Political Economy of High-Technology Trade Disputes

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**Book Abstract** What are the political and economic determinants of high-tech trade disputes?

This project plans to answer this question by examining economic features of high-tech industries and the issue linkage between high-technology and national security concerns. Chapter 1 examines how the economic characteristics of high-tech industries, namely, short product life cycles and high levels of uncertainties about returns on investments, create obstacles to bilateral settlements of trade conflicts. In chapter 2, I plan to investigate the policy preferences of high-tech producers in China and the United States and how these preferences connect with trade policy outcomes. In chapter 3, I will study when politicians choose to connect the development of high-technology with national security concerns.
Chapter 1. Economic Features of High-Tech Industries and Policy Implications

Abstract  Why do countries sometimes fail to negotiate bilateral settlements to resolve trade conflicts in high-tech industries? I argue that high-tech industries usually have high levels of uncertainty about return on investment (ROI). This feature creates an obstacle to the appraisal of different trade policies and makes it hard for disputants to settle on trade policy arrangements in replace of punitive tariffs. In addition, high-tech industries usually feature rapid updating of products. As a result, governments have an incentive to provide policy supports, whether fair or not, to their domestic industries and enable them to quickly reap the benefits and solidify their positions in the market. Frequent updating of products also means that bilateral settlements may quickly become out-updated when new products are introduced into the market. These mechanisms make bilateral settlements a less appealing option when it comes to high-tech trade conflicts. In the cross-national data analysis, I find that high ROI uncertainty and R&D intensity, which is a proxy for product life cycles, are positively correlated with the usage of punitive tariffs. This chapter contributes to the trade policy literature by pointing out the economic features of high-tech industries and their policy implications.

The Puzzle

Why do countries sometimes fail to negotiate bilateral settlements to resolve trade conflicts over high-tech products? In recent years, we have witnessed the rise of high-tech trade conflicts. In the U.S.-China trade war that started in 2017, high-tech competition and protection of intellectual property rights were widely believed to be the major triggers (Liu and Woo, 2018). And the semiconductor industry was the main battlefield of the Japan-South Korea trade conflict taking place in 2018. As of 2019, high-tech products account for 21% of the total world manufactured exports.¹ High-tech trade and conflicts around it thus become important topics to study.

In general, trade conflicts can be settled in two ways, punitive tariffs and bilateral settlements. Under the current WTO system, domestic producers can require their home government to conduct anti-dumping and countervailing (AD-CV) investigations if they are hurt by unfair trade practices

¹See World Bank Dataset. Retrieved from https://data.worldbank.org/indicator/TX.VAL.TECH.MF.ZS. Here, industries are labeled as high-tech if their research and development investments constitute high shares of total industrial outputs (Hatzichronoglou, 1997). Typical high-tech products include information and communication services, pharmaceuticals, and electronical equipment.
of foreign countries. However, the domestic producers are also provided the chance to negotiate bilateral settlements with the foreign producers to terminate the investigations and avoid punitive tariffs. In the latter case, the foreign countries either promise to stop their unfair practices or control the price and quantity of the disputed products. Common policy tools for bilateral settlements include voluntary export restrains (VERs), price undertaking, and suspension agreements (Bown, 2014).

The conventional wisdom is that compared to punitive tariffs, negotiated settlements can improve both sides’ welfare by preventing market volatility and saving the home government costs of investigation (Prusa, 1992; Veugelers and Vandenbussche, 1999). In addition, when committing to controlling the quantity or price of their exports, the foreign producers can gain the rents resulted from price increases of the target products (Bown, 2014). Therefore, the foreign producers should have incentives to propose an offer that improves the home producers’ welfare compared to their tariff payoffs so as to reach bilateral settlements.

However, according to the data provided by Bown (2010), between 1995 and 2015, around 65% AD-CV cases over high-tech products ended with punitive tariffs. As a baseline, 57% of trade conflicts over products of low technological content ended with punitive tariffs. Why do policy makers choose punitive tariffs when bilateral settlements are economically more optimal? And why are high-tech products frequent subjects of punitive tariffs?

My answer to these questions are two-fold. First, I argue that high-tech industries are usually associated with high uncertainties over return on investment (ROI). This feature increases the possibility of bargaining failure by making it hard for disputants to appraise different offers. Specifi-
cally, the home country may believe that making the foreign country restrain its policy support to a certain level is reasonable. But the foreign country may claim the opposite, arguing that policy supports to the target industry can generate tremendous economic returns that are underappreciated by the foreign country. Therefore, it cannot restrain its trade practices as required by the home country. Due to high uncertainties over returns to policy support, it is difficult for the home country to verify whether the foreign country is telling the truth or simply bluffing to obtain a favorable deal. As a result, the two sides may not be able to agree on the range of offers that are acceptable to both parties and this divergence will lead to bargaining breakdowns.

Second, I argue that high-tech products are usually updated constantly within short time frames and this feature creates commitment problems in two ways. First, this ever-changing market condition rewards first movers. Early comers in the market can quickly reap the benefits by setting the production standards and collecting patent royalties. As a result, the government has an incentive to provide policy support to relevant industries to allow them to quickly reap the benefits. After the target industry solidifies its position in the market, the home government no longer fears the punishment from other countries or international organizations.

Second, constant product updating means that high-tech products usually have short life cycles. Consequently, bilateral settlements that apply to one product may quickly become obsolete when the updated product enters the market. But renegotiating bilateral settlements that reflect the new market condition is time consuming and thus cannot protect the domestic producers from the threat of the new product in a timely manner. This makes bilateral settlements an unsatisfying policy option. In contrast, unilaterally using punitive tariffs saves the time for negotiation and allows the home government to react promptly, which makes it a more appealing policy option.
This chapter makes the following contributions. First, it contributes to the trade disputes literature by pointing out the private information problem created by the ROI uncertainty in high-tech industries. High-tech industries are playing an increasingly important role in the world economy nowadays. It is therefore crucial to study the features of high-tech industries and the novel challenges they pose to trade policies. However, to the author’s knowledge, the conventional wisdom rarely discusses how the private information problem prevalent among high-tech industries may hinder the peaceful resolution of trade conflicts. This project plans to fill the gap by formalizing the private information problem and illustrating how it leads to bargaining failures.

Second, this project will generate useful policy recommendations. The advancement of technology calls for the reform of trade dispute resolution system. Understanding the causes of bargaining breakdowns over high-tech products will allow us to formulate policies to promote the peaceful resolution of trade conflicts.

**Literature Review**

The existing literature on the political economy of trade disputes suggests four approaches to explaining the bargaining failures and frequent use of punitive tariffs over high-tech products. The first approach focuses on the preferences of interest groups and suggests that AD-CV investigations may end with tariffs if relevant interest groups in high-tech industries demand it. The second approach relies on collective action capabilities of parties of interest to explain the final outcomes of trade conflicts. The third approach suggests that information asymmetry may create biases in favor of protectionist groups and it may help to explain the usage of punitive tariffs. The fourth approach suggests that connection of high-tech developments with strategic competitions might make governments more willing to employ unilateral measures. Some other studies explain trade
protectionism by examining institutional settings (Lohmann and O’halloran, 1994; Milner and Rosendorff, 1996). However, it is unclear why other industries are less likely to be protected by tariffs than high-tech ones when they are facing the same institutional setting. Therefore, this line of research will not be discussed below. The following literature review will survey theories that fall into the aforementioned four boxes.

