S. trade relations.

With my empirical focus on U.S. export relationships, I trade a smaller coverage of the international trade network (compared to existing data on WTO dispute settlement) for a much more comprehensive view on the conflictiveness of trade relations. The more completely and correctly my data capture the actual dispute behavior, the more this empirical strategy allows me to study the bargaining and escalation patterns of trade disputes in the absence of the selection problems inherent in the WTO data.

An important initial question therefore is whether the NTE reports, which constitute the textual source of my data collection procedure, accurately reflect the actual bargaining and escalation patterns of U.S. export relations without being subject to selection effects of their own.

For two interrelated reasons, the NTE reports likely describe U.S. trade enforcement actions accurately. On the one hand, USTR has no incentive to *under*state government actions taken to strengthen U.S. trade interests abroad. These actions demonstrate the U.S. government's commitment towards 'the national interest.' Greater market access abroad is typically beneficial for industries and workers alike because it increases export sales and secures employment. Export-related trade enforcement activities are likely to unambiguously boost the government's standing at home. On the other hand, USTR also cannot realistically *over*state U.S. government actions. The NTEs are subject to critical scrutiny of Congress. The NTEs are part of an accountability exercise to review the U.S. government's work concerning trade negotiations and enforcement. It is therefore implausible that exaggerated accounts of U.S. activities will go unchallenged. Together, these points ensure the validity of the NTE reports as a source of verbal information on dispute escalation.

To extract this verbal information, I implement a dictionary-based automated content analysis (ACA) routine. The goal of this purpose-built procedure is to translate the unstructured textual information of the reports into structured data. Specifically, I am interested in data that uniquely links U.S. trade bargaining and enforcement actions to individual products across all trade partners and over time. That is, I require data in a *partner-product-action-year* format. A dictionary-based ACA method is most appropriate for extracting detailed sub-document level information of this kind. The technique allows effective dimensionality reduction by condensing a diverse set of words, phrases, and expressions into a manageable number of pre-defined and mutually exclusive categories. At the same time, dictionary methods can be tailored specifically to match the structure and content of the textual input documents (for an overview, see: Liu and Zhang 2012).

The text-to-data transformation of the NTE reports is greatly aided by their well-demarcated subject-matter, their clear structure, and their stylized wording. First, the NTEs provide comprehensive but exclusive accounts of U.S. trade bargaining and enforcement actions. This removes the need for separating out irrelevant input information and thus eliminates a potential source of error.

Second, the NTEs exhibit a highly structured and standardized language. This increases the precision of the ACA routine, limits the overall length of the dictionaries, and increases the fit of the search terms. Third, the annual publication format and the structuring of the reports into country chapters immediately identify two key dimensions of the resulting data, namely the *year* and the trade *partner*.

Table 1: NTE Automated Content Analysis Dictionary – Products, Partners, and Dispute Escalation

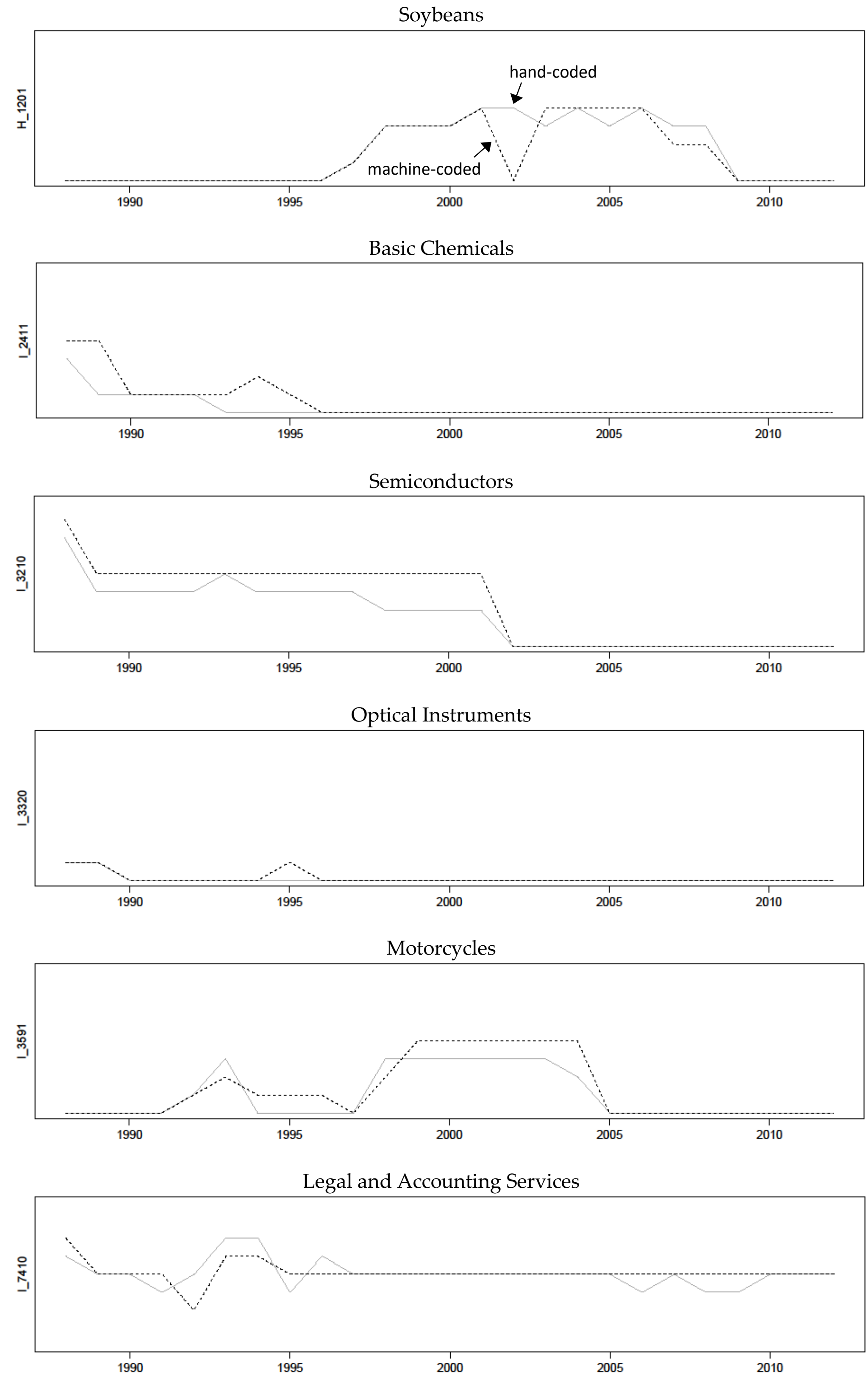
Escalation level	Product referenced	*U.S. interests referenced*	*U.S. action referenced*	*Type of U.S. action*	*Example action*
8	yes 1	yes +1	yes +6	robust	"sanctions"
7	1	+1	+5	robust	"sues"
6	1	+1	+4	robust	"threatens"
5	1	+1	+3	active	"presses"
4	1	+1	+2	active	"seeks"
3	1	+1	+1	passive	"is concerned"
2	1	+1	0	none	n.a.
1	1	0	0	none	n.a.
0	0	0	0	none	n.a.

