The effects of general policy uncertainty on trade flows and U.S. wages

by

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M.A., Kansas State University, 2015

M.A., Kansas State University, 2019

AN ABSTRACT OF A DISSERTATION

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Abstract

This dissertation consists of three essays at the crossroads of international trade and the labor market. We measure the degree of uncertainty using a general and well-established methodology based on Baker et al. (2016). We investigate the degree to which trade policy uncertainty (TPU) at the industry-country-year level affects the global trade flows of major importers and exporters (e.g., the U.S., Canada, China, Mexico, and the European Union). Similarly, we construct the U.S. index of economic uncertainty at the industry-year level to investigate its effects on U.S. wages.

In the first essay, we use a text-mining approach to construct a general index of trade policy uncertainty (TPU) for the U.S. and some of its main trade partners. This TPU index captures uncertainty on U.S. trade policy at a very detailed level (partner and industry levels) from 2001 to 2017 based on US trade-related news information. It's general, thereby enabling us to control for uncertainty relative to the use of highly-regulated tariff barriers under the WTO, temporary trade barriers (TTB), export restrictions, and potential reinterpretations of trade-related national security concerns, among others. Results suggest that a one-standard-deviation increase in policy uncertainty tends to decrease U.S. imports by 1.14 percent. In contrast, uncertainty on the trade policy applied by U.S. trade partners tends to reduce U.S. exports only to markets where the importers display a significant market power level. The results also show that the effects of trade policy uncertainty are mitigated with the formation of preferential trade arrangements (PTAs).

In the second essay, motivated by the important findings of U.S. TPU effects on U.S. trade flows, we extend the study to another four markets, namely, Canada, Mexico, China, and the European Union, and their trade partners. We construct a TPU index for each of these four markets based on their news information using the same method applied to the first essay. Again, this TPU index captures uncertainty on the trade policies of these four

markets at the importer-exporter-industry level from 2001 to 2017. The primary findings of the second essay are very much in line with the previous results. Uncertainty on the trade policy implemented by Canada, Mexico, China, and the EU tends to lower their imports. Specifically, a one-standard-deviation increase in policy uncertainty is associated with a decline of 0.71 percent in their imports. Moreover, uncertainty on the trade policy applied by the trade partners of these four groups is more likely to reduce their exports. Specifically, a one-standard-deviation increase in TPU leads to a decline of 0.62 percent in these four markets' exports. The impact of trade policy uncertainty on imports and exports for each of the four markets is also negative. In addition, PTAs tend to mitigate the negative effect of trade uncertainties on these four markets' trade flows.

In the third essay, we study the reaction of the labor market to the economic uncertainty in the U.S. We specifically construct the U.S. economic uncertainty index with the same method we used to create the TPU in the previous two chapters on wages. The economic uncertainty index is generated based on U.S. economic-related news information that captures uncertainty on U.S. economic events and policies at the industry level from 2001 to 2018. Interestingly, the increase in economic uncertainty is likely to reduce wages in the U.S. labor market. Our result shows that the total effects of the concurrent and lagged economic uncertainty indexes cause a decline in wages by 2.12 percent. We also get plausible results by constructing alternative U.S. economic uncertainty indices using 1) newspapers released by other countries and 2) other countries' economic uncertainty indexes as instruments.

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Dedication

To my parents, for their sacrifices, support, and endless love for me.

Chapter 1

General Trade Policy Uncertainty and U.S. Trade Flows

1.1 Introduction

World exports of goods and services have grown from 12.9 percent to 28.7 percent of the world's GDP in the last 50 years.[1] This spectacular increase in economic integration was possible due to the presence of a rules-based international trade system sponsored by the General Agreements on Tariffs and Trade (GATT) and its successor agreement, the World Trade Organization (WTO).[2] Some of the important reasons to forge these international trade agreements were to control for the inefficiencies and uncertainty generated by unilateral trade policies.[3] The GATT's principles of most-favored-nation (MFN) treatment and reciprocity are essentially designed to promote cooperation in tariff setting, thereby leading to a more efficient and predictable trade outcome since negotiations can focus their efforts

[1] Authors' calculations based on data provided by the World Bank. See information at "https://data.worldbank.org/indicator/NE.EXP.GNFS.CD."

[2] Notice that five rounds of multilateral negotiations concluded before 1970 had already cut by 40 percent the tariffs applied by industrial countries in manufactured products. See Table 1 in Bagwell, Bown, and Staiger (2016) for details.

[3] The concern with the uncertainty of trade policy can be seen in the key role of predictability in the WTO's stated objective: "to ensure that trade flows as smoothly, predictably and freely as possible." See "https://www.wto.org/english/thewto_e/whatis_e/inbrief_e/inbr_e.htm."

towards reducing the trade barriers through a unique set of trade instruments (tariffs).[4][5]

In this paper, we construct a general index of trade policy uncertainty (TPU) and investigate its effects on U.S. imports and exports at the bilateral and industry levels from 2001 to 2017. This research topic is important since the last decade has seen important shifts in U.S. trade policy that have led to a substantial increase in trade policy uncertainty towards traditional allies of the U.S. and other WTO members. After the financial crisis of 2008, U.S. changes in trade policy during the Barak Obama's administration intensified with the use of temporary trade barriers (anti-dumping and countervailing measures) on imports from developing countries in particular from China.[6] More recently, uncertainty surrounding U.S. trade policy has increased with a rise in the likelihood of policy changes through even less traditional channels than temporary trade barriers.[7] In March of 2018, the U.S. President Donald Trump surprised even his advisers in announcing tariffs on steel and aluminum products, which were later applied to other North American Free Trade Area (NAFTA) members, using reasoning based on national security concerns. Importantly, this argument has been rarely used by previous U.S. administrations, had been last used by the U.S. in 1986 to control imports of machine tools.[8] Likewise, notice that Brazil and South Korea were later

[4]Bagwell and Staiger (1999 and 2012) show that the principles of nondiscrimination and reciprocity assist governments in abandoning non-cooperative tariff setting. This reason is vital since unilateral tariffs tend to exploit a country's market power for terms-of-trade reasons. Another main reason for the formation of trade agreements is the Commitment Theory. See Bagwell, Bown, and Staiger (2016) for details. In this case, the focus is on trade agreements' role in decreasing the consequences of trade policy uncertainty and guaranteeing a better allocation of economic resources by preventing lobbyists from manipulating trade policy (see Maggi and Rodriguez-Clare (1998, 2007)).

[5]These GATT/WTO pillars also assist governments in increasing transparency, reducing costs, and mitigating opportunistic behavior during multilateral negotiations.

[6]See Bown (2017) for the evolution of U.S. dispute cases in the WTO and an overall understanding of the historical background and trade agreements' importance. Bown (2019) explains the importance of special protection mechanisms (beyond the MFN tariffs) used by the U.S. on imports from China in the last 40 years.

[7]In fact, republican senator Josh Hawley introduced a bill to withdraw the U.S. from WTO in May of 2020, which found some support at the U.S. house of representatives where some democrats put forward a similar bill displaying a somewhat rare degree of bipartisanship on this matter. See Bown and Levy (2020). Moreover, the U.S. government has vetoed nominations for the WTO's Appellate Body, essentially preventing the formal consideration of policy disagreements across members since the end of 2019. For details, see Bown and Keynes (2020).