Preferences

Do firms in high-tech industries of developed countries prefer the usage of punitive tariffs? To the author’s knowledge, the current literature does not offer direct empirical evidence to the question. But the general studies on firms’ trade policy preferences suggest that we should expect productive and internationally-oriented tech firms to oppose punitive tariffs and their less productive counterparts to support these trade barriers.

First, the Ricardo-Viner model predicts that producers in industries that enjoy comparative advantage should support free trade. Developed countries are mostly rich in high-skilled labors capable of accomplishing high-tech works. Thus, we should expect high-tech firms in those countries to support trade liberalization. In addition, the new-new trade theory (NNTT) that focuses on inter-firm preference variations suggests that firms with large sizes and high productivity are more competitive in the global market and thus more likely to support trade liberalization than smaller firms (Kim and Osgood, 2019; Osgood et al., 2017; Plouffe, 2017). As shown in Figure 1 below, at least in the United States, the market concentration levels of high-tech industries are much higher than their low-tech counterparts. Specially, the top 50 firms in the information industry account for around 61.7% of the total output in the industry. High market concentration means that high-tech industries are usually dominated by large firms and we should accordingly expect less punitive
tariffs in these industries. However, as shown in Figure 5 in the appendices, the opposite is true.

Fig 1: Market concentration levels of different industries in the United States

Notes: The figure shows the market concentration levels of industries in the U.S. in 2017. The data come from the United States Census Bureau (2017).

Second, the rising literature on global value chains (GVCs) suggests that firms deeply involved in GVCs should be more pro-trade. High-tech products are usually made up of complex components and require extensive cooperation between researchers and manufacturers worldwide. As
a result, production activities of high-tech products are usually organized through global supply chains where relevant multinationals outsource parts of their products to foreign producers according to their factor endowments. These growing oversea interests of multinationals should function to dampen their desire for trade remedies (Jensen et al., 2015). Lipson (1982) predicts that increasing intra-industry trade will increase the net benefits of trade, thus increasing supports for liberal trading regime. Empirically, Blanchard et al. (2017) find that the increasing level of global value chain linkage is associated with lower tariffs and decreased usage of temporary trade barriers. Bown et al. (2020) find that higher domestic value added attributed to foreign products increases the likelihood that anti-dumping measures get removed. Based on a survey experiment on firms in Costa Rica, Kim and Osgood (2019) find that multinationals care less about traditional trade remedies such as tariffs and subsidies and more about protecting their oversea investments.

In sum, the NNTT and GVC literature suggest that big tech firms should in general be pro-trade and if we observe trade conflicts in high-tech industries, they should be mainly driven by small firms and those who are less involved in GVCs. These theories clarify parts of the puzzle. However, assuming that productive and internationally-oriented tech firms oppose punitive tariffs and their less productive and less internationally-oriented counterparts in the same industry support punitive tariffs, it is unclear why sometimes the latter’s preferences are better reflected in the final settlements and other times, the former’s preferences dominate the final outcomes of trade conflicts. More examinations on how different firms in high-tech industries interact and how their preferences are aggregated by the government are needed.

**Domestic Pressure Groups and Collective Actions**

If big tech firms are pro-trade, which actors in high-tech industries demand trade remedies? I
am still in the process of cleaning the data about petitioners of AD-CV investigations. But a brief glance of products subject to punitive tariffs reveals that it is mainly the manufacturers of intermediate products in high-tech sectors that are protected by trade remedies.

Table 1: Top 20 High-Tech Products that are Subject to Punitive Tariffs

<table>
<thead>
<tr>
<th>Product (ISIC, Rev 3)</th>
<th>No. Punitive tariffs imposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacture of basic chemicals, except fertilizers and nitrogen compounds</td>
<td>610</td>
</tr>
<tr>
<td>Manufacture of plastics in primary forms and of synthetic rubber</td>
<td>227</td>
</tr>
<tr>
<td>Manufacture of man-made fibres</td>
<td>150</td>
</tr>
<tr>
<td>Manufacture of other chemical products n.e.c.</td>
<td>142</td>
</tr>
<tr>
<td>Manufacture of bearings, gears, gearing and driving elements</td>
<td>95</td>
</tr>
<tr>
<td>Manufacture of pharmaceuticals, medicinal chemicals and botanical products</td>
<td>89</td>
</tr>
<tr>
<td>Manufacture of domestic appliances n.e.c.</td>
<td>64</td>
</tr>
<tr>
<td>Manufacture of motor vehicles</td>
<td>57</td>
</tr>
<tr>
<td>Manufacture of electric motors, generators and transformers</td>
<td>46</td>
</tr>
<tr>
<td>Manufacture of other general purpose machinery</td>
<td>46</td>
</tr>
<tr>
<td>Manufacture of fertilizers and nitrogen compounds</td>
<td>43</td>
</tr>
<tr>
<td>Manufacture of other electrical equipment n.e.c.</td>
<td>41</td>
</tr>
<tr>
<td>Manufacture of accumulators, primary cells and primary batteries</td>
<td>30</td>
</tr>
<tr>
<td>Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, an</td>
<td>29</td>
</tr>
<tr>
<td>Manufacture of optical instruments and photographic equipment</td>
<td>25</td>
</tr>
<tr>
<td>Manufacture of pumps, compressors, taps and valves</td>
<td>23</td>
</tr>
<tr>
<td>Manufacture of other special purpose machinery</td>
<td>22</td>
</tr>
<tr>
<td>Manufacture of bicycles and invalid carriages</td>
<td>21</td>
</tr>
<tr>
<td>Manufacture of medical and surgical equipment and orthopaedic appliances</td>
<td>19</td>
</tr>
<tr>
<td>Manufacture of office, accounting and computing machinery</td>
<td>19</td>
</tr>
<tr>
<td>Manufacture of parts and accessories for motor vehicles and their engines</td>
<td>18</td>
</tr>
<tr>
<td>Manufacture of electricity distribution and control apparatus</td>
<td>17</td>
</tr>
<tr>
<td>Manufacture of electronic valves and tubes and other electronic components</td>
<td>17</td>
</tr>
<tr>
<td>Manufacture of instruments and appliances for measuring, checking, testing, navigating and other pur</td>
<td>12</td>
</tr>
<tr>
<td>Manufacture of machine-tools</td>
<td>12</td>
</tr>
<tr>
<td>Manufacture of pesticides and other agro-chemical products</td>
<td>12</td>
</tr>
<tr>
<td>Photographic activities</td>
<td>12</td>
</tr>
<tr>
<td>Manufacture of machinery for textile, apparel and leather production</td>
<td>11</td>
</tr>
<tr>
<td>Manufacture of electric lamps and lighting equipment</td>
<td>9</td>
</tr>
<tr>
<td>Manufacture of engines and turbines, except aircraft, vehicle and cycle engines</td>
<td>9</td>
</tr>
</tbody>
</table>

Notes: The figure shows high-tech products that are frequent targets of punitive tariffs. The data come from the Temporary Trade Barriers Database and cover the final settlements of anti-dumping and countervailing investigations from 1995 and 2015.