Notes: If an explicit reference is made in a NTE country chapter with regard to a given product, this results in a baseline score of 1, otherwise the score is 0. If U.S. interests are referenced in addition to a product reference, the score increases by 1. If a U.S. action is referenced as well, the score increases by 1-6 points depending on the type of action. A reference to U.S. actions is interpreted as also implying a reference U.S. interests (i.e., if the first is given, the second is thought to be given as well). The overall score determines the escalation level attributed to an product-partner observation in a given year.

What remains, therefore, is to correctly identify and link the individual *products* and the respective U.S. *actions*. To implement this procedure, I compiled three separate dictionaries. The first dictionary attributes verbal references to products to a standardized product-classification scheme. The second and third dictionaries identify U.S. actors and U.S. actions (in both cases distinguishing between industry and government). The core task of the ACA routine is to attribute the correct U.S. action to each product. This attribution follows the logic outlined in Table 1. The lowest escalation level of 0 is ascribed if there is no reference to a product at all. For higher escalation levels, more stringent requirements need to be fulfilled. For instance, a level of 2 requires a product reference alongside a reference to respective U.S. industry interests. Similarly, a level of 3 requires a product reference alongside a U.S. government reference and a passive U.S. government action. Higher escalation levels are ascribed based on more active or robust U.S. government actions.

The complete technical details of the ACA routine are descried in greater detail in Appendix E, which also contains the dictionaries, the replication code, the final data, and the complete validation materials (in addition see: Martini 2018b). To provide an indication of the validity of the results produced by the ACA, Figure 4 presents a selection of dispute histories for a range of industries between the United States and Japan over the 1988–2012 period. The individual panels of the plot compare the machine-coded data to data that was manually coded from the same reports.

Figure 4: Comparison of Machine and Hand-coded U.S.–Japanese Dispute Histories, 1988–2012



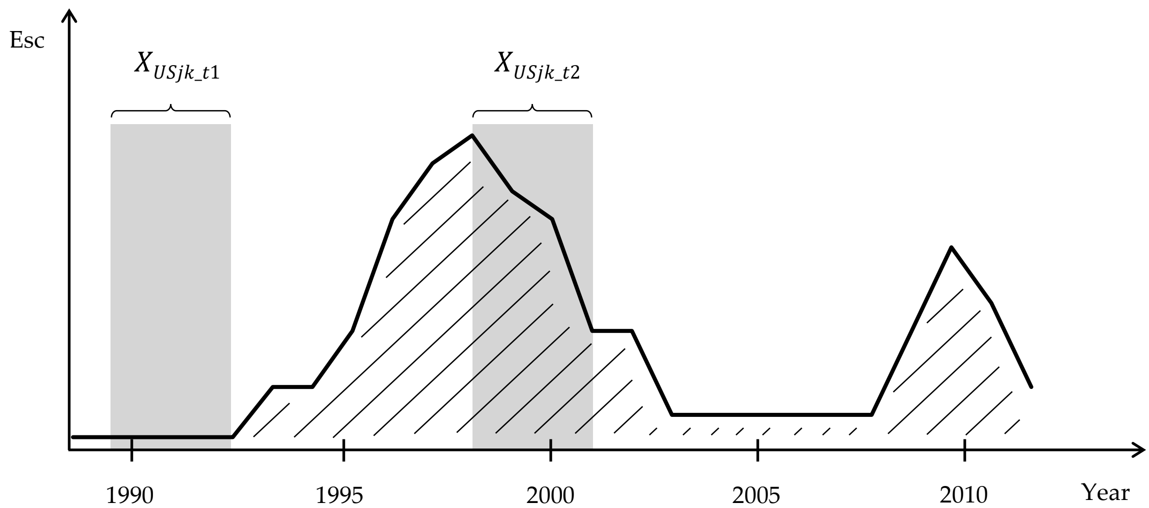
Visual inspection suggests considerable agreement between the two data series. Although the overlap in the data is not perfect, the general trends and patterns are clearly identified by the ACA. Given that complete manual coding of the NTE reports is a) infeasible due to the immense time investment and b) not necessarily imperfect as well[13], these results appear quite satisfactory.

As a more comprehensive validation, I systematically compare the results of the automated coding procedure against the entire hand-coded data for Japan across all industries. I find that the hand-coded and machine-coded data exhibit correlations ranging between .73 and .76 depending on the aggregation method. While again these correlations are not perfect, they are further substantiating the validity of the results. Overall, the data resulting from the ACA procure contain 51,503 *partner-product-action-year* observations with an escalation level of at least 1 (i.e., cases in which at least a product reference is made). From these data, one can reconstruct the dispute histories of thousands of product-level trade relations between the U.S. and its trade partners.

4.3 Dispute Outcomes: Implied Trade Policy Changes

To assess on what terms disputes end after they have escalated to various degrees, I calculate a measure that I refer to as *implied trade policy changes*. The goal is to identify the degree to which one side prevailed in a dispute by assessing changes in the importer's trade policies following the conclusion of the dispute. Unlike the information on dispute escalation, the information on dispute outcomes cannot be extracted from the NTE reports. This is simply because the reports do not contain this information, in particular, for a large share of the less escalated disputes. Consequently, a focus on the NTEs alone does not allow me to link the pattern of dispute escalation to the pattern of dispute outcomes. To obtain the required information, I assess the changes in trade barriers resulting from a dispute, by investigating the effect of these changes on the underlying observable trade flow.

Figure 5: Measuring Dispute Outcomes as Implied Trade Policy Changes



I implement this strategy by measuring the changes in bilateral industry-level trade flows that correspond to the timing of the dispute history (see: Figure 5). I begin by calculating the average value of

[13] In particular, because frequent multiple references to the same product made across different parts of the NTE country chapters are very hard to keep track of.

U.S. exports in industry k to trade partner j, X_{USjk}, over two time windows, $t1$ and $t2$. The first time window consists of the three years prior to the first dispute year. The second time window consists of the three years following the last year in which the maximum escalation level of a dispute is reached. I average within the time windows to mitigate measurement error in trade values for individual years as well as to reduce loss of information due to missing data points. To account changes in price levels over time, I inflation-adjust all trade data using GDP-deflators prior to performing any calculations.