[8]In this case, the U.S. administration's decision was based on Section 232 of the Trade Expansion Act of 1962, which relates trade policy and national security concerns. Then, top-economic adviser Gary Cohn resigned a few days after the steel and aluminum tariffs announcement, arguing being surprised by the sudden announcement of these measures and being disap-

spared from these national-security based tariff measures by accepting quantitative limits on their exports of these products to the U.S. This policy shift has further undermined the WTO efforts to transform all trade barriers into tariffs (tariffication approach).[9] Moreover, U.S. measures towards exports have also increased TPU through an unconventional policy approach. Bown (2020) explores how the U.S. executive branch can now more easily restrict the export of large sways of products through the processing of export licenses.[10] It is then imperative to better understand the general (and sometimes unconventional) ways that trade policy uncertainty may affect trade flows.

Several important articles have recently considered the effects of TPU related to specific policy spaces, particularly tariff gaps, on the decision to export, on trade volumes, and labor market outcomes, among others. Pierce and Schott (2016, 2018) primarily investigate whether manufacturing employment and firm-level investment decisions were affected by China's accession to the WTO in 2001, respectively.[11] In this case, they consider how the elimination of uncertainty related to the gap between U.S. non-normal trade relation tariffs[12] and applied MFN tariffs encouraged U.S. firms to outsource the production of inputs and final goods to China, thereby reducing manufacturing employment across U.S. industries and individual firms' investments. Similarly, Handley and Limão (2015) consider the effects of Portugal's accession to the European Economic Community (E.E.C) in 1986 on its exports to the members of that preferential trade agreement. They explain that, before Portugal became a member of the E.E.C, Portuguese exporters enjoyed preferential tariffs below the

pointed with the White House's decision-making process. See https://www.wsj.com/articles/gary-cohn-to-resign-as-president-trumps-economic-adviser-1520376157were announced. Please read excerpt extracted from the Ronald Raegan library & museum about the quantitative controls of machine tools at https://www.reaganlibrary.gov/research/speeches/121686b.

[9] See Chad Bown's article with further information on the policy consequences of U.S. steel and aluminum tariff measures at https://www.piie.com/blogs/trade-and-investment-policy-watch/trumps-steel-and-aluminum-tariffs-are-cascading-out-control".

[10] Recently, even traditional companies such as General Electric were concerned that the U.S. government would deny a license to export engines to China. For information, see an article at the Wall Street Journal (https://www.wsj.com/articles/trump-administration-considers-halting-ge-ventures-engine-deliveries-to-china-11581790083).

[11] Handley and Limão (2017) consider a similar question, albeit focusing on how China's accession to the WTO boosted Chinese exports to the U.S. In this case, their empirical strategy follows a firm heterogeneity model where some firms upgrade their technology as uncertainty towards their access to the U.S. market decreases.

[12] These tariffs correspond to the ad-valorem equivalent of 1931 Smooth-Hawley's Act Tariffs.

MFN tariffs applied by that preferential trade bloc to non-member countries.[13] However, the gaps between the E.C.C's MFN tariffs and its preferential tariffs to Portugal were not legally permanent, representing a constant source of uncertainty negatively affecting Portuguese exports. Differently, Crowley, Meng, and Song (2018) consider the effects of anti-dumping duties against Chinese products in one market over Chinese exporters' decision to sell similar goods in another market. As they explain it, applying anti-dumping duties to Chinese products exported to a particular market tends to increase the uncertainty related to market access to similar Chinese products in other markets.

To capture the multitude of channels under which TPU may affect U.S. trade flows, we construct a general index of U.S. TPU at the bilateral (140 trading partners) and industry levels (2-digit of the Harmonized System) with information covering from 2001 to 2017. The idea is that a broad measure of U.S. TPU may significantly affect U.S. imports at the bilateral and industry level. Likewise, we also investigate whether the U.S. TPU index affects U.S. exports. In this case, we also control for U.S. trade partners' market power as the effects of tariffs and other trade remedies imposed on U.S. exporters should depend on these partners' ability to affect international markets. In both cases, we construct general indexes of TPU following the text mining approach described in (and keywords used by) Baker, Bloom, and Davis (2016). In their case, they mostly focus on measuring more aggregate indexes of Economic Policy Uncertainty (EPU) for the U.S. and other select countries. They show that increases in EPU have significant adverse effects on relevant macro-related variables (employment and investment) and also affect firm-level decisions in sectors more exposed to government regulations and purchases.

Our measures of TPU seem to capture significant bilateral and sectoral trends over time. The U.S. TPU index tends to increase following the great recession years (2008-2009), peak-

[13] Handley (2014) uses a similar firm heterogeneity model to consider the tariff gap between Australia's bound tariffs and its MFN applied tariffs on foreign firms' decision to export to that country. More recently, Graziano, Handley, and Limão (2020) consider the effects of uncertainty regarding BREXIT on trade between the U.K and European Union (EU) members. In this case, they show that the higher the interaction between the market prediction that BREXIT would be accepted in the British referendum of 2016 and the MFN tariffs applied by the EU (i.e., the higher the probability of tariff reversal), the lower trade between the U.K. and the EU members is.

ing precisely during the first year of President Trump's administration. This index suggests that the most significant increases in U.S. TPU took place towards China, Canada, and Mexico at the bilateral level. This result seems to fit very well with the promises of then U.S. Presidential candidate Donald Trump to either substantially renegotiate NAFTA or withdraw the U.S. economy from this agreement.[14] Likewise, in the first year of his administration, President Donald Trump initiated a formal investigation into Chinese trade and intellectual property rights practices, leading to heightened tension between the two economies.[15] Our index also shows that the evolution and level of U.S. TPU at the sectoral level reflect the higher protection levels applied to agricultural products and steel products. Likewise, our measure of U.S.-related TPU for important partners suggests a similar trend. Suppose we focus on TPU related to U.S. trade policy towards Canada, China, and Mexico. In that case, we find higher uncertainty levels in edible fruits and nuts, steel products, and certain fabrics, for instance. These products have been important subjects of U.S. trade policy.

We then use these TPU measures with variation at the bilateral, year, and industry levels to investigate the effects of uncertainty on U.S. imports and exports using data for 140 countries at the 2-digit of the Harmonized System (HS). Our strategy is based on the industry-level gravity model developed in Feenstra, Ma, and Xu (2019), which controls for bilateral (direct) tariffs and the relative level of protection at the industry level. Our baseline model shows that an increase in U.S. TPU has significant adverse effects on U.S. imports at the bilateral and industry level. Notably, the model shows that a one-standard-deviation increase in TPU leads to a 1.14 percent decline in imports. A similar analysis applies to U.S. exports, where we notice significant heterogeneity across trade partners. In this case, U.S. exports are negatively affected by TPU if the trade partner displays considerable market power and for years after the great recession of 2008-2009. More specifically, we find that a one-standard-deviation increase in TPU leads to a decline in U.S. exports of 2.32 percent

[14] For example, please see the article on "https://www.reuters.com/article/us-usa-election-idUSKCN0ZE0Z0."

[15] This refers to a formal investigation brought under Section 301 of the U.S. Trade Act of 1974. The final report can be found at "https://ustr.gov/sites/default/files/Section%20301%20FINAL.PDF".

if the importer displays high levels of market power. On the contrary, this effect is not significant for importers with lower market power levels.

We extend our empirical model to consider two major trade-related matters. First, we follow Hummels and Klenow (2005) and Debaere and Mostashari (2010) in defining the intensive and extensive margins of trade. We then apply our gravity model to study by which degree the U.S. TPU affects the international trade margins. Our results strongly suggest that U.S. TPU tends to affect international trade through the intensive margin only. Second, we consider the effects of preferential trade agreements (PTAs) in determining the effects of TPU on U.S. trade flows. As of June 2021, there are about 349 PTAs in force according to the WTO.[16] They have represented the primary source of tariff liberalization since tariff bindings have been last modified 26 years ago during the conclusion of the Uruguay Round in 1995. We find that PTAs serve as a source of insurance in tariff setting since they tend to significantly reduce the effect of TPU on U.S. imports and exports.