Table 1 shows that intermediate products in chemical, vehicles, and electronics are frequent targets of punitive tariffs. The existing literature provides several potential explanations to this pattern. First, intuitively, with the increasing level of offshoring, the manufacturing firms in high-tech sectors should be shrinking in size and numbers. According to Baldwin and Robert-Nicoud (2007), ailing industries tend to lobby harder for policy supports as there are less new comers in such industries compared with their rising counterparts. As a result, it is easier for ailing industries to
obtain rents brought by government policies, which makes them more willing to spend on lobbying activities. However, it is questionable whether manufacturing firms in high-tech industries of developed countries are declining. Further empirical analyses are needed to test this theory.

The second school of literature holds that governments are more responsive to interest groups with stronger collective action capabilities (Gilligan, 1997; Grossman and Helpman, 1992). However, as shown in Figure 1, high-tech industries are dominated by big firms. Compared with those in industries with lower market concentration, big high-tech firms are in a better position to lobby independently and should worry less about lobbying collectively or through industrial associations. The collective action theory does not seem to be a promising explanation to the successes of anti-trade voices in high-tech trade conflicts.

Information

The informational approach focuses on using information asymmetry to explain the existence of sub-optimal trade policies. Coate and Morris (1995) argue that voters’ lack of information about the efficiency of policies and politicians’ type will enable the politicians to choose sub-optimal policies that benefit special interests. Perlman (2020) finds that firms in the agrochemical industry are able to exploit their expertise to obtain preferential policies.

One distinct feature of high-tech industries is their intensive demand for expertise. Policy makers are highly dependent on the knowledge of high-tech practitioners when making policies. It is possible that anti-trade firms may use their expertise to obtain protectionist measures. However, if the big-tech firms are pro-trade, it is unclear why they do not use their expertise to eliminate such information asymmetry created by anti-trade firms. If we are going to follow the informational
approach, we need to find the source of uncertainty that is subject to manipulation but cannot be easily eliminated by pro-trade forces.

*International level explanations*

Trade policy is an international issue in nature. Therefore, it would be misleading to check only domestic origins of trade remedies. The conventional wisdom provides two avenues to explain the usage of punitive tariffs.

First, the strategic trade theory argues that domestic actors may choose trade policies conditional on the action of foreign governments (Milner and Yoffie, 1989). Milner and Yoffie (1989) argue that if firms’ oversea investments are under the threat of protectionist measures by the foreign governments, they are more likely to lobby for trade barriers at home. Thus, high-tech firms will lobby for punitive tariffs towards a foreign country in trade conflicts if their oversea investments are threatened by protectionist policies of the home government in that country. I plan to test this claim in the empirical section.

Second, linking trade policy issues with geopolitical considerations may also decrease the likelihood of bilateral settlements of trade conflicts. Policy makers may use trade policies as tools for geo-political competition. Kwan (2020) holds that geopolitical competition between China and the U.S. is the major reason of the trade war. In addition, the security externality literature argues that trading with rivals may increase the latter’s military capability and acquirement of advanced technology. All of these generate negative security externalities to the home country. As a result, policy makers dominated by the geo-political competition mindset will use trade barriers to sever trading connections with the rivals (Gowa, 1995). Accordingly, we should expect geo-political
rivals to be more likely to use punitive tariffs toward each other when they are involved in trade conflicts. This mechanism will not be the focus of this chapter but I will discuss it in chapter 3.

Theory

This article seeks to explain the outcomes of high-tech trade conflicts by pointing out the production features of high-tech industries and their trade policy implications. High-tech industries have two features. First, the high-tech product life cycles usually follow a S-curve which is marked by high uncertainty in the R&D stage. This feature creates the private information problem and may result in bargaining failures when countries negotiate agreements over high-tech products. Second, the first-mover advantage is highly valued in the high-tech market and high-tech products usually have short product life cycles. These two features generate commitment problems on governments’ part when it comes to restraining their unfair trade practices.

Return-on-Investment Uncertainty and Bargaining Failures

One important feature of high-tech industries is that their production activities usually follow a S-curve (Anderson and Tushman, 1990; Foster, 1986; Taylor and Taylor, 2012). The life cycle of a high-tech product can be roughly divided into three stages. As shown in Figure 2, the first stage is the stage of ferment (the part before point A). At this stage, it is highly uncertain whether consumers will view the new product appealing and years of R&D investments may fail to bring any market profits. This stage is thus associated with high market uncertainty. At stage two (space between A and B), the technology matures and is ready to be applied in production. The market rewards the first comers by allowing them to quickly reap benefits through setting the standards of production, obtaining patents, and rapidly expanding their market share. At stage three, the market becomes saturated and R&D intensity declines. The product is gradually replaced by other more
technologically advanced products and eventually exits the market. And new S-curves for the new products start. Thus, high-tech industries will constantly experience periods of high market uncertainty as along as new products keep entering the market. And this uncertainty may result in bargaining breakdowns by making it hard for the disputants to find mutually acceptable arrangements.

![Fig 2: Product Life Cycles](image)

According to the bargaining literature, if $P_1$ and $P_2$ want to strike agreements that yield both parties better payoffs than tariffs, they need to agree on the range of offers that are better than tariffs and acceptable to both parties. If $P_1$ believes one offer is acceptable to $P_2$ but $P_2$ does not think so, the bargaining will breakdown (Fearon, 1995; Prusa, 1992). In other words, belief divergences about acceptable offers will result in bargaining failures.

In high-tech trade conflicts, such divergence may result from the uncertainty over returns to policy supports. At the stage of ferment, the government may provide strong policy supports to a
high-tech industry and receive negligible improvement in productivity. For example, the Obama administration invested heavily in the development of solar energy but the flagship firm, Solyndra, still went bankrupt after years of policy supports (Fehrenbacher, 2015). Other times, the return to policy support may be exponentially higher than the investments.

Consequently, it is difficult for the bargaining parties to determine how much policy support is necessary and how much trade barrier reduction is appropriate. The foreign government under investigation may claim that its policy support towards the target industry will yield tremendous economic benefits and thus it refuses to reduce the policy support. However, the home government may not believe the claim and think that the foreign government is just exaggerating the economic importance of the industry in order to justify its trade policy. As a result, the home government may make an offer that demands reduction in policy support that is unacceptable to the foreign country. And this will eventually result in a bargaining failure. Accordingly, I make the following hypothesis.

Hypothesis 1 The higher the uncertainty over returns to policy supports to an industry, the more likely that the trade conflicts over the industry will end with punitive tariffs.