The choice of the time windows is based on the assumed bargaining activities of the parties. The first window is intended to capture trade flows under a relatively new or existing trade barrier before the trade partner can make any concessions that become effective while the parties are bargaining. This window may not capture the effect of barriers that were imposed or stiffened before the United States initiated bargaining. This cannot be averted, however, because moving into the bargaining phase would not only lead to overlaps with potential early concessions. It would also lead to overlaps with the second time window in the case of short disputes. The choice for the second time window is based on the assumption that, consistent with theoretical predictions, the parties explicitly or implicitly reach agreement at the end of the highest escalation period. The implementation of such an agreement should then become visible in the beginning of this second window.

Based on the two average trade flows within the time windows, I calculate the implied trade policy change, reflected in the change in U.S. exports from the first to the second time window, as follows:

$$\Delta X_{USjk} = log\left(\frac{X_{USjk\_t2}}{X_{USjk\_t1}}\right). \tag{7}$$

Equation 7 defines the change in trade as the log-ratio of the average trade value in the second time window to the average trade value in the first time window. The logarithm ensures that changes are symmetric in both directions because $log(x/y) = -log(y/x)$. For instance, if trade after a dispute is four times larger than before a dispute, the ratio inside the brackets equals $4/1$ = 4. By contrast, if trade after a dispute is four times smaller than before a dispute, the ratio equals $1/4$ = .25. In other words, if trade increases, the ratio can range anywhere between one and infinity, whereas if trade decreases, the ratio ranges somewhere between zero and one. The logarithm allows expressing these changes in a balanced manner. For instance, the logarithm of 4 to base 10 is approximately .6, whereas the logarithm of .25 to base 10 is approximately –.6. Because the logarithm of 1 is zero, this transformation allows a natural interpretation of changes in both directions.

5 Analysis I: Dispute Escalation as a Function of the Political Salience Constellation

This section is devoted to testing Hypothesis 1. It analyzes the relationship between (i) the political salience of bilateral industry-level trade relations for the United States and its trade partners, and (ii) the degree to which these trade relations escalate into trade disputes.

5.1 Methods

To investigate this relationship statistically, I fit a series of twelve different interaction models based on my political salience measure and the data resulting from the automated content analysis. These models have the general form

$$Esc_{USjk1-3} = g_{1-4}(\alpha + \underbrace{\beta_1 G_{USjk} + \beta_2 L_{jk} + \beta_3 G_{USjk} L_{jk}}_{s_{rel}} + \underbrace{\delta M_{jk}}_{s_{abs}} + \underbrace{\gamma_1 + \gamma_2}_{u} + \varepsilon_{USjk}), \quad (8)$$

where Esc_{USjk} is one of the three dependent variables discussed earlier – *maximum escalation*, overall *dispute intensity*, or *dispute duration* between the United States and a trade partner j in industry k. Next, inside the function $g(.)$, α is an intercept. The following three terms specify the interaction specification that captures the logic of Hypothesis 1. The coefficient β_3 on the multiplicative term $G_{USjk} L_{jk}$ is the parameter of primary interest. The coefficient δ on the term M_{jk} captures the effect of the overall imports on dispute escalation. Note that $G_{USjk} = \Delta M_{USjk} / \Delta M_{jk}$ and $L_{jk} = \Delta M_{jk} / M_{jk}$, are a set of 'nested ratios' (ΔM_{jk} is the denominator in the first and the numerator in the second ratio) that express the countries' salience levels in relative terms. M_{jk}, as the only non-simulated quantity, is the relevant 'anchor' value in absolute value terms. G_{USjk} and L_{jk} thus decouple the bilateral salience constellation from the size of the underlying trade value. The two salience measures can therefore also be thought of as capturing the parties' relative stakes in the dispute (s_{rel}), whereas M_{jk} can be thought of as capturing the absolute stakes (s_{abs}).

Next, γ_1 and γ_2 are two sets of dyad and product fixed-effects that account for unobserved heterogeneity (u) at the dyad and product levels.[14] The first set of fixed-effects accounts for dyad-specific factors. In particular, the dyad effects account for the parties' relative power or the parties' relative cost absorption capacities. This ensures that the actor-level explanations for trade disputes , on which much of the existing literature has focused, are fully included in the model. The dyad effects further account for factors such as economic structure and development, and the quality of bilateral political relations. The second set of fixed-effects accounts for product/industry-specific factors such as overall size and productivity of the industry, or industry-specific differences in lobby strength.

Lastly, $g(.)$ represents a set of link functions for four generalized linear models (GLMs), while ε_{USjk} represents an error term with the corresponding error structure. The four models are the Linear (identity link), the Tobit (Probit/identity link), the Ordered Logit (generalized logit link), and the Poisson (log link) models. Since all three dependent variables, Esc_{USjk}, are non-negative, contain relatively many categories, have right-skewed distributions, and are (except for the duration variable) non-interval-scaled, there is no model that perfectly fits all aspects of the data, but the above selection reflects some candidates.

For the analysis, all time-varying economic data, in particular M_{jkt}, are aggregated into a cross-

[14] Note that dyad and importer effects are identical in my data, which contains the U.S. as the sole exporter.

section (i.e., M_{jk}) by averaging the inflation-adjusted values over time. This is necessary because of the non-time-varying nature of the salience measures G_{USjk} and L_{jk} and because the construction of the three escalation measures results in a cross-sectional setup. Although aggregating over the time-dimension results in a loss of information, the costs are limited. This is, in particular, because the detailed structure of multilateral industry-level data still allows to control for unobserved heterogeneity using a fixed-effects specification. This point is discussed in more detail below.

5.2 Results

Table 2 reports the results for all combinations of the three dependent variables and four models. The first thing to note is that the results clearly support the interaction logic formulated in Hypothesis 1. With the one exception of the Poisson model of dispute duration, the coefficient of interest on the multiplicative term $G_{USjk} \times L_{jk}$ is substantively large and statistically significant in all cases. These results suggest substantial increases in escalation and dispute severity for mutual increases in the parties' salience levels.