We find these results robust to numerous additional tests. A considerable part of our analysis compares our baseline results to measures of TPU that rely on alternative words to determine the presence of uncertainty and using articles published by newspapers based on the three largest U.S. trade partners. In the former case, we consider these results while producing the TPU measures using the keywords adopted by Caldara et al. (2020). In both cases, we confirm our baseline results. In particular, the adverse effects of TPU on U.S. exports materialize only if the importer has high levels of market power, even using information published in newspapers based in Canada, China, and Mexico. Furthermore, we confirm our baseline results using more demanding sets of words with direct references to imports and exports, applying binary (rather than continuous) versions of the TPU index, and relying on alternative sets of tariffs to identify and control for direct (bilateral) and indirect trade costs.

The rest of the paper proceeds as follows. Section 2 describes our data, the construction of our TPU index, and the description of its main economic characteristics across countries, sector, and years. Section 3 describes our econometric approach, which is based on the

[16] https://www.wto.org/english/tratop_e/region_e/region_e.htm

gravity model of trade. In this section, we include the extensions of our gravity equation to control for the effects of TPU on trade margins, the effects of PTAs in determining the impact of TPU, and the role of market power in determining the effects of TPU on U.S. exports. Section 4 describes our main results. In this case, Section 4.1 focuses on the results related to U.S. imports, while Section 4.2 discusses several results related to U.S. exports. In each case, we discuss robustness tests for each direction of U.S. trade flows. Section 5 concludes the paper.

1.2 Data

In this section, we describe the dataset used in this paper. First, we explain the construction of our U.S. TPU index. In this case, we provide examples of industries more subject to high and low uncertainty levels and the countries with the most significant changes in uncertainty during the time frame covered by our data. Second, we discuss the other information we gather to investigate the effects of U.S. TPU uncertainty on U.S. trade flows. In this case, we discuss the identity of U.S. main trade partners, the margin of preferences granted by the U.S., and received by U.S. exporters, the degree of market power across the U.S. trade partners. Moreover, we describe industry-level characteristics that vary across countries, which may significantly explain the effects of uncertainty on U.S. trade flows.

1.2.1 Trade Policy Uncertainty Index

Economic policy uncertainty (EPU) has been shown to be an essential factor in explaining the changes to important micro- and macro-level variables. Baker, Bloom, and Davis (2016) show that the U.S. economy's EPU index is strongly correlated with the stock price volatility for U.S. firms intensely exposed to federal purchases. Moreover, they show that this effect is driven by sector-specific EPU related to firms in the defense, health, and finance industries, subject to comprehensive regulatory norms, and some are dependent on government purchases.[17] This result suggests that industry-specific economic uncertainty is essential to

[17] They show that changes in the EPU are negatively correlated to the firm-level investment rates. This result applies to the average firm (i.e., beyond the firms in defense, health, and finance industries).

better understand the general effects of uncertainty across sectors. Likewise, trade policy uncertainty (TPU) has been shown to be relevant for firm-level investment decisions. Amiti, Kong, and Weinstein (2020) show that specific events related to the U.S.-China trade war have negatively affected the stock price of firms who are exposed to these trade-related measures, thereby leading to a decrease in the investment rate of U.S. listed companies by 1.9 percentage points. Thus, considering the effects of industry-specific and country-specific uncertainty is essential to understand economic events, such as bilateral trade flows at the industry level.

The trade policy uncertainty (TPU) index is created following the strategy adopted by Baker, Bloom, and Davis (2016) while focusing on variations at the industry and bilateral levels. We generate an index based on international trade-related news articles' frequency in four well-regarded newspapers circulating in the U.S. More specifically, we include information from news articles from the U.S. News (founded in 1933), The Guardian U.S. edition (founded in 1821), Politico (founded in 2007), and Livingston (founded in 1945). We have several reasons for focusing on these four outlets. First, these outlets have only been accessible electronically over the years included in our research (2001-2017). Second, these news outlets allow for the automatic selection of trade policy-related news articles, decreasing computational costs since our main focus is to consider the uncertainty effects of trade policy on trade flows at the industry and bilateral levels. Third, these four outlets do not present time window restrictions in the automated search for trade-related news, while some popular newspapers allow for the automated search only for articles published in the most recent years or even months.[18] [19] Last, the articles published by these outlets do not contain advertisements unrelated to trade, which facilitates the parsing of words and avoids confusion with articles related to other topics.

[18] The Wall Street Journal allows for the automated search for articles published in the last twelve months and the USA Today for articles published in the previous five months.

[19] Baker, Bloom, and Davis (2016) focus on more aggregate levels of EPU. Their index is constructed using articles published in the USA Today, Miami Herald, Chicago Tribune, Washington Post, Los Angeles Times, Boston Globe, San Francisco Chronicle, Dallas Morning News, New York Times, and Wall Street Journal. Unfortunately, many of these outlets have the aforementioned technical restrictions, making the TPU index's construction with industry and bilateral variation very time-consuming. Not to mention that all these outlets require a subscription.

We developed a code using Python with the Selenium framework to parse and download the news data using the corresponding labels on the HTML source page, such as $< div >, < p >, < li >$. As indicated above, an essential point for us involves identifying the industry related to trade-related news. In this study, we define an industry using the 2-digit codes of the HS. An example may help clarify how our parsing of words helps us determine the industry in question. In the case of HS code 15 (see Tables A.6 and A.7 in the appendix),[20] we label news related to this industry if it contains any of the combinations of words "animal fat," "animal oil," "vegetable fat," or "vegetable oil." Figure 1.1 shows an example where the red rectangles indicate the title words parsed by our code. In this case, the word "steel" identifies the industry (code 72 of the 2-digit of the HS), while the word "Chinese" indicates that these trade news involve China. Instead, the green rectangles indicate the date, where we only keep information from 2001 to 2017. The elements we parsed and extracted included the news' title, date, tags, content, and author. We downloaded 3,842 news articles from January 2001 to September 2019 but eventually only used 2,476 news articles from January 2001 to December 2017 to match other dataset elements, such as trade flows and tariff information.

Table 1.1 includes examples of trade-related articles downloaded from these four news sources. The words in bold assist us in identifying whether the article relates to uncertainty, to U.S. bilateral trade policy, and also identifies the industry. We define that an article involves uncertainty if it contains any words of the following group: "uncertainty," "uncertain," "not certain," "unsure," "not sure," "unpredictable," "unknown," "Brexit," "war," "trade war," "tariff hike," and "increase in tariff." For instance, parsing the words of the article published by US News in 2016, we can identify that this trade-related article involves China, and the traded product involves steel (industry code 72) products. Other articles, such as the one published by The Guardian in 2006, identifies multiple industries related to meat products (industry code 2), dairy products (industry code 4), cereals (industry code 10), and sugar (industry code 17). Notice that some articles do not identify a country, and

[20] The entire industry 15 definition relates to "Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes."