Product Life Cycles and Commitment Problems

Another feature of high-tech industries is that high-tech products usually have short life cycles. The famous Moore’s law predicts that the number of transistors per silicon chip will double every two years (Moore, 1998). And this pattern is applicable to other high-tech products as well. As a result, time is highly valued in the market as the introduction and obsolescence of one product usually take place in a short period of time. The producers reap benefits mainly by becoming the
first movers in the market and updating their products constantly before they become obsolete. This feature creates commitment problems for governments when it comes to restraining their unfair trade practices in the following two ways.

First, the government has an incentive to provide policy supports, whether fair or not, to help the target industry quickly transfer from the ferment stage to maturity stage and become the first mover in the market. In this process, the government is balancing between the costs of getting punished for its unfair trade practices and the benefits of helping the target industry reach maturity. If the industry reaches maturity before the imposition of major punishments, then the benefits outweigh the costs. Unfortunately, it is time consuming to conduct AD-CV investigations. On average, it takes governments around 13 months to make the final decision about AD-CV investigations without considering the time relevant producers spent on preparing for these petitions.\(^2\) In contrast, it only takes Apple one year to release a new version of iPhone. Thus, should one government facilitates its high-tech industries to gain unfair comparative advantages, punishments may not be in place in a timely manner to deter such behavior. This time difference incentivizes governments to conduct unfair trade practices to gain the first-mover advantage, which makes any bilateral settlements that rely on governments’ promise to restrain their unfair trade practices a non-preferred policy option.

Second, short product life cycles shorten the time horizon of relevant producers. For a bilateral settlement to be effective, some tit-for-tat strategy needs to be in place to deter defections (Fearon, 1998). But when a product exits the market or a new product is introduced, the terms in relevant bilateral agreements will become obsolete and require a new round of negotiation to be updated. However, negotiating a new settlement is time consuming. If the foreign country conducts unfair

\(^{2}\)The data come from Bown (2010).
trade practices to support the new products, the home country may not be able to update bilateral settlements to cover the new products in a timely manner. This problem makes any agreements relying on two parties’ cooperation less attractive and renders punitive tariffs, an unilateral policy, an attractive option. When using tariffs, the home country does not need the cooperation of the foreign country and thus can update the tariff list in a timely manner to protect the domestic industries.

Hypothesis 2 Products with short life cycles are more likely to be subject to punitive tariffs in trade conflicts.

In the following section, I will build a game theoretic model to illustrate the argument about return-on-investment (ROI) uncertainty. And I will add another model about the commitment problem in the future.

**Game theoretic analysis of high-tech trade conflicts**

This section will not be presented during the IR retreat.
The model aims to explain how the ROI uncertainty affects the final outcomes of trade conflicts. It mainly draws on Vanberg (2001).

**The Information Structure**

The game has three actors: the foreign exporter (E), the home government (G), and the domestic interest group (I). E knows the value of its policy support to the high-tech industry and has the incentive to exaggerate this value to G and I in order to negotiate for less restraints of policy support. To simplify the situation, I assume that there are two types of E, one who attaches high values to its policy support towards the target industry (EH) and one who cares less about the policy support (EL). The key difficulty faced by G and I is that they do not know which E they
are playing with. If they wrongly believe that $E$ is a low value type and make an offer that is acceptable to $E_L$ but unacceptable to $E_H$, the bargaining breaks down.

**The Sequence of Moves**

At the beginning of the game, nature chooses two types of $E$, $E_H$ and $E_L$. Knowing her own type, the foreign exporter $E$ chooses whether to conduct unfair trade practices to gain competitive advantage. Here, I treat foreign exporters and their home government as an unitary actor, assuming that their interests are consistent with each other. If $E$ chooses inaction, then the status quo is maintained and everybody gets 0. If $E$ opts to conduct unfair trade practices, the domestic interest group ($I$) then decides whether to file a petition or not. If $I$ decides not to file a petition, there will be no trade conflicts. If $I$ files a petition, then the trade conflict begins, and the home government ($G$) needs to decide whether to approve the petition or not. If not, the case is dropped. If the petition gets approved, the case proceeds to the bargaining stage and $E$ is given the chance to make an offer to $I$ to end the conflict. If $E$ refuses to make an offer, the dispute proceeds to the final investigation stage. If $E$ makes an offer and $I$ accepts it, the trade dispute ends with bilateral settlements. If $I$ rejects the offer, the case proceeds to the final stage. There are four possible outcomes of the trade conflict: no conflict, case dropped, bilateral settlement, and punitive tariff.

**Preferences**

The domestic interest group (or firm) needs to consider three factors: the costs of filing the petition ($C_{I1}$ for the preliminary stage and $C_{I2}$ for the final stage), the benefits brought by different policy tools, and the likelihood that the domestic government will return a positive verdict in the final stage ($p$). If it does not file the petition, it loses the competitive advantage $A$ and gets the payoff $-A$. If it files the petition and gets rejected, it pays the costs of litigation $C_{I1}$ and gets the payoff
If the case proceeds to the bargaining stage and $I$ accepts $E$’s offer, it gets the agreement payoff $X_A$ minus the costs of filing the petition. If $I$ rejects the offer, it gets the expected payoff of the final investigation ($E_I$) minus the costs of litigation at the preliminary and final stages. Thus the payoff is $E_I - C_{I1} - C_{I2}$, which is $pX_D + (1 - p) \times (-A) - C_{I1} - C_{I2}$. If $E$ refuses to make any offer, $I$ receives the same payoff.

The domestic government needs to balance between the political support from the interest group ($S$) and voters’ welfare ($W$). If $G$ rejects $I$’s petition, it loses $I$’s support and the general voters (consumers) get the payoff $W_0$. Additionally, $G$ needs to pay the costs of preliminary investigation $C_{G1}$. Thus, its payoff is $-S + \alpha W_0 - C_{G1}$ where $\alpha$ indicates how much $G$ cares about the welfare of voters. Arguably, $\alpha$ is correlated with the size of voters. If $E$ does not make any offer or gets rejected at the bargaining stage, $G$ conducts the final investigation and its payoff is $pG_D + (1 - p)G_0 - C_{G1} - C_{G2}$ where $G_D$ is $G$’s payoff when it imposes punitive duties. $G_D$ can be further expressed as $S + \alpha W_D$. $G_0$ is $G$’s payoff when the final investigation ends with a negative result and it can be expressed as $-S + \alpha W_0$.

The target exporter ($E$) mainly cares about its income. If the petition never occurs or gets dropped, $E$ gets the status quo payoff 0. If the case proceeds to the final stage, it gets the expected payoff $E_E$, which is $p(-X_D) + (1 - p) \times 0$ where $X_D$ is $E$’s payoff when punitive tariffs are imposed. If the case ends in bilateral settlements, $E$ gets $A - X_A$.