Table 2: Relating Maximum Escalation Levels to Counterfactual Gain and Loss Shares (Salience)

	DV: I. Maximum Escalation			
	Linear	Tobit	Ologit	Poisson
G_{USjk}	–1.789***	–1.717	–1.405	–0.636
	(0.484)	(0.987)	(0.821)	(0.348)
L_{jk}	–0.745	–1.980	–1.555	–0.949
	(0.684)	(1.414)	(1.181)	(0.561)
$G_{USjk} \times L_{jk}$	8.823***	9.995***	8.156***	3.011***
	(1.580)	(2.688)	(2.228)	(0.887)
M_{jk}	0.044***	0.025*	0.029**	0.002
	(0.008)	(0.012)	(0.010)	(0.002)
Log Sigma	–	0.773***	–	–
		(0.017)		
$Fixed\ effects$	$k, j = ij$	$k, j = ij$	$k, j = ij$	$k, j = ij$
R^2	0.525	–	–	–
Log-likelihood	–	–5264.1	–4507.8	–
	DV: II. Dispute Intensity			
	Linear	Tobit	Ologit	Poisson
G_{USjk}	–10.504	–22.623**	–0.749	0.142
	(5.623)	(7.546)	(0.804)	(0.448)
L_{jk}	4.327	–33.323**	–0.308	0.449
	(5.415)	(10.596)	(1.166)	(0.681)
$G_{USjk} \times L_{jk}$	74.007***	128.933***	8.572***	2.227*
	(17.145)	(22.417)	(2.185)	(1.111)
M_{jk}	0.657***	1.117***	0.041***	0.008**
	(0.130)	(0.010)	(0.009)	(0.003)
Log Sigma	–	2.975***	–	–
		(0.017)		
$Fixed\ effects$	$k, j = ij$	k, j_{WB}	$k, j = ij$	$k, j = ij$
R^2	0.507	–	–	–
Log-likelihood	–	–9636.3	–8496.2	–

	DV: III. Dispute Duration			
	Linear	Tobit	Ologit	Poisson
G_{USjk}	–1.212	–3.131	–0.379	0.777
	(1.106)	(2.065)	(0.933)	(0.525)
L_{jk}	–0.329	–10.047***	–1.214	–0.304
	(1.026)	(3.049)	(1.434)	(0.986)
$G_{USjk} \times L_{jk}$	9.735**	25.027***	6.510**	0.279
	(3.204)	(6.020)	(2.479)	(1.280)
M_{jk}	0.093***	0.208***	0.030**	0.010**
	(0.019)	(0.024)	(0.010)	(0.003)
Log Sigma	–	1.558***	–	–
		(0.023)		
$Fixed\ effects$	$k, j = ij$	k, j_{WB}	$k, j = ij$	$k, j = ij$
R^2	0.375	–	–	–
Log-likelihood	–	–4362.4	–3597.4	–

Notes: Dyad or World Bank importer income group (j_{WB}), and industry (k) fixed-effects are included as indicated; intercept and fixed-effects coefficients are not reported. Importer income group effects are used in two models instead of dyad effects because convergence issues in the maximum likelihood estimation precluded the use of dyad effects. M_{jk} is measured in billion (10^9) US$ for meaningful coefficient interpretation. Huber-White robust standard errors for Linear and Poisson models and regular standard errors for Tobit and Ordered Logit models are in parentheses; ***, **, and * indicate significance at the .001, .01 and .05 levels, respectively. $N = 4{,}758$ for all models.

Across all models, the usual interpretation of interaction terms applies. The implied slope of one constituent term therefore depends on the value of the second constituent term. The slope on G_{USjk} is then given by $\hat{\beta}_1 G_{USjk} + \hat{\beta}_3 G_{USjk} L_{jk} = (\hat{\beta}_1 + \hat{\beta}_3 L_{jk}) G_{USjk}$, where $(\hat{\beta}_1 + \hat{\beta}_3 L_{jk})$ is the composite coefficient on G_{USjk} that changes with the level of L_{jk}. Analogously, the composite coefficient on L_{jk} is $(\hat{\beta}_2 + \hat{\beta}_3 G_{USjk})$. The individual coefficients $\hat{\beta}_1$ and $\hat{\beta}_2$ on G_{USjk} and L_{jk} thus only describe the implied slopes for each variable if the other equals zero. Note that throughout the coefficient estimates on the constituent terms G_{USjk} and L_{jk} are much smaller in absolute size than the coefficient on the interaction term and largely insignificant.

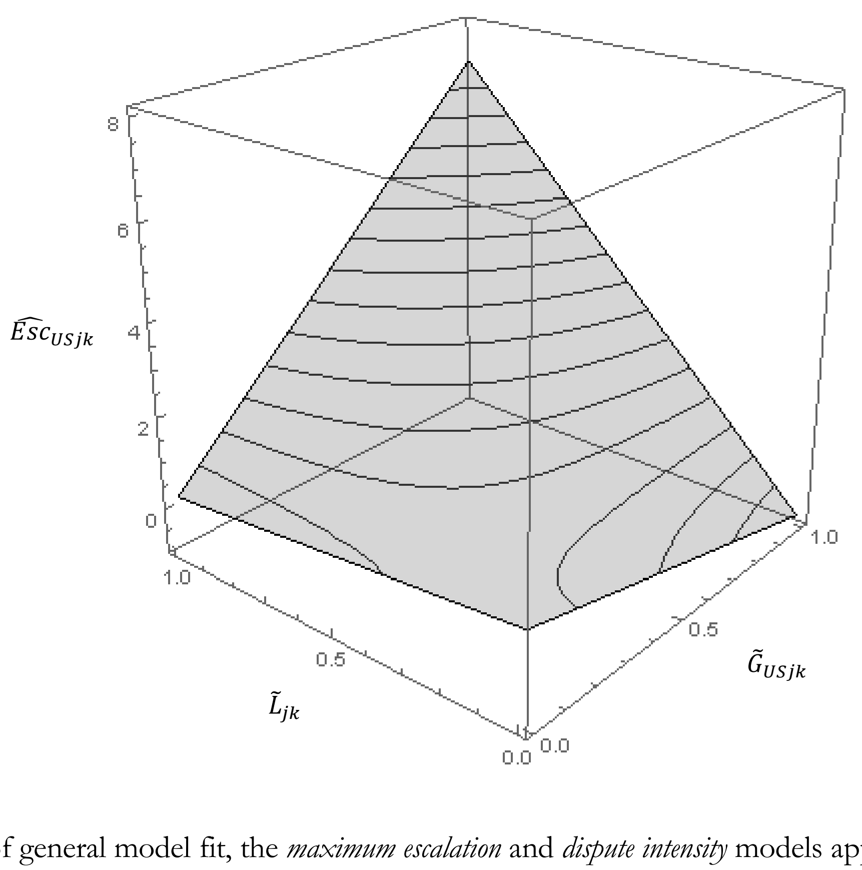
These results are fully in line with my theory. Because one would not expect any dispute escalation if either of the two parties has no stakes in an issue, one would expect these coefficients to be close to zero statistically insignificant. The fact that most coefficient estimates on the constituent terms are slightly negative should not be over-interpreted given their wide confidence intervals. In principle, the negative slopes of the regression lines conditional on the trade partner's salience being equal to zero are consistent with the idea of anticipation effects that make dispute escalation particularly unlikely in the context of extreme asymmetries in parties' salience levels.