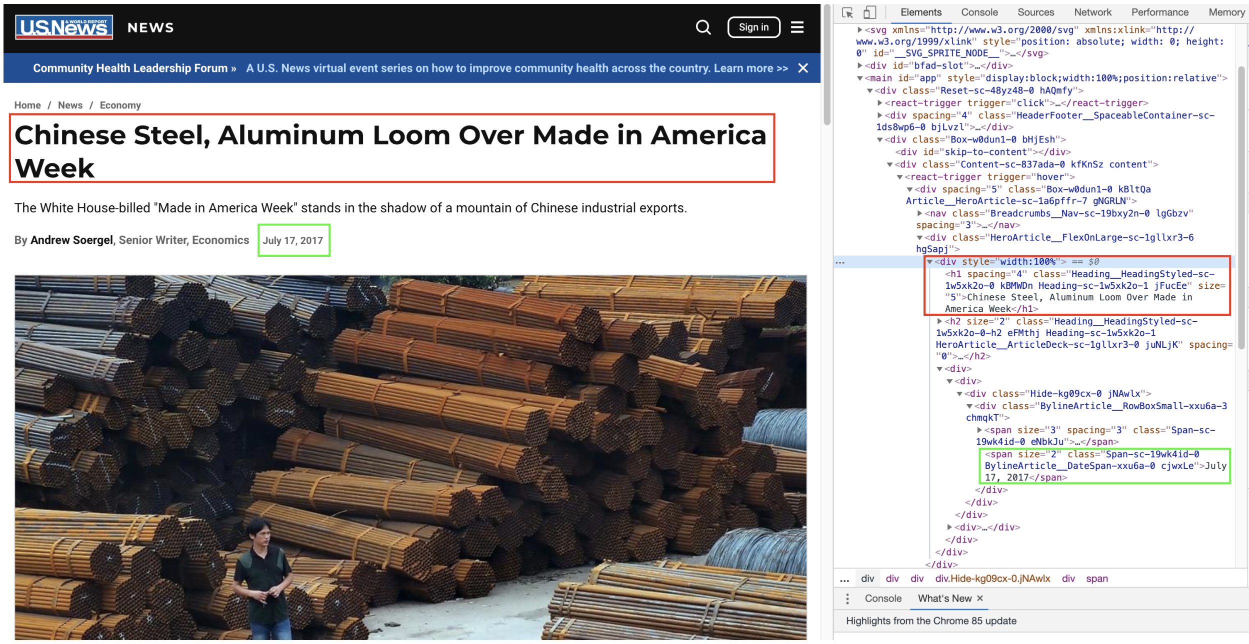


Figure 1.1: Labels on the HTML source page

we then do not count it towards U.S. bilateral trade policy uncertainty with any country.[21] A list of countries included in this study can be found in Table A.5 of the Appendix.

As indicated above, we followed Baker, Bloom, and Davis (2016) in constructing a TPU index for the U.S. economy with variation in the industry (s), country (j), and year (t) levels. We denote this variable as $TPU^j_{s,t}$. To assess the industries most affected by U.S. TPU we constructed an equivalent measure of uncertainty without bilateral variation, and we label it as $TPU_{s,t}$. Likewise, we can measure the degree of uncertainty in the U.S. trade policy towards each trading partner by constructing the TPU index with bilateral variation TPU^j_t. Finally, we measure the evolution of U.S. TPU over the years with a year-varying measure denoted TPU_t. Below we describe our TPU measure that varies at the industry, bilateral, and year levels in detail since we use it as a major control to explain U.S. trade flows. Our index $TPU^j_{s,t}$ was obtained using the following steps:

Step 1: We generate the frequency of news that contains TPU related words for each newspaper and year. As indicated above, we consider the following set of uncertainty related

[21] The idea here is to provide examples about identifying countries, sectors, and whether the article deals with uncertainty. For instance, it is possible that some trade-related articles do not mention any of the uncertainty-related words.

Table 1.1: News examples.

News Source	Year	News body	Country	HS 2-digit industry
POLITICO	2017	the Trump administration has launched an investigation into whether to restrict imports of aluminum from China, Russia and other suppliers including NAFTA partners Canada and Mexico... Trump gave the same instructions last week in signing an order calling for an investigation into whether to restrict steel imports on national security grounds...the **uncertainty** over what, if any, actions will come out of the investigation	China, Canada, Mexico	72
US News	2016	...expansion through the rest of the year remains **uncertain**...Trump, for example, has hit out at Chinese steel...	China	72
Livingston	2016	...Indonesian textile association's (API) advisory board chairman was the latest concerned party to invoke **uncertainty** about the advantages of hitching on to the pact... if the country's textile industry does not prepare for the upcoming changes properly, the TPP could harm it. The provision requires that textile and apparel products made using TPP members' yarn and fabrics should be eligible for zero-tariff in trades between the deal's participants.	Indonesia	53, 61
The Guardian	2016	...it could take up to 10 years to negotiate a post-**brexit** UK-EU trade deal ......the EU-Canada deal, took seven years to negotiate and was about 22 years in the making. but this was a relatively simple trade agreement...tonnes of sheep and goat meat to be imported duty-free into the EU	EU, Canada	2
Livingston	2015	...regarding Canada's dairy supply have turned frosty, and the country's free trade deal with Europe seems to have made little progress following reports of uneasiness over the agreement. however, the **uncertainty** didn't stop...	EU, Canada	4
The Guardian	2006	Northern countries would commit to reducing agricultural subsidies, but since they produce foodstuffs - cereals, meat and dairy ...sugar cane-growing in florida, rice farming in japan ... One country's competitive gain is another's loss, while all lose because of the financial and monetary **uncertainty** competitive devaluation produces....	Japan	2, 4,10,17

words: uncertainty, uncertain, not certain, unsure, not sure, unpredictable, unknown, Brexit, war, trade war, tariff hike, and increase in tariff. We can then measure the frequency with which trade policy uncertainty news appears by newspaper, industry, trade partner, and year, applying the following formula:

$$U^j_{i,s,t} = \sum_q U_{q,i,t} F^j_{q,i,t} F_{q,i,s,t}, \tag{1.1}$$

where $U_{q,i,t}$ represents the number of times that uncertainty-related words appear in each article q published in newspaper i at year t. The binary variable $F^j_{q,i,t}$ equals 1 if country j is mentioned in article q published in newspaper i at year t, and equals 0 otherwise. Instead, the binary variable $F_{q,i,s,t}$ equals 1 if industry s is mentioned in article q published in newspaper i at year t, and equal 0 otherwise.

Step 2: Following Baker, Bloom, and Davis (2016) strategy, we then scale the variable $U^j_{i,s,t}$ described in expression (1.1) by the total number of articles published by the same newspaper in a particular year. Next, we standardize it to the unit standard deviation from 2001 to 2017. Lastly, we take the average across the selected newspapers by industry, country, and year.

$$z^j_{s,t} = \frac{1}{N}\sum_{i=1}^{N}\left[\frac{\frac{U^j_{i,s,t}}{T_{i,t}}}{std\left(\frac{U^j_{i,s,t}}{T_{i,t}}\right)}\right], \tag{1.2}$$

where $T_{i,t}$ stands for the total number of articles published by newspaper i at year t, and N represents the number of newspapers we selected.

Step 3: Finally, we normalize the variable $z^j_{s,t}$ described in expression (1.2) to a mean of 100 from 2001 to 2017.

$$TPU^j_{s,t} = \frac{100z^j_{s,t}}{\frac{1}{K}\sum_{k=1}^{K} z^j_{s,t}}, \tag{1.3}$$

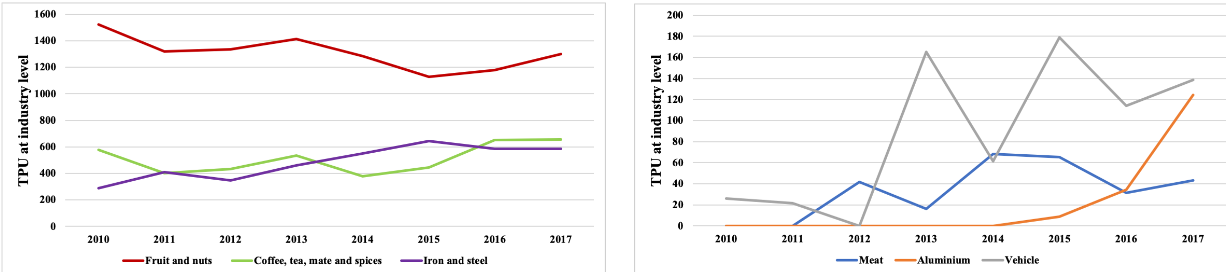
where K is the total number of observations included in our analysis.