**The Major Obstacle to Bilateral Agreements**

The major challenge the domestic government and interest groups face is to determine $E$’s type, which can be captured by $X_A$. If $E$ attaches a high value to its policy support to the target high-
tech industry, then bilateral settlements that require it to reduce the policy support would be highly
costly to $E$. I label this type of $E$ the high cost type and its bilateral settlement payoff is written as
$A - X_{AH}$. Accordingly, $E_H$ is unwilling to make a favorable offer to $I$ to end the conflict. If $X_A$ is
low, namely $E$ is a low cost type, then $E$ is willing to make sacrifices to avoid tariffs. In this case,
$E$’s bilateral settlements payoff is $A - X_{AL}$ and $X_{AL}$ is strictly smaller than $X_{AH}$. Substantively,
$X_A$ captures the returns to $E$’s policy supports towards the industry. When the returns to policy
supports are high, cutting investments (subsidies) or doing price control will become highly costly
for $E$. However, in reality, it is hard for $G$ to measure $X_A$ and $E$ has the incentive to exaggerate
how valuable the target industry is. As a result, the two parties may not be able to agree on how
much comprise is appropriate for $E$. A bargaining failure will take place if $E$ is a high-cost type
but $G$ believes that $E$ is a low-cost type and makes an unsatisfactory offer to $E$.

**Empirical Analyses**

The unit of analysis here is product-year. The data come from Bown (2010) and cover the time
period between 1995 and 2015. The universe of cases include all the anti-dumping and counter-
vailing investigations conducted by governments towards a certain product in the dataset. Overall,
the dataset records 5422 AD-CV investigations and 6631 products are involved.

**The Dependent Variable**

The main dependent variable is the final outcomes of trade conflicts. It is coded as a dummy
variable which takes the value of 1 if the trade conflict towards a product ends with punitive tariffs
and 0 if the case is dropped halfway or resolved with bilateral settlements. I combined bilateral
settlements with dropped cases because the dataset often failed to distinguish between the two.
Some cases might be coded as dropped when they were actually settled bilaterally. The data about
punitive tariffs are relatively more reliable as they need to be reported to the customs and the WTO.

Explanatory Variables

To test Hypothesis 1, I utilize the industry level business R&D investments and industrial output data provided by the Analytical Business Enterprise Research and Development (ANBERD) database (OECD 2002) and construct the following index to measure the uncertainty over returns to policy supports.

\[
Uncertainty = Var^5_i \left( \frac{Value added_{i+1j} - Value added_{ij}}{R&D Investment_{ij} + (Value added_{i+1j} - Value added_{ij})} \right)
\]

\(Value added_{i+1j} - Value added_{ij}\) in the numerator indicates the output increase of a given industry \(j\), as measured by increase in deflated value added, in a given year \(i\). And \(R&D Investment_{ij}\) denotes the R&D investments made by business actors towards industry \(j\) in a given year \(i\). The ratio between them denotes the return to investments. The R&D investments are sometimes zero and it creates infinite values if the denominator is zero. Thus, I add \((Value added_{i+1j} - Value added_{ij})\) to the denominator to avoid infinite values. The resulting index increases in \(Value added_{i+1j} - Value added_{ij}\) and decreases in \(R&D Investment_{ij}\). And I took the variance of five consecutive years of observations to denote the uncertainty over returns on investments. Take the year 2015 for example, I took the variance of the index between 2010 and 2014 and used it as the return-on-investment uncertainty in 2015. The higher the variance, the more uncertain the returns on R&D investments are. I understand that ROI for private sectors is different from ROI for governments, or rather, return to government policy support. And I will explore more accurate measurements in the future.
To test hypothesis 2, I need to come up with a measurement of the length of product life cycles for each industries. I have not found a satisfactory measurement yet. One potential candidate is to use R&D intensity as a proxy for product life cycles. In this case, the R&D intensity is measured by $\frac{R&D \text{ investment}_i}{Output\text{ increase}_{i+1}}$, where $i$ indicates the year of observation. Substantively, this variable measures the amount of industrial output increase in year $i + 1$ that can be attributed to R&D investments in year $i$. When using it as a proxy for product life cycles, I assume that higher R&D intensity is correlated with shorter product life cycles. I will present the preliminary results with R&D intensity as a proxy for now and update the empirical results in the future when I find a more satisfactory measurement.

**Control Variables**

*Sizes of Economy* According to Johnson (2013), large countries usually have high import-demand elasticity and low import-supply elasticity as they usually have a wide range of substitutes and other countries rely heavily on the large countries as the market for their exports. In addition, if large countries reduce their demand for certain products, it will drive the world price of the product to decrease, thus reducing the loss in consumer surplus caused by trade barriers. In contrast, small countries are just price takers. Thus, they will suffer losses on national welfare by imposing tariffs on other countries. Accordingly, I expected large economies to be more likely to use punitive tariffs than small countries. I used the GDP data provided by the World Bank to measure the size of economy.

*Transparency of Economic Data* When one country’s economic data are not transparent, it would become difficult for it to reach bilateral settlements with other countries as it is hard for other countries to trust any claims made by the country and monitor whether it complies with relevant
settlements. Thus, I expect countries with intransparent economic data to be more likely to be the target of punitive tariffs. Data about economic transparency come from Hollyer et al. (2018). They assume that if one country has more missing values when it submits data to international organizations, it has a less transparent economic system. Based on this assumption, they create an index that ranges from -0.92 to 9.96 with greater numbers indicating higher transparency.

*Information Technology Agreement*  The Information Technology Agreement (ITA) was concluded in 1996 and formally implemented in 1997 (ITA-1). In 2015, the ITA was expanded to cover more products and member countries (ITA-2). The agreement aims at eliminating tariffs over certain information and communication (ICT) technology products, including semiconductors, computers, and telecommunication equipment. Most OECD countries and many developing countries are the signatories of ITA. Therefore, if products in the dataset are listed in ITA, we should expect these products to be less likely to be subject to tariffs. This variable is a dummy variable with 1 indicating inclusion in the ITA and 0 otherwise.
The preliminary results are shown above. As shown in table 2, as a first-cut, I discover that higher uncertainty over returns on investments, as measured by R&D-output uncertainty, is correlated with a higher likelihood that a trade conflict ending with punitive tariffs. It is consistent with H1 that the uncertainty over return on investment will result in bargaining breakdowns. In addition, R&D intensity, as a proxy for product life cycles, is positively correlated with the likelihood that
trade conflicts end with punitive tariffs.

**Plans for future studies**

I plan to make improvements on the following aspects for future studies.

First, I will find more satisfactory measures of uncertainty over returns to policy support. The current measurement is not satisfactory in that it can be driven by both volatility in industrial outputs and R&D investments. Industries such as agriculture can have a high level of uncertainty according to this measurement as the industrial output can vary considerably as a result of extreme weather or change in market demand. But it is not caused by change in returns on investments. I deal with this problem by only including manufacturing industries in the sample. But manufacturing industries such as textile ones may also experience output volatility due to change in market demand. In addition, I only have data about R&D investments of private sectors. ROI uncertain of private businesses may not be an ideal proxy for return to government policy supports. For future research, I will explore better measurements of the level of uncertainty over return on government support.