The quantitative interpretation of the coefficient estimates depends on both the units in which the variables are measured and the link function of the model. Because G_{USjk} and L_{jk} are shares that range between 0 to 1, the one-unit change in these quantities implies a change from 0 to 1 – the theoretical minimum and maximum of the parties' salience levels. For the three Linear models in the first column of Table 2, this means that a mutual shift from 0 to 1 in both G_{USjk} and L_{jk}, indicates an predicted increase in *maximum escalation* of (–1.789) + (–0.745) + 8.823 = 6.289 levels, an increase in *dispute intensity* of (–10.504) + 4.327 + 74.007 = 67.83 points, and an increase in *dispute* *duration* of (–1.212) + (–0.329) + 9.735 = 8.194 years while holding all other factors constant.

These results clearly suggest a substantial shift through large fractions of the scale of the respective escalation measures for a mutual increase in salience from 0 to 1. Although it needs to be kept in mind that the non-interval-scaled *maximum escalation* and *dispute intensity* variables are approximations, the general trend is readily apparent and substantial. A similar picture emerges from the other models (for space reasons, I relegate the discussion of these results to Appendix F, along with various alternative specifications and robustness checks that further substantiate the clear pattern emerging from Table 2).

It is also interesting to consider the coefficient estimates on M_{jk}. Because M_{jk} is measured in billion US$, the Linear model predicts that a one-billion increase in trade increases *maximum escalation* by 0.044 levels. Increases on a similar scale are suggested by the other models. Although the coefficient is significant in almost all cases, an increase on this scale appears not to be particularly pronounced given that US$ 1 billion is a sizable amount of trade (the mean bilateral industry-level trade volume in the data is US$ 0.774 billion, the maximum is US$ 117 billion). In line with theoretical expectations, this suggests that the (absolute) trade volume as such is much less relevant for dispute escalation than the parties' (relative) stakes in the given trade relationship.[15]

Figure 6: Interaction Surface Derived from the Linear Model with DV I. Maximum Escalation



In terms of general model fit, the *maximum escalation* and *dispute intensity* models appear to fit the data

[15] Alternative specifications with M_{USjk} instead of M_{jk} (or both) do not change this pattern. As discussed in the previous section, M_{jk} is the theoretically correct anchor for the two ratio-type salience measures.

better than the *dispute duration* model. This is indicated both by the smaller standard errors across all models and the higher R-squared values of the Linear models. This supports the notion that the two former measures are more direct measures of escalation than *dispute duration*. The fact that this pattern is apparent from the results, as one would expect on theoretical grounds, lends further support to the overall results.

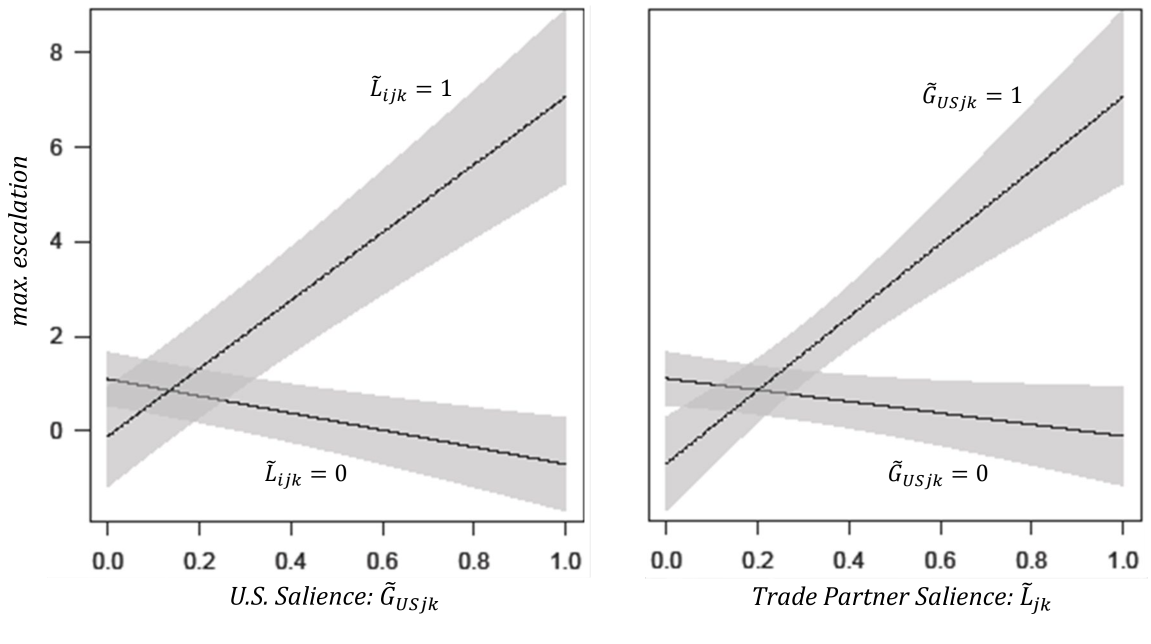
Figure 6 graphically represents the predicted interaction surface for the two salience measures G_{USjk} and L_{jk}. The figure is based on the results of the Linear model with the *maximum escalation* dependent variable. The surface is given by

$$\widehat{Esc}_{USjk} = \left(\hat{\alpha} + \overline{\gamma}_1 + \overline{\gamma}_2\right) + \hat{\beta}_1 \tilde{G}_{USjk} + \hat{\beta}_2 \tilde{L}_{jk} + \hat{\beta}_3 \tilde{G}_{USjk} \tilde{L}_{jk} + \hat{\delta}\overline{M}_{jk}, \quad (9)$$

where $\widehat{Esc}_{USjk}$ is the escalation level predicted from the estimated coefficients $\hat{\beta}_1$, $\hat{\beta}_2$, and $\hat{\beta}_3$ for different combinations of $\tilde{G}_{USjk}$ and $\tilde{L}_{jk}$ across the {0, 1} range. The tildes indicate that these quantities are simulated for the purpose of the prediction. The expression $\hat{\alpha} + \overline{\gamma}_1 + \overline{\gamma}_2$ comprises the estimated intercept and the means (indicated by the overbars) of the dyad and product fixed-effects. The term $\hat{\delta}\overline{M}_{jk}$ is the mean trade flow value multiplied by its estimated coefficient. For the purpose of plotting, all these factors are treated as constants and, as a sum, determine the 'intercept' offset when both salience measures are zero.