Figure 1.2 shows the yearly evolution of the industry-specific TPU index ($TPU_{s,t}$) for six representative industries. The left-hand-side panel shows three industries ranked among the top ten highest U.S. TPU levels in 2001, 2010, and 2017. Two industries are part of the agricultural sector, which is the most protected sector across developed countries. In contrast, the third industry corresponds to Iron and Steel, subject to special trade protection mechanisms in four U.S. administrations during the last 40 years.[22] In this case, the steel industry TPU index shows an ascendant evolution from 2010 and beyond, culminating with the first year of the Trump administration.[23] On the other hand, the right-hand panel shows three industries with relatively low TPU. Notice that the U.S. applies very low MFN tariffs on automobiles and auto parts (2.5 percent) and aluminum (zero percent). The last U.S. trade special protection program for cars dates back to the 1980s when Japan agreed to control the quantity of vehicles exported to the U.S. These facts indicate that industry-level fixed effects should be an important element of our econometric strategy investigating the effects of TPU on trade flows.[24]

[22] More specifically, the Reagan and the George H. W. Bush administrations applied quantitative controls to U.S. imports of steel. In contrast, the George W. Bush administration applied 30 percent safeguard tariffs on steel products. See details in Devereaux, Lawrence, and Watkins (2006). Likewise, in March of 2018, the Trump administration then applied 25 percent tariffs on steel products.

[23] The iron and steel-specific TPU index rises from 289 to 586 during the 2010-2017 years.

[24] Notice that we follow the steps described in expressions (1.1)-(1.3) to calculate our TPU index to measure industry-specific uncertainty ($TPU_{s,t}$), bilateral-specific uncertainty (TPU^j_t), and the uncertainty relative to a particular year (TPU_t). We placed the specific formulas for these aggregations of the TPU index in



(a) 3 industries with initially high level of TPU after 2010

(b) 3 industries with initially low level of TPU after 2010

Figure 1.2: Examples of TPU index by industry over years

The maps in figure 1.3 report the country-level U.S. TPU index (TPU_t^j) for the 140 trading partners included in this study. The top panel describes the TPU levels in 2001 (the start year of our dataset), while the panel at the bottom focuses on 2017 (the end year). The comparison between the two panels suggests that the largest increases in U.S. TPU involve the three largest U.S. trade partners, namely, Canada, China, and Mexico. This finding matches well with the tone and topics that have been discussed during the 2016 U.S. presidential campaign when then-presidential candidate Donald Trump repeatedly threatened to withdraw the U.S. from NAFTA[25], and accused China of unfair commercial and trade practices. On the other side of the spectrum, the country with the largest drop in U.S. TPU was India, with a drop in this index of 75 percent. In this case, the nuclear tests carried out by India in 1998 heightened tensions between India and the U.S. This fact led the U.S. to impose economic and military sanctions on India that year. The tension between the two countries was alleviated during the early 2000s with India's support to the U.S. war on terror. These facts remind us that our empirical strategy to investigate the effects of TPU on trade flows needs to control for country-level fixed effects that vary across years.

Figure 1.4 shows the yearly evolution of the TPU index (TPU_t) from 2001 to 2017. The information in Figure 1.4 shows a significant degree of instability of this index before the financial crisis of 2008-2009. The index peaks in 2001 because of the September 11 terrorist

Appendix Section A.1.

[25]For one example of then-presidential candidate Donald Trump's threats to leave NAFTA see "https://www.reuters.com/article/us-usa-election/trump-vows-to-reopen-or-toss-nafta-pact-with-canada-and-mexico-idUSKCN0ZE0Z0."

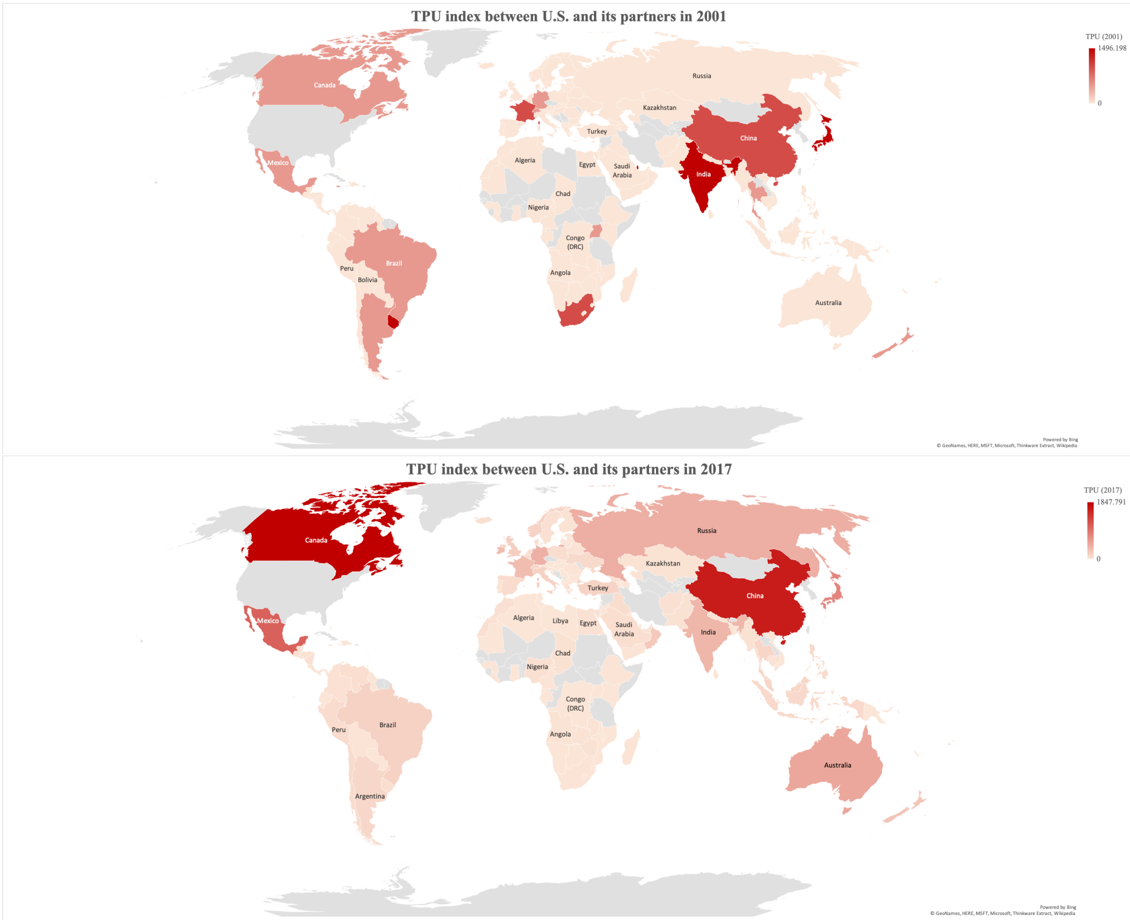


Figure 1.3: Change in TPU index at country-year level between 2001 and 2017

attacks and drastically falls during the following year. Likewise, it peaks again with the U.S. and its allies' invasion of Iraq in 2003 and significantly falls during the next two years. The index seems to increase considerably in 2006 and 2007 during the (first phase) commodity boom before the financial crisis. In this case, the increase in TPU is likely related to several governments' concerns with the rise in food prices and the temptation to use trade policy as a remedy.