Second, I will conduct mediation analysis to analyze the causal chains through which the features of high-technology affects the final solution of trade conflicts. In addition. I plan to conduct causal inferences to study the effects of high-technology. The cross-national data used here have limitations in that the cross-national measurements of some key variables are lacking. For example, the lobbying abilities of different interest groups affect whether their voices will be reflected in trade conflicts. However, I do not have a suitable cross-country measurement of it. The current statistical model is thus subject to omitted variable bias. Thus, it is necessary to find a more rigorous identification strategy.
Third, I will examine more dependent variables. Given that existing WTO anti-dumping and countervailing institutions cannot solve the problem caused by uncertainty and short time horizons, it is likely that countries may resort to non-institutional policy tools to solve high-tech trade disputes. For example, they may choose to utilize non-tariff barriers and the WTO security escape clause to speed up the implementation of protectionist policies. Therefore, we should witness more non-institutional trade policies when it comes to high-tech trade.
Chapter 2. Domestic Politics of High-tech Trade Conflicts: Policy Preferences of High-Tech Producers

Contents that will be presented during the IR retreat stop here.

Policy Preferences of High-Tech Producers

Who is demanding trade barriers in high-tech conflicts? This chapter seeks to answer this question by investigating high-tech interest groups’ attitudes towards different trade policy tools which include tariffs, non-tariff barriers, and bilateral settlements. Extensive research has been done on interest groups’ trade policy preferences in general (Kim, 2017; Osgood, 2018; Plouffe, 2017), but limited attention has been paid on high-tech firms’ preferences. This project plans to make one of the first systematic empirical analyses of high-tech firms’ trade policy preferences in the U.S. and China. The two countries are chosen because the former is a frequent user of AD-CV investigations and the latter a frequent target of them.

The existing literature suggests that firms that are larger in size and higher in productivity levels stand to benefit more from free trade (Kim and Osgood, 2019; Osgood et al., 2017; Plouffe, 2017). Given that high-tech firms are consistent with these descriptions, we should expect them to oppose tariffs and other protectionist measures. However, high-tech firms often offshore their production activities overseas (Carmel and Agarwal, 2006). This action poses a threat to domestic producers of intermediate products. As a result, we should expect domestic suppliers of intermediate products to support trade barriers and a cleavage formed between those producers and high-tech firms who mainly control the R&D and marketing part of supply chains. Here, I use high-tech firms to refer to firms who control R&D activities and intermediate product producers to refer to those who supply
parts to the high-tech firms. Both actors are in high-tech industries. This conjecture is consistent with the patterns revealed in Table 1 where the most frequent targets of high-tech trade disputes are intermediate products. Accordingly, I have the following hypotheses.

Hypothesis 1: High-tech firms tend to prefer bilateral settlements and oppose punitive tariffs and non-tariff barriers in trade conflicts.

Hypothesis 2: Domestic suppliers of intermediate products to high-tech firms in developed countries tend to support punitive tariffs and non-tariff barriers and oppose bilateral settlements in trade conflicts.

**Empirical Strategy**

I plan to study the policy preferences of high-tech producers in the United States and China through a multi-method approach. First, I plan to gather high-tech firms’ and industry associations’ public statements and conduct text analysis to study these actors’ most concerned issues and attitudes towards different policy tools in trade conflicts. Second, I will use Large-N analysis to examine the determinants of the expressed policy preferences and the unit of analysis will be firm-year. Specifically, I want to study whether producers’ positions in global supply chains play a role here and how intermediate producers’, high-tech firms’, and high-tech industrial associations’ preferences differ from each other. Third, if possible, I want to distribute surveys to high-tech practitioners in China and the U.S. to understand their policy concerns. In the following section, I will discuss how to measure the policy preferences of high-tech producers.

*Measuring Policy Preferences of High-Tech Producers*

To understand the policy demands of U.S. high-tech producers, I will utilize the public hearing
records provided by the USITC for anti-dumping and countervailing cases. As of May 11, 2021, there are 842 cases recorded by the USITC and 35 of them are still ongoing. The cases cover the time period between 2002 and 2021.

For each AD-CV investigation, the USITC will normally hold a public hearing allowing parties of interest to state their stances and policy concerns. The parties of interest usually include domestic producers who file the complaint, domestic importers whose interests are at stake, foreign exporters under investigation, trade policy experts, and foreign government representatives. Take the 2012 Ad-CV investigation against Chinese solar panels for example (Inv. Nos. 701-TA-481 and 731-TA-1190). All the parties of interests were divided into supporters and opponents of the AD-CV order. Representatives of the SolarWorld Industries America, Inc. were invited to show how their survival was under threat by Chinese exporters. And U.S. importers such as SunEdison LLC was given the chance to argue why imposing punitive tariffs would negatively impact their construction of solar power plants. Chinese exporters and government official also made testimonies to their own defense.

<table>
<thead>
<tr>
<th>Government</th>
<th>Supporter</th>
<th>Opponent</th>
</tr>
</thead>
<tbody>
<tr>
<td>The USITC staff</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State government witnesses</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These public hearing records allow me to identity the parties of interest and their positions for each AD-CV case. Moreover, I can scrape their testimonies and conduct text analysis to understand the issues they care about. I plan to apply unsupervised learning method to get a general sense of the major topics in the corpus and how the prevalence of these topics changes with producers’
characteristics such as their positions in the supply chains.

As for the Chinese data, unfortunately, although the Ministry of Commerce of the P.R.C. stipulates that relevant investigation agencies can hold hearings for Ad-CV investigations, they are not required as long as the agencies deem the hearings unnecessary and the transcripts of these hearings are not readily available.\(^3\) As a result, I cannot collect data the way I do for the U.S. sample. My plan is to first get the list of all AD-CV investigations from the Ministry of Commerce’s official website.\(^4\) And then I will collect investigation-related news reports and official-website news releases of Chinese high-tech firms and conduct text analyses to infer their preferences.

**Independent variables**

The key independent variable is the position in global value chains. I plan to divide the producers into three types, primary-good producers, intermediate-product producers and those producing final products. For the American sample, such information can be inferred from the information of different parties provided in the public hearing transcripts and human coding will be needed to further classify the producers into a specific category. For all Chinese AD-CV investigations, the HS code of the product and the firms involved are usually specified in the news release on the official website. So similar coding process will be done for the Chinese sample.

**Lobbying Intensity of High-Tech Producers**

After clarifying different groups’ preferences, I will examine who has stronger political influences. My hypothesis is that high-tech firms tend to be large and productive and thus are better able to internalize the negative impacts of tariffs. Additionally, consumption of high-tech products only


constitutes a small share of household expenditures (Aguiar and Bils, 2015). Therefore, consumers are not sensitive to the price increases caused by tariffs. This leaves room for high-tech firms to pass on the tariff burden to consumers. Thus, high-tech firms should lobby less intensively compared to intermediate-product producers who are smaller in sizes.

Hypothesis 3: High-tech firms lobby less intensely compared to producers of intermediate products in the same industry in trade conflicts.

**Empirical Strategy**

I plan to test Hypothesis 3 through large-N data analysis on the U.S. sample.