Averaging over these quantities implies that Figure 6 shows the predicted escalation levels for an average dyad, an average product, and an averagely-sized absolute trade volume. This means that as trade flows change or different industries or trade partners are concerned, the entire surface of the regression plane shifts up or down while the form of the overall relationship remains the same. The regression plane rises steeply as both salience levels increase, and remains at low levels if either or both variables take on low values.

Figure 7: Conditional Slope Estimates from the Linear Model with DV I. Maximum Escalation



This strongly conditional relationship can also be seen from a different perspective. Recall that in an interaction, the steepness of the slope describing the relationship between $\widehat{Esc}_{USjk}$ and $\tilde{G}_{USjk}$, i.e., $(\hat{\beta}_1 + \hat{\beta}_3\tilde{L}_{jk})$, changes with $\tilde{L}_{jk}$. The same holds in reverse. Figure 7 illustrates these changes in slopes for the two extreme cases where the respective other variable switches from 0 to 1. The figure essentially combines the four vertical faces of the cube in Figure 7 above into two panels. It also shows the 95 percent confidence intervals, which are calculated following Friedrich (1982).

Once more, the key point to note is how, in each case, the predicted effect of one salience variable on maximum escalation levels switches from slightly negative to strongly positive as the second salience variable shifts from zero to one. For instance, if a trade partner's salience level equals 0, even a shift to very high salience for the U.S. is not predicted to lead to an increase in dispute escalation. On the other hand, if the trade partner's salience level equals 1, each increase in salience for the U.S. is predicted to considerably increase dispute escalation. Insofar, the two plots condense the essence of Hypothesis 1 and substantiate a key part of the theoretical mechanism outlined above.

6 Analysis II: Dispute Outcomes as a Function of Dispute Escalation

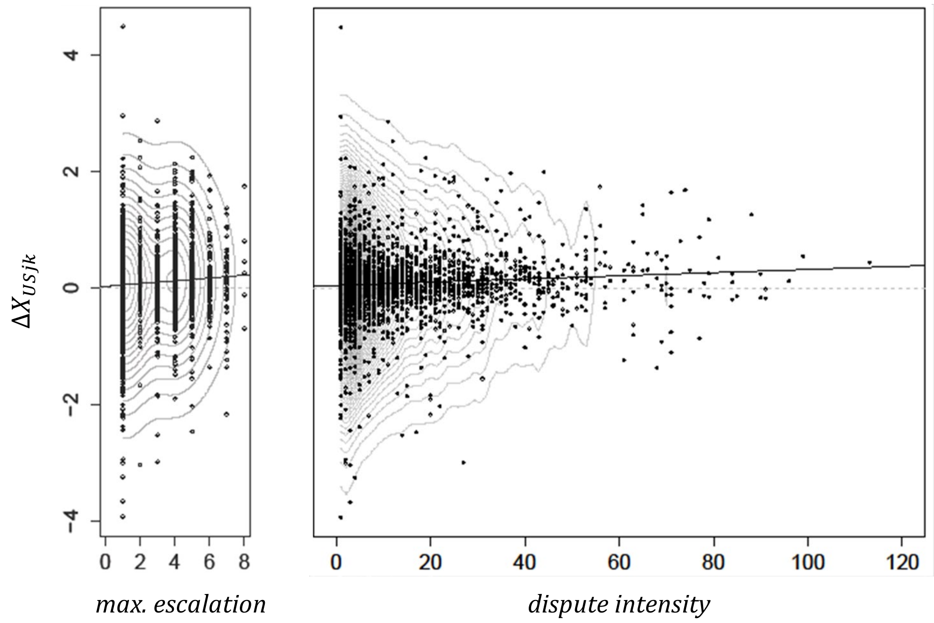
This section is concerned with jointly testing Hypotheses 2 and 3. It analyzes the relationship between a) the level of dispute escalation, and b) both the trend (mean) and variability (variance) of changes in trade flows. These observable changes of trade flows are intended to capture the unobservable changes in trade policies and therefore the essence of eventual dispute outcomes.

6.1 Methods

Testing Hypotheses 2 and 3 requires a statistical technique that, unlike regular regression methods, explicitly allows modeling not only the mean but also the variance of an outcome variable as a function of a set of predictors. A *variance function regression* is an appropriate tool for this purpose (Western and Bloome 2009; also see: Aitkin 1987, Harvey 1976, Nelder and Lee 1991). By allowing for changes in the variance of the dependent variable as a function of the predictors, a variance function regression is a method to directly model heterogeneity in the residual variance of a regression. This differs from standard regression settings, where the residual variance is viewed as unexplained. Moreover, since residual heterogeneity implies heteroscedasticity, it is usually treated as a nuisance in standard statistical applications because it violates traditional regression assumptions. In the present context, however, the residual variance of the dependent variable is of substantive interest.

Figure 8 presents descriptive plots of the ΔX_{USjk} against the *maximum escalation* and the *dispute intensity* measures. Visual inspection suggests that there is indeed an upward trend in mean and a downward trend in variances as escalation levels increase. In the following, the ΔX_{USjk} data, proxying dispute outcomes, will serve as the dependent variable while the two escalation measures will now serve as the primary independent variables of interest.

Figure 8: Implied Trade Policy Changes Plotted Against Escalation Levels



Notes: The dashed gray line is the zero line, the solid black line is the univariate regression slope, and the solid gray lines represent the two-dimensional kernel density of the data points.

In implementing the variance function regression, I follow the iterative maximum likelihood procedure of Western and Bloome (2009). While this approach works through an iterative optimization algorithm, the basic logic can be understood from the first two implementation steps. The first step relates the predictors to the mean of the dependent variable, thereby producing initial estimates of the first set of coefficients. The second step relates the predictors to the variance of the dependent variable, resulting in initial estimates of the second set of coefficients. All further steps serve to obtain efficient estimates and correct standard errors. The first step consists of fitting a simple OLS regression. Specifically, I specify the model as

$$\Delta X_{USjk} = \beta_0 + \beta_1 Esc_{USjk1-2} + \beta_2 Fyr_{USjk} + \beta_3 Dur_{USjk} + \varepsilon_{USjk}, \qquad (10)$$

where β_0 is an intercept, β_1 through β_3 are standard regression coefficients that capture the relationship between the change in the mean of ΔX_{USjk} associated with changes in the predictors, and ε_{USjt} is an error term that is assumed to be normally distributed. $Esc_{USjk1-2}$ is either *maximum escalation* or *dispute intensity*. These are the right-hand-side variables of primary interest. The procedure is run separately for each of these variables. Two additional variables are added to model the time dependencies in the data. Fyr_{USjk} indicates the first dispute year and Dur_{USjk} is the duration of the dispute measured as the time distance between the (middle years of) the two time windows.