Instead, Figure 1.4 suggests that the TPU index has remained stable at high levels during 2008-2010 and have consistently increased from 2010 onwards, peaking during the first year of U.S. President Donald Trump's administration. There are several economic and trade-related reasons for this specific trend. First, the fall in incomes due to the great recession renewed some calls for protectionist measures, which has certainly raised trade

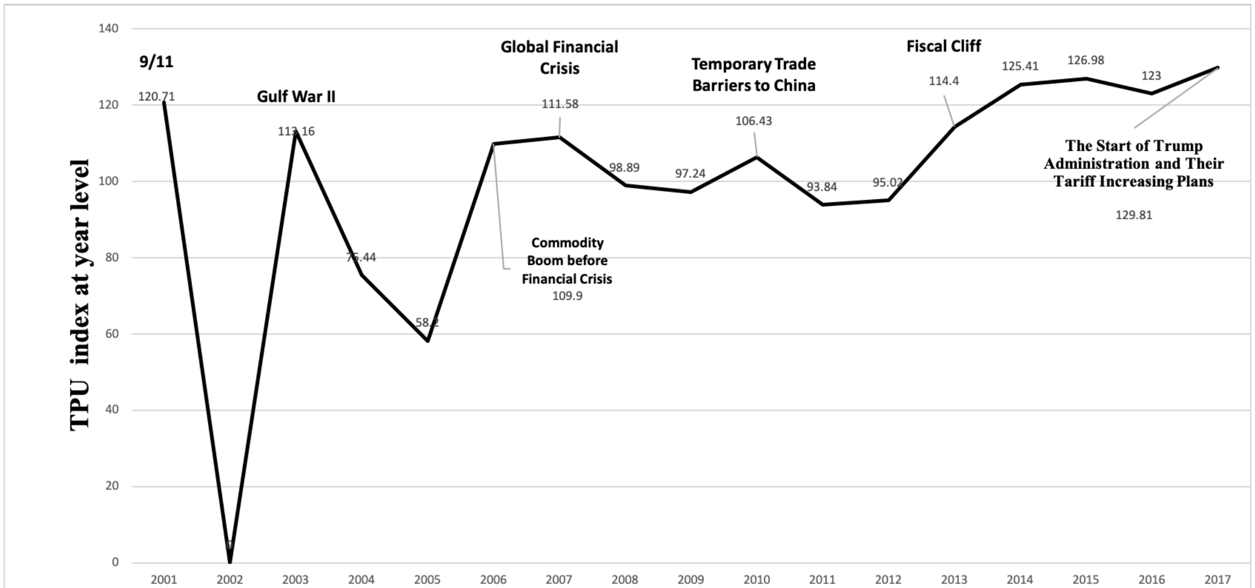


Figure 1.4: TPU by year from 2001 to 2017

policy uncertainty. However, notice that Kee, Neagu, and Nicita (2013) show that the level of protectionism worldwide has not increased much during the 2008-2009 years, except for some middle-income countries (e.g., Argentina). Second, the (second phase) commodity boom of 2008-2011 led many countries to be overly concerned with the rise of food prices in conjunction with stagnant or declining incomes. Giordani, Rocha, and Ruta (2017) show that export control measures adopted by some exporters of food products have led other exporters to impose additional export barriers while leading importers to decrease barriers to imports. This linked trade policy's net results have led to significant changes in world prices that have negatively affected all parties. It is certainly the case that these facts have increased U.S. TPU during that time frame given the important role played by the U.S. as an importer and exporter of different commodities. Third, the rise of China as a global economic power has also led the U.S. and other countries to consider protectionist measures. Bown (2019) details the increasing share of U.S. imports from China covered by temporary trade barriers (anti-dumping, countervailing, and safeguard duties) after 2008.

Table 1.2 shows summary statistics for the U.S. TPU index with different levels of aggregations. We have a total 126,517 measures of our main variable $TPU^{j}_{s,t}$, but we rely on a subset of it given that other parts of the dataset (tariff data) impose constraints to it. Moreover, we control for the lagged values of the TPU given that the effects of uncertainty may take sometime to affect the contracts related to imports and exports of products. It is clear from the information available in Table 1.2 that the data on TPU is a bit noisy as the standard deviation corresponds to multiple times the standardized average values. Moreover, it becomes noisier at more disaggregate levels. As such, one of our robustness tests consider binary variables of this variable to ascertain the role of uncertainty, while controlling for its distribution across our sample.

As explained in the Introduction, we also examine our baseline results by measuring the level of uncertainty following alternative approaches and information sources. In this regard, we measure our key uncertainty variable $TPU^j_{s,t}$ while relying on the uncertainty-related words used in Caldara et al. (2020). In this case, we continue using expressions (1.1)-(1.3) except that, in step 1, we use Caldara et al.'s (2020) words in capturing the frequency of uncertainty-related words to measure the binary variable $U_{q,i,t}$. Notice that our set of words capturing uncertainty have some words not included in theirs, although their set contains more variations of expressions related to uncertainty.[26] Table 1.2 shows that the index $TPU^j_{s,t}$ using Caldara et al.'s (2020) uncertainty-related words displays an even higher standard deviation than using our baseline words. Furthermore, Figure A.2 in the appendix compares the presence of uncertainty using our TPU approach across manufacturing sectors with Caldera et al.'s (2020) average TPU presence for three distinct years. Broadly speaking, these two indexes show a similar pattern and importance of trade policy-related uncertainty.[27]

Most of our results investigating the effects of TPU on U.S. trade flows rely on information

[26] The set of words related to uncertainty used in Caldara et al. (2020) is the following: "risk*," "threat*", "cautio*", "uncertain*", "propos*", "future", "worr*", "concern*", "volatil*", "tension*", "likel*", "probabil*", "possibil*", "chance*", "danger*", "fear*", "expect*", "potential*", "rumor*", and "prospect*".

[27] Notice that the index described in Figure 1 of Caldera et al. (2020) relies on TPU dummies at the firm-year level. These dummy variables take value 1 if the value of TPU is greater than 0 and 0 otherwise. They then average the TPU dummies across firms for each industry such that the averages range from 0 to 1. Following their approach, we create similar TPU dummies at the country-industry-year level and then take their average across countries by year. Notice that the TPU index generated by Caldara et al. (2020) covers a broader realm of industries, including both goods and services at the 3-digit of the NAICS. However, we only focus on trade in goods at the HS 2-digit level in this paper. We have then narrowed down our comparison to manufacturing industries, which seems the best match between our paper and theirs.

Table 1.2: Summary statistics.