*Lobbying Intensity*

To measure the lobbying intensity, I will utilize the U.S. firms’ lobbying records provided by Lobbyview (Kim, 2018). The dataset covers the time period between 1999 and 2021. It provides client level data showing the names of lobbying groups (mostly firms), their NAICS codes, the amount of money they spent on lobbying each year, and brief descriptions about the issues covered by the lobbying activities. I plan to use lobbying frequencies, money spent, and levels of focus on issue areas as three measurements of lobbying intensity. I assume that the more frequent firms lobby, the more contributions they make, and the more focused they are on one issue, the more intensively they lobby.

*Position in Supply Chain*

53908 entities are recorded in LobbyView and 24962 of them have NAICS codes. It is thus possible to determine the type of producers these entities present and code their positions in global supply chains based on the NAICS codes. It is challenging to code entities that do not have NAICS code.
My plan is to recruit human coders to code the rest entities.

**Contributions**

This chapter makes the following contributions. First, it systematically measures the preferences of high-tech producers in the U.S. and China. The current literature only provides general studies of firms’ preferences in regards to trade policies. This chapter fills the gap by providing a high-tech industry specific descriptions of producers’ trade policy preferences.

Second, the chapter contributes to the global value chain literature by connecting producers’ relative positions in the global value chain with their trade policy preferences and the final outcomes of trade conflicts. Several seminal works in the literature indicate that political cleavages are forming between firms with oversea supply chains and these without (Kim, 2017). This project will be good addition to this rising literature by pointing out how the economic features of high-tech industries (e.g., low shares of household expenditures) contribute to the political cleavage.
Chapter 3. National Security Framing and High-Tech Developments

When do politicians connect the development of high technology with national security interests? Except for military technologies, the national security implications of high technologies such as aviation and communication are not so clear-cut. This ambiguity leaves room for politicians to interpret the security implications of high technologies.

However, politicians face a significant trade-off when deciding whether to link one technology with national security. On one hand, applying a national security framing to a specific technology provides politicians with excuses to impose trade restrictions on it. Trade agreements under the current WTO system usually have security exception clauses that allow politicians to justify their protectionist measures in the name of national security.\(^5\) Invoking security concerns thus helps to avoid costs of violating the WTO rules.

On the other hand, politicizing one technology will have negative distributional effects as it hinders international technological cooperation and damages the interests of domestic high-tech firms who have overseas supply chains and foreign market (Bown, 2020; Lovely, 2018; Swanson and Kang, 2020). Take the semi-conductor industry for example. When the Trump administration planned to impose tariff on semi-conductors and their manufacturing equipment exported from China, the Semiconductor Industry Association (SIE) expressed strong oppositions to this policy, arguing that trade restriction would undermine the U.S. semiconductor industry’s competitiveness in the following ways. First, a considerable number of semiconductors are first manufactured in the U.S. and then sent to China for assembly, testing, and packaging (ATP). Restricting Chinese exports

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will hurt sales of the U.S. upstream suppliers. Second, the labor costs of ATP activities in China are relatively low. If the U.S. downstream producers cannot import semiconductors processed in China, they will lose their competitive advantage in price. Third, should China retaliate, the U.S. semiconductor manufacturers will lose their Chinese market (Semiconductor Industry Association, 2018).

Considering this trade-off, it would be interesting to study when politicians link high-tech developments with national security interests. My expectation is that politicians are less likely to politicize a product if it relies on overseas supply chains.

Hypothesis 1: High-tech products in industries that rely heavily on overseas supply chains are less likely to be connected with national security concerns by politicians compared to products that are less integrated in overseas supply chains.

Empirical Strategy

I plan to use both Large-N and text analysis to study the determinants of politicians’ decisions to link high-tech developments with national security concerns. The unit of analysis will be product-year. The universe of cases will be all products that are defined as technology-intensive by the OECD standard. And I plan to first conduct a preliminary analysis on the U.S. sample and then decide whether it is feasible to conduct cross-national analysis. The U.S. is selected as the policy transparency level is high and high-quality data about government policies are readily available on websites such as the Federal Register.

Dependent Variable

I plan to use both observational data and text analyses to study the level to which U.S politicians
relate one high-tech product with national security.

For the observational data, I plan to collect data from the Federal Register to understand the U.S. government policies towards different high-tech products. The Federal Register provides online archives of federal rules and regulations. I input the key word “national security” and set the issue area to be “Science & Technology” and got 18,369 results. My tentative plan is to assign the value of 1 to all products that are mentioned under “Science & Technology” section and connected with national security concerns. And other products that are in the dataset but not mentioned in the Federal Register will be assigned the value of 0. Connecting the observations with product codes will be a challenging process. I plan to first test if I can extract the product information from relevant records. And if it is not feasible, I will recruit coders to connect each record with relevant products.

One advantage of this measurement is that it captures the real effort that the U.S. government makes to link relevant technologies with security concerns instead of just cheap talks. But one drawback is that this measurement may not capture technologies that are linked with security but never subject to any official regulations that are published on the Federal Register website.

As for the text data, I plan to collect political speeches made by U.S. presidents and top government officials. The relevant data sources are listed below. The sample will mainly cover presidential speeches, White House briefings, congressional hearings, and speeches made by the senate and house members. I plan to extract two pieces of information from the corpus. First, whether a

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6 According to National Archives’ website, the Federal Register includes the following types of documents: “Federal agency regulations; Proposed Rules and Notices of interest to the public; Executive orders; Proclamations; Other Presidential documents.” The above description is retrieved in May 17, 2021 from https://www.archives.gov/federal-register/the-federal-register/about.html.

7 Sources such as Voxgov also provide relevant data. But UCSD does not subscribe to them. So such data sources are not listed here.
high-tech product is connected with national security in these documents. My plan is to apply supervised learning method to classifying these documents into ones that establish this link and ones that do not. Second, I want to know when national security framing is applied to a high-tech product, what topics will be mentioned. This part will mainly be exploratory and I will apply unsupervised learning method to discover the major topics in the corpus and their relative topic prevalence.