The Fyr_{USjk} variable is intended to capture shocks to trade flows that are associated with a given year, such as the effects of the dotcom crisis or the 2008 financial crisis. The Dur_{USjk} variable is intended to capture the effects of the general drift in trade volumes over time. In particular, trade flows typically increase over time due to economic growth. This implies that longer durations between time windows are naturally associated with increases in trade volumes, irrespective of escalation processes. The variable is therefore important to account for this source of export growth. I do not consider *dispute duration* (the third summary statistic of dispute activity from above) in this part of the analysis because *maximum escalation* or *dispute intensity* are more direct measures of escalation (as argued above) and because the overlap with the Dur_{USjk} variable makes an interpretation of this measure difficult. For the *maximum escalation* or *dispute intensity* models, I present various alternative specifications and robustness checks in the appendix.

Estimating equation (10) by OLS yields an initial set of coefficient estimates that capture the relationship between the predictors and the mean of the dependent variable. It also allows the calculation of the residuals, as a precondition for the second implementation step. Easily calculated as observed minus predicted values, I first compute the predicted values as

$$\widehat{\Delta X}_{USjk} = \hat{\alpha} + \hat{\beta} Esc_{USjk} + \hat{\delta}_1 Fyr_{USjk} + \hat{\delta}_2 Dur_{USjk} \quad (11)$$

to obtain the residuals from

$$\hat{\varepsilon}_{USjk} = \Delta X_{USjk} - \widehat{\Delta X}_{USjk}. \quad (12)$$

For each observation, the residuals specify, in units of the dependent variable, how far away the observed values in the data are from the predicted regression plane. Hypothesis 3 suggests that the residual variance decreases with increasing levels of escalation. One would therefore expect residuals for observations associated with higher levels of escalation to be smaller on average than those associated with lower levels of escalation.

This proposition can directly be tested. Using a gamma regression with a log link function, I regress the squared residuals from equation (10) on the same set of predictors as before. This gives a model of the form

$$\hat{\varepsilon}^2_{USjk} = g(\lambda_0 + \lambda_1 Esc_{USjk} + \lambda_2 Fyr_{USjk} + \lambda_3 Dur_{USjk} + \vartheta_{USjk}), \quad (13)$$

where λ_0 is an intercept, λ_1 through λ_3 are regression coefficients, $g(.)$ is the log link function of the gamma regression and ϑ_{USjk} is the associated error term. I use the squared residuals because the interest is in the absolute size of the residuals rather than in their direction (here the symmetry imposed by the log-ratio specification in equation (7) is useful). The gamma regression is used because the squared residuals are non-negative and have a right-skewed distribution.

After step two of the procedure, initial estimates for the sets of mean and variance coefficients $\widehat{\boldsymbol{\beta}}$ and $\widehat{\boldsymbol{\lambda}}$ are obtained. The remainder of the procedure serves to correct two problems. First, the standard errors for the second stage do not take into account the uncertainty from the first stage. Second, the estimates of the first stage are inefficient as a result of the heteroscedasticity in ΔX_{USjk}. To address these issues, the following iterative procedure is employed. First, obtain fitted values from the gamma regression as

$$\hat{\sigma}^2_{USjk} = exp(\hat{\lambda}_0 + \hat{\lambda}_1 Esc_{USjk} + \hat{\lambda}_2 Fyr_{USjk} + \hat{\lambda}_3 Dur_{USjk} + \hat{\vartheta}_{USjk}). \quad (14)$$

Next, estimate a weighted linear squares (WLS) regression of ΔX_{USjk} on the set of predictors, using $1/\hat{\sigma}^2_{USjk}$ as weights. This step is a re-estimation of step one and mitigates the effects of heteroscedasticity by down-weighting the influence of observations with larger residuals. From the WLS regression, one obtains updated estimates for $\widehat{\boldsymbol{\beta}}$ and $\hat{\varepsilon}_{USjk}$. The new estimates of $\hat{\varepsilon}^2_{USjk}$ are then used as the dependent variables in a renewed gamma regression, which produces. This allows the calculation of updated estimates of $\hat{\sigma}^2_{USjk}$.

The estimates of $\hat{\varepsilon}_{USjk}$ and $\hat{\sigma}^2_{USjk}$ are then used in the joint maximum likelihood estimation of $\widehat{\boldsymbol{\beta}}$ and $\hat{\boldsymbol{\lambda}}$ by iterating the weighted least squares and gamma regressions. Following Harvey (1976) and Aitkin (1987), the kernel of the log-likelihood for the normal distribution underlying the least squares stage is given by

$$l(\boldsymbol{\beta}, \boldsymbol{\lambda}) = -\frac{1}{2}\left[\ln\left(\hat{\sigma}^2_{USjk}\right) + \hat{\varepsilon}^2_{USjk}/\hat{\sigma}^2_{USjk}\right]. \quad (15)$$

The iterative procedure consists of evaluating the log-likelihood after each round of updating and assessing the difference between the new and the old value of the log-likelihood. The procedure is repeated until convergence, that is, until the difference between the new and old values falls below a previously specified threshold. At this stage, the standard errors for both models are correct.

6.2 Results

Table 3 shows the results of the procedure. The columns marked by $\hat{\beta}$ and $\hat{\lambda}$ report the estimated mean and variance coefficients, respectively. As can be seen, the $\hat{\beta}$ coefficient on the Esc_{USjk} variable is *positive* and statistically significant in both the *maximum escalation* and the *dispute intensity* models. These results support Hypothesis 2, which predicts larger *increases* in export volumes for the United States following disputes that have escalated further.

Table 3: Variance Function Regression Results

	Esc_{USjk} = Maximum Escalation		Esc_{USjk} = Dispute Intensity	
	$\hat{\beta}$	$\hat{\lambda}$	$\hat{\beta}$	$\hat{\lambda}$
$Intercept$	0.087***	–1.252***	0.087***	–1.255***
	(0.010)	(0.061)	(0.010)	(0.061)
Esc_{USjk}	0.030**	–0.138*	0.026*	–0.210**
	(0.011)	(0.070)	(0.011)	(0.080)
Fyr_{USjk}	0.007	–0.026	0.003	–0.017
	(0.011)	(0.064)	(0.010)	(0.063)
Dur_{USjk}	0.026	0.154	0.021	0.233**
	(0.014)	(0.069)	(0.015)	(0.079)
N	2767	2767	2767	2767

Notes: The dependent variable is ΔX_{USjk} as defined in equation (7). The columns with $\hat{\beta}$ and $\hat{\lambda}$ report the estimated mean and variance coefficients, respectively. Both sets of coefficients are given for standardized predictor variables; $\hat{\beta}$ and $\hat{\lambda}$ therefore capture the average changes in the mean and the variance of the dependent variable associated with changes in the predictors by one standard deviation. N is smaller here than for the results reported in Table 2, because not all dispute histories have trade reported at both time windows and because no time windows can be calculated for non-cases that have no start and end dates; ***, **, and * indicate significance at the .001, .01 and .05 levels, respectively.