	N	Mean	SD	Min	Max
TPU Indexes for Import					
TPU_t	17	100.000	31.914	0.000	129.811
TPU_{t-1}	16	98.137	31.991	0.000	126.979
TPU_t^j	2366	100.000	261.319	0.000	2343.643
TPU_{t-1}^j	2226	100.805	262.375	0.0000	2343.643
$TPU_{s,t}$	1649	100.000	290.503	0.000	1752.842
$TPU_{s,t-1}$	1552	98.765	288.690	0.000	1752.842
$TPU_{s,t}^j$	126517	100.000	3172.172	0.000	330722.700
$TPU_{s,t-1}^j$	109683	105.385	3342.543	0.000	330722.700
TPU indexs for Import based on Caldara's (2020) Uncertainty Terms					
TPU_t	17	100.000	29.515	0.000	125.902
TPU_{t-1}	16	101.152	30.085	0.000	125.902
TPU_t^j	2366	99.797	369.610	0.000	5932.784
TPU_{t-1}^j	2226	100.066	367.274	0.000	5932.784
$TPU_{s,t}$	1649	100.000	466.904	0.000	4008.571
$TPU_{s,t-1}$	1552	98.926	466.364	0.000	4008.571
$TPU_{s,t}^j$	126517	100.000	4463.941	0.000	682801.200
$TPU_{s,t-1}^j$	109683	104.035	4615.580	0.000	682801.200
TPU indexs for Import based on Import-Specific Terms					
TPU_t	17	100	34.169	0.000	131.892
TPU_{t-1}	16	98.290	34.530	0.000	131.892
TPU_t^j	2366	100.000	261.319	0.000	2343.643
TPU_{t-1}^j	2226	100.941	262.526	0.000	2343.643
$TPU_{s,t}$	1649	100.000	469.374	0.000	4686.592
$TPU_{s,t-1}$	1552	98.561	467.880	0.000	4686.592
$TPU_{s,t}^j$	126517	100.000	5663.774	0.000	1029547.000
$TPU_{s,t-1}^j$	109683	102.205	5857.580	0.000	1029547.000
TPU indexs for Export					
TPU_t	17	100.000	31.914	0.000	129.811
TPU_{t-1}	16	98.137	31.991	0.000	126.979
TPU_t^j	2375	100.081	277.403	0.000	2504.896
TPU_{t-1}^j	2235	100.426	268.901	0.000	2504.896
$TPU_{s,t}$	1649	100.000	290.503	0.000	1752.842
$TPU_{s,t-1}$	1552	98.765	288.690	0.000	1752.842
$TPU_{s,t}^j$	178924	100.000	3495.431	0.000	472755.700
$TPU_{s,t-1}^j$	159467	101.992	3634.76	0.000	472755.700
Import Tariffs					
$ln\tau_{s,t}^{us,j}$	122065	0.033	0.065	0.000	1.504
$ln\tau_{s,t}^j$	114144	0.521	0.808	0.000	18.278
Export Tariffs					
$ln\tau_{s,t}^{j,us}$	139826	0.079	0.095	0.000	3.295
$ln\tau_{s,t}^j$	148217	0.489	0.606	0.000	19.027
Trade Values					
Import Values (log)	126517	14.786	3.190	9.210	25.734
Export Values (log)	178924	14.543	2.886	9.210	24.674

published by U.S.-based newspapers. It is then important to measure our TPU index using newspapers based on important U.S. trade partners. This strategy allows us to verify whether our results for U.S. exports are robust to alternative foreign media outlets. Thus, we also measure our TPU index following steps 1-3 using articles published by media outlets in the three largest U.S. trade partners. In Mexico's case, we use information from the Yucatan Times, which began operations on December 4 of 2010, the Banderas News, which is Puerto Vallarta's liveliest website, and the Mexico News Daily, which was launched in June 2014 as a digital publication. For Canada, we rely on information from the Financial Post and the Maclean's. Notice that both outlets have been reliable information sources since the beginning of the 20th century. In China's case, we use information from China Daily, an English-language daily newspaper established in 1981 with the widest print circulation of any English-language newspaper in China, the official English-language website of China's news service (www.ecns.cn), and the newspaper the SHINE. Notice that the SHINE is powered by Shanghai Daily, which was launched in 1999, and is the largest English-language newspaper in East China.

1.2.2 Other Important Data

We have collected trade values and tariff information from UN Comtrade Database and the World Integrated Trade Solution (WITS), respectively. Our tariff data covers from January 2001 to December 2017, and it then is the main constraint we face to investigate the role of TPU on U.S. trade flows at the industry level. According to Table 1.2, the simple average U.S. MFN tariff ($\ln(1 + t_{s,t}^{us,j}) = \ln \tau_{s,t}^{us,j})$) is 3.3 log points, while the average MFN tariff faced by U.S. trade partners in other markets for similar goods ($\ln(1 + t_{s,t}^{j}) = \ln \tau_{s,t}^{j})$) is 52.1 log points.[28] In a nutshell, the simple average MFN tariff in the U.S. is much lower than in the rest of the world. Likewise, the average MFN tariff applied to U.S. exported products ($\ln(1 + t_{s,t}^{j,us}) = \ln \tau_{s,t}^{j,us})$) is 7.9 log points, but the same measure for U.S. trade partners in

[28]We aggregate U.S. MFN tariffs at the product level (6-digit of the HS) to the industry level (2-digit of the HS) by taking a simple average of the tariffs. Similar process is used to aggregate the MFN for other countries.

other market is 48.9 log points.[29] Thus, the principle of reciprocity seems to be at work here since the U.S. imposes lower multilateral tariffs on partners and U.S. products are also subject to lower multilateral tariffs.

Notice that the evolution of U.S. trade flows follows the patterns for TPU identified in the maps of Figure 1.3. Imports from China represented 9.3 percent of total U.S. imports in 2001, while they skyrocketed over the last two decades, turning that country into the major source of U.S. imports, representing 22.3 percent of total imports in 2017. On the other hand, U.S. imports from China displaced Canadian imports since the latter fell by 6 percentage points as a share of U.S. total imports. However, both countries represented the two main sources of U.S. imports in 2017 and, maybe not coincidently, present the highest U.S. TPU values. On the U.S. export side, China has also become an important destination for U.S. products growing from 3.3 percent to 8.6 percent of total exports between 2001 and 2017. Still, Canada, the E.U., and Mexico represent the main destination for U.S. goods with 18.7 percent, 13.4 percent, 16.1 percent of the total exports, respectively. China's minor role as a destination for U.S. exports is related to the bilateral trade imbalance between the two nations and represents an important point of friction between them.

Our analysis controls for other important variables such as the presence of a preferential trade agreement (PTA) and for the degree of market power of the importing economy. We construct a binary variable ($PTAMGN_{s,t}^{us,j}$) that equals one if the preference margin, i.e., difference between the U.S. MFN at the industry level and its preferential tariff ($\ln(1 + t_{s,t}^{prefus,j}) = \ln \tau_{s,t}^{prefus,j}$)), is greater than zero. Otherwise the value of this variable is zero. We also test for the degree of market access by setting the value of this variable to equal one if the preference margin is greater than two percentage points. This strategy follows Estevadeordal, Freund, and Ornelas (2008) that point out to the presence of compliance costs to obtain duty free status within PTAs. Likewise, we control for the presence of preferential access granted by U.S. trading partners to U.S. exporters following similar methodology.

[29]Still, the MFN tariffs applied by the U.S. are, on average, lower than MFN tariffs applied by trade partners on U.S. products. The Trump administration has raised this politically sensitive point. See White House's report on this issue at "https://www.whitehouse.gov/wp-content/uploads/2019/05/RTA-Report-Final-OTMP.pdf."

Our data about the presence of preferential trade between the U.S. and trading partners seem to follow well-established facts about the U.S. preferential programs. Countries that receive the largest preferential margins across industries are Guyana, Nepal, Jordan, Lesotho, Nicaragua. Notice that Jordan and Nicaragua have a Free Trade Area in place with the U.S., while Lesotho enjoys preferential access through the African Growth and Opportunity Act. At the industry level, the industries with greatest U.S. preferential margins are apparel and textiles (HS 62 and HS 63), tobacco and manufactured tobacco (HS 24), and oil seeds and oleaginous fruits (HS 12). For decades the U.S. apparel and textiles industry was subject to quantitative import controls through the Multifiber agreement. It is now protected by some of the highest tariffs (about 60 percent on average) on the U.S. tariff schedule.