Table 4: Data Sources

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Content</th>
<th>Time Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Miller Center</td>
<td>Presidential speeches</td>
<td>1789-present</td>
</tr>
<tr>
<td>The American Presidency Project</td>
<td>The Messages and Papers of the Presidents</td>
<td>1789-1929</td>
</tr>
<tr>
<td></td>
<td>The Public Papers of the Presidents</td>
<td>1929-present</td>
</tr>
<tr>
<td></td>
<td>The Compilation of Presidential Documents</td>
<td>1977-present</td>
</tr>
<tr>
<td>Federal News Service</td>
<td>“White House briefings &amp; statements by the President, Congressional hearings, National Press Club speeches ..., special briefings...”</td>
<td>Mostly post 1988</td>
</tr>
<tr>
<td>Congressional Record for the 43rd-114th Congresses</td>
<td>Speeches on the floor of the House and the Senate</td>
<td>1873-2017</td>
</tr>
</tbody>
</table>

Independent Variable

As mentioned in Hypothesis 1, the major explanatory variable here will be one industry’s involvement in global supply chains. The World Input-Output Database provides data about the percentage of one industry’s outputs that are attributable to foreign supplies (Timmer et al., 2015). The data can be used as a measurement of how much one industry relies on overseas supply chains. And I expect that the higher the percentage of foreign supplies, the less likely that high-tech products in one industry will be connected with national security.
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Osgood, I. (2018). Globalizing the supply chain: Firm and industrial support for us trade agree-

charmed life of superstar exporters: Survey evidence on firms and trade policy. *The Journal of 

Perlman, R. L. (2020). For safety or profit? how science serves the strategic interests of private 


Appendices

Appendix 1: Patterns of Trade Conflicts

Notes: The figure shows the final settlements of trade conflicts initiated by OECD countries towards developing countries between 1995 and 2015. Bilateral settlements include suspension agreements and price undertaking. “Dropped” means the case did not reach the final stage. “Duty” means the investigation ended with punitive tariffs. The data come from the Temporary Trade Barriers Database (Bown, 2010). (a) shows countervailing investigations and these cases account for 12.16% of the total observations in the dataset. (b) shows anti-dumping cases and they account for 37.597% of the total observations in the dataset.

Notes: The figure shows the final settlements of trade conflicts initiated by OECD countries towards OECD countries between 1995 and 2015. The data come from the Temporary Trade Barriers Database (Bown, 2010). (a) shows countervailing investigations and these cases account for 5.35% of the total observations in the dataset. (b) shows anti-dumping cases and they account for 20.54% of the total observations in the dataset.
Fig 5: Final Settlements of Trade Conflicts Initiated by developing Countries towards OECD Countries

Notes: The figure shows the final settlements of trade conflicts initiated by developing countries towards OECD countries between 1995 and 2015. The data come from the Temporary Trade Barriers Database (Bown, 2010). (a) shows countervailing investigations and these cases account for 5.35% of the total observations in the dataset. (b) shows anti-dumping cases and they account for 20.54% of the total observations in the dataset.

Fig 6: Final Settlements of Countervailing Investigations Initiated by OECD Countries towards developing Countries

Notes: The figure covers data between 1995 and 2015. Only manufacturing industries are included in the sample. And products covered by the ITA are excluded. These cases account for 7.87% of the total observations in the dataset.
Fig 7: Trade Dispute Settlements by Industries

Notes: The graph shows the cases initiated by OECD towards developing countries. The x axis shows the percentage of cases ending with punitive tariffs.
Table 5: Country dyads that are frequently involved in AD-CV investigations

<table>
<thead>
<tr>
<th>Dyad</th>
<th>No. Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina-China</td>
<td>9</td>
</tr>
<tr>
<td>India-China</td>
<td>8</td>
</tr>
<tr>
<td>European Union-China</td>
<td>7</td>
</tr>
<tr>
<td>Brazil-China</td>
<td>6</td>
</tr>
<tr>
<td>Peru-China</td>
<td>6</td>
</tr>
<tr>
<td>European Union-South Korea</td>
<td>5</td>
</tr>
<tr>
<td>India-Malaysia</td>
<td>5</td>
</tr>
<tr>
<td>United States-China</td>
<td>5</td>
</tr>
<tr>
<td>European Union-Japan</td>
<td>4</td>
</tr>
<tr>
<td>European Union-Malaysia</td>
<td>4</td>
</tr>
<tr>
<td>India-South Korea</td>
<td>4</td>
</tr>
<tr>
<td>United States-Japan</td>
<td>4</td>
</tr>
<tr>
<td>Brazil-Germany</td>
<td>3</td>
</tr>
<tr>
<td>China-European Union</td>
<td>3</td>
</tr>
<tr>
<td>China-Japan</td>
<td>3</td>
</tr>
<tr>
<td>European Union-Thailand</td>
<td>3</td>
</tr>
<tr>
<td>India-Taiwan</td>
<td>3</td>
</tr>
<tr>
<td>India-Thailand</td>
<td>3</td>
</tr>
<tr>
<td>United States-South Korea</td>
<td>3</td>
</tr>
<tr>
<td>United States-Taiwan</td>
<td>3</td>
</tr>
<tr>
<td>Argentina-Brazil</td>
<td>2</td>
</tr>
<tr>
<td>Argentina-United States</td>
<td>2</td>
</tr>
<tr>
<td>Canada-China</td>
<td>2</td>
</tr>
<tr>
<td>China-United States</td>
<td>2</td>
</tr>
<tr>
<td>European Union-Singapore</td>
<td>2</td>
</tr>
<tr>
<td>European Union-Taiwan</td>
<td>2</td>
</tr>
<tr>
<td>European Union-United States</td>
<td>2</td>
</tr>
<tr>
<td>South Africa-Belgium</td>
<td>2</td>
</tr>
<tr>
<td>South Africa-Germany</td>
<td>2</td>
</tr>
<tr>
<td>South Africa-Ireland</td>
<td>2</td>
</tr>
<tr>
<td>South Africa-Spain</td>
<td>2</td>
</tr>
<tr>
<td>Turkey-China</td>
<td>2</td>
</tr>
</tbody>
</table>
Fig 8: Yearly Trend in the Number of Anti-dumping Investigations on High-tech Products
## Appendix 2: Different Model Specifications

### Table 6: Correlation between ROI uncertainty and punitive tariffs

<table>
<thead>
<tr>
<th>Duty</th>
<th>OLS (1)</th>
<th>OLS+Fixed-effects (2)</th>
<th>Logit+Fixed-effects (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D-output uncertainty</td>
<td>0.004**</td>
<td>0.003*</td>
<td>0.069**</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.001)</td>
<td>(0.034)</td>
</tr>
<tr>
<td>Transparency</td>
<td>0.014</td>
<td>−0.021</td>
<td>−0.125</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.013)</td>
<td>(0.121)</td>
</tr>
<tr>
<td>Ln GDP.initiator</td>
<td>0.034***</td>
<td>0.014</td>
<td>3.069***</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.009)</td>
<td>(1.270)</td>
</tr>
<tr>
<td>Ln GDP.target</td>
<td>0.095***</td>
<td>0.488***</td>
<td>0.053***</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.126)</td>
<td>(0.171)</td>
</tr>
<tr>
<td>Constant</td>
<td>−3.223***</td>
<td></td>
<td>−3.223***</td>
</tr>
<tr>
<td></td>
<td>(0.374)</td>
<td></td>
<td>(0.355)</td>
</tr>
</tbody>
</table>

| Observations          | 1,718 | 1,718 | 1,718 |
| R²                    | 0.075 | 0.399 | 0.075 |
| Adjusted R²           | 0.073 | 0.379 | 0.073 |
| Residual Std. Error   | 0.479 (df = 1713) | 0.392 (df = 1661) | 0.479 (df = 1713) |
| F Statistic (df = 4; 1713) | 34.731*** | | 34.731*** |

*Note:* $^*p<0.05; ^{**}p<0.01; ^{***}p<0.001$