Furthermore, the $\hat{\lambda}$ coefficient on the Esc_{USjk} variable is *negative* and statistically significant for both models. These results support Hypothesis 3, which states that the variability in implied trade concessions *decreases* as disputes escalate further. The negative $\hat{\lambda}$ estimates are consistent with the idea that more intense disputes are associated larger compromises from both sides. Overall, my results present evidence in support of Hypotheses 2 and 3 and lend further credence to the theoretical mechanism I propose to govern the escalation and bargaining patterns of trade disputes.

7 Discussion and Conclusion

In this paper, I explored the bargaining and escalation patterns of trade disputes. Specifically, I examined industry-level disputes between the United States and its trade partners over the latter's import policies. I not only investigated dispute escalation as a function of the parties' political salience in the given trade relationship. I also examined the pattern of eventual dispute outcomes as a function of escalation levels. In this context, I make empirical, methodological, and theoretical contributions that are of immediate interest of scholars working on trade disputes. This includes the compiled data on government salience, dispute events, and dispute outcomes. In the following, I briefly discuss two of these contributions before highlighting the policy implications of my results in some more detail.

On the one hand, I provided a method for measuring parties salience' in their bilateral industry-level trade relations. My approach is firmly rooted in exiting theoretical knowledge on international trade and political economy. Based on my trade barrier data, I employed a trade policy simulation to calculate the counterfactual gains and losses that *would* accrue to foreign and domestic producers in a given industry, respectively, *if* import barriers were to be reduced. Assessing and quantifying the importance that governments attach to their various trade relations in a systematic, comparable, and theory-guided manner has so far not been possible. Insofar, my method closes an important gap that has long posed challenges for research on trade policy.

On the other hand, I have theoretically and empirically pointed to the systematic relation between the pattern of government salience and the patterns in dispute escalation and dispute outcomes. I suggested that escalation decisions are driven by incentives to manipulate the costliness of bargaining. The starting point is that higher salience in an issue have an effect analogous to reducing parties' costs of conflict. Because higher salience levels make parties more cost-tolerant, high-salience parties profit in expectation by intentionally creating *additional* costs through escalation behavior. I illustrated how this expectation results in costly compromises in the event that two high-salience parties interact and how the pattern of dispute outcomes becomes more varied in other constellations.

To conclude, I briefly discuss the implications of my work for policy-making and dispute mitigation at the WTO and beyond. In particular, I point to the options for third parties to anticipate, mitigate, and manage trade disputes. I further highlight how these options may, in the long term, contribute to a more comprehensive reform of the rules for trade policy reporting.

It follows from the above discussion that dispute intensity tends to change with a number of factors. First, dispute intensity increases with (1) the lower of the parties' (relative) salience level. This is because the party with lower salience levels selects out of a dispute first. Irrespective of which side does so, this ends the escalation process. Second, dispute intensity increases with (2) the parties' absolute salience levels, which anchors the parties' relative salience levels on a fixed level of reference. In the context of trade disputes, this has been the total industry-level value of imports faced by the importer. Third, dispute intensity decreases as (3) the costs of a dispute increase relative to the combined effect of the parties' absolute and relative salience levels. That is, higher relative escalation costs imply lower escalation levels – all else equal.

Fourth, dispute intensity increases with (4) the level of uncertainty the parties face because under greater uncertainty, the parties take longer to come to an agreement. Lastly, by implication, dispute intensity increases with (5) the rate of change in the parties' dispute-relevant characteristics and, in particular, their salience levels. The rate of change matters for dispute behavior both because uncertainty will generally spread faster in quickly changing environments and because such environments are more likely to see parties' characteristics drift away from the status quo agreement. This then creates incentives to renegotiate.

Adequate knowledge of these factors – both in terms of the mechanism through which they are connected and in terms of the values they take on in individual cases – is important to timely identify or mitigate emerging trade disputes as well as to effectively help alleviate disputes that have already erupted. International organizations (IOs) such as the WTO or UNCTAD that work in the area of international trade and trade policy could potentially play a more active role in this context than is currently the case. The insights and methods presented in this paper offer opportunities to increase the scope of action of international organizations in trade policy monitoring and dispute management – irrespective of existing budget and personnel constraints.

Such opportunities for IOs apply to a) fact-finding and b) direct dispute management. Concerning fact-finding, the methods to estimate the size of trade barriers and to assess the resulting trade interests of countries makes it possible to get an comprehensive overview of the international trade system in terms of broader risk levels. It is necessarily true that quantitative methods cannot replace case knowledge in policy contexts where issues are dealt with on a case-by-case basis. However, the methods provided allow for a systematic identification of priority areas and can efficiently guide case selection for further qualitative research and selective in-depth investigations. In combination with a regard to the rate of change in the relevant fundamentals, such efforts may hold the potential for building up a systematic monitoring and early-warning system.

Concerning direct dispute prevention and management, international trade organizations could specifically request further information on individual trade policies, or promote and encourage active communication between countries on specific policies, or actively attempt to mediate in selected cases. These efforts would collectively serve the purpose to share information and increase transparency. Essentially, all these efforts would aim at reducing uncertainty by means other than a dispute – and thus limit the potential for costly disputes to emerge or escalate. This would ultimately free resources that countries could dedicate to more productive goals.

In the long-term, these activities may support a wider reform of the international trade policy reporting system – away from the current voluntary registration scheme and towards a fully institutionalized and binding reporting mechanism. Such a system may still allow exceptions and reward transparency through legally sanctioned transitional periods and other escape clauses that have proved to be effective in previous efforts towards trade policy governance (e.g., tariff-binding schemes or the reporting and implementation rules for anti-dumping, countervailing duties, and safeguards). Ultimately, such a system would increase transparency and predictability and thus help reduce the incidence and severity of trade disputes.

In any of these situations, theoretical knowledge enables dispute managers to *know where to look*. Once concrete cases for direct action are identified, theoretical knowledge also enables dispute managers to *know what can be tweaked*. This may not be obvious from the specific situation alone, where the intricate nature and idiosyncratic features of the case can obstruct the view on the aspects of greatest importance. Theoretical knowledge can help dispute managers to see through these complexities.

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