The effects of TPU on U.S. exports may depend on the degree to which importers can affect international prices. For this reason, we expect that the effects of higher TPU may be more detrimental for U.S. exports if the importer has significant market power. Our data on market power across products (6-digit of the HS) and countries is provided by Nicita, Olarreaga, and Silva (2018). They estimate the rest of the world's elasticity of export supply faced by importers for 100 WTO members (counting the E.U. members as a single trade union). We use the inverse of this elasticity to measure market power at the product and country levels. In this case, we follow a two-step process. First, we use a trade-weighted average to aggregate these measures from the product level (6-digit of the HS) to the industry level (2-digit of the HS). These measures are noisy and policymakers prefer to categories rather continuous levels, as pointed out by Broda, Limão, and Weinstein (2008). Therefore, in the second step, we follow the literature by using binary variables that capture low and high market power levels using thresholds based on the market power distribution across countries and industries. More specifically, we test our results using the median ($PWR50_s^j$), the 67th ($PWR67_s^j$), and the 75th ($PWR50_s^j$) percentile of this distribution.[30]

[30]We also test whether the effects of U.S. TPU on U.S. trade flows vary according to some industry- and country-level characteristics. For instance, we consider the effects of TPU while controlling for the industry-level capital-labor ratio. The information for this measure across U.S. industries is obtained from the National Bureau of Economic Research. At the country level, we investigate the effects of TPU controlling for the capital-labor endowment, the share of high-skilled labor in the active economic population, and the degree of ethnic diversity. These variables are provided by Nunn (2007) and Nunn and Qian (2014). Other

1.3 Gravity Model

This section first develops our baseline model to predict U.S. imports and exports following Feenstra, Ma, and Xu (2019). Next, we consider extensions of this model by incorporating the intensive and extensive margins of trade and controlling for preferential trade access.

1.3.1 Baseline Specification

The structural gravity model used in Feenstra, Ma, and Xu (2019) shows that, under symmetric CES utility functions, U.S. imports ($Y_{s,v,t}^{us,j}$) of variety v from country j, originating in industry s at year t can be related to country i's imports of an identical product ($Y_{s,v,t}^{i,j}$) according to the following expression:

$$\frac{Y_{s,v,t}^{us,j}}{Y_{s,v,t}^{i,j}} = \left(\frac{m_{s,t}^{j} d^{us,j} \tau_{s,t}^{us,j}}{m_{s,t}^{j} d^{i,j} \tau_{s,t}^{i,j}} \right)^{1-\sigma} \frac{\left(P_{s,t}^{us}\right)^{\sigma-1} E_{s,t}^{us}}{\left(P_{s,t}^{i}\right)^{\sigma-1} E_{s,t}^{i}} \tag{1.4}$$

where we can cancel out county j's marginal costs in industry s, $m_{s,t}^{j}$. Notice that $P_{s,t}^{us}$ and $P_{s,t}^{i}$ represent the aggregate price index in industry s for the U.S. and country i, respectively, while $E_{s,t}^{us}$ and $E_{s,t}^{i}$ represent the total expenditure in industry s for these countries. Moreover, $d^{us,j}$ and $d^{i,j}$ stand for the distance between U.S. and country j and the distance between countries i and j, respectively. The MFN tariffs applied by the U.S. and by country i on varieties produced by industry s are labeled $\tau_{s,t}^{us,j}$ and $\tau_{s,t}^{i,j}$, respectively. At the same time, σ represents the elasticity of substitution among varieties of the same industry and is assumed to be greater than one.

We re-arrange equation (1.4) by multiplying both sides by $V_{s,t}^{j}$, which stands for the number of varieties produced by industry s located in country j. We can then sum across

typical gravity measures (e.g., common language) are downloaded from DATA.GOV. TPU interaction with these terms are mostly insignificant and are available upon request.

U.S. trading partners to obtain:

$$V^{j}_{s,t}Y^{us,j}_{s,v,t}\sum_{i\neq us}\left[\left(d^{i,j}\right)^{1-\sigma}\left(P^{i}_{s,t}\right)^{\sigma-1}E^{i}_{s,t}\right]=\left(d^{us,j}\tau^{us,j}_{s,t}\right)^{1-\sigma}\left(P^{us}_{s,t}\right)^{\sigma-1}E^{us}_{s,t}\sum_{i\neq us}\left[V^{j}_{s,t}Y^{i,j}_{s,v,t}\left(\tau^{i,j}_{s,t}\right)^{\sigma-1}\right] \tag{1.5}$$

Next, we multiply and divide the right-hand-side of expression (1.5) $\sum_{k\neq us}Y^{k,j}_{s,t}$. We can then solve for $Y^{us,j}_{s,t}$ (=$V^{j}_{s,t}Y^{us,j}_{s,v,t}$), which represents U.S. imports from country j in industry s at year t, and obtain the following expression:

$$Y^{us,j}_{s,t}=\left[\frac{(d^{us,j}\tau^{us,j}_{s,t})^{1-\sigma}\left(P^{us}_{s,t}\right)^{\sigma-1}E^{us}_{s,t}}{\sum_{i\neq us}(d^{i,j})^{1-\sigma}\left(P^{i}_{s,t}\right)^{\sigma-1}E^{i}_{s,t}}\right]\left(\sum_{k\neq us}Y^{k,j}_{s,t}\right)\sum_{i\neq us}\frac{Y^{i,j}_{s,t}}{\sum_{k\neq us}Y^{k,j}_{s,t}}\left(\tau^{i,j}_{s,t}\right)^{\sigma-1} \tag{1.6}$$

Following most of the literature, we rely on a log-linearized version of the gravity equation described by expression (1.6). We can then write our structural gravity equation for U.S. imports in the following manner:

$$lnY^{us,j}_{s,t}=\theta^{us}_{s,t}+\gamma^{j}_{t}+\lambda^{j}_{s}+\beta_1 ln\tau^{us,j}_{s,t}+\beta_2 ln\tau^{j}_{s,t}+\beta_3 ln\left(\sum_{k\neq us}Y^{k,j}_{s,t}\right)+\epsilon^{j}_{s,t} \tag{1.7}$$

In expression (1.7), the term $\theta^{us}_{s,t}$ represents a set of industry-year fixed effects, which absorb the aggregate price index $P^{us}_{s,t}$ and the total expenditure $E^{us}_{s,t}$. Likewise, the terms γ^{j}_{t} and λ^{j}_{s} stand for country-year and country-industry fixed effects that control for distance $d^{us,j}$ and any economic and political factors that affect imports at the country and industry levels. The variable $\tau^{us,j}_{s,t}$ represents the average U.S. MFN import tariff on products exported by industry s from exporter j at time t. The variable $\tau^{j}_{s,t}=\sum_{i\neq us}\frac{Y^{i,j}_{s,t}}{\sum_{k\neq us}Y^{k,j}_{s,t}}\left(\tau^{i,j}_{s,t}\right)^{\sigma-1}$ is a measure of the average MFN export tariffs that country j faces when exporting varieties originating in industry s to the rest of the world (i.e., excluding the U.S.).[31] This term captures a possible diversion of trade since higher tariffs in the rest of the world may increase U.S. imports, ceteris paribus. The term $\sum_{k\neq us}Y^{k,j}_{s,t}$ includes all the export values from country j to countries other than the U.S. The error term $\epsilon^{j}_{s,t}$ includes some unobserved factors, such

[31] Notice that Tables A.1 and A.2 in the appendix test our baseline models for imports and exports replacing MFN tariffs by bilateral tariffs, which reflect the application of preferential tariffs between PTA members.

as $-\ln\left[\sum_{i\neq us}(d^{i,j})^{1-\sigma}\left(P^{i}_{s,t}\right)^{\sigma-1}E^{i}_{s,t}\right]$.

We are interested in the impact of the TPU index generated from trade news (see expression (1.3)) on US imports based on the structural model discussed above and whose prediction can be converted into the estimable equation (1.7). Therefore, we include the TPU index as an additional determinant of trade flows as follows:

$$lnY^{us,j}_{s,t} = \theta^{us}_{s,t} + \gamma^{j}_{t} + \lambda^{j}_{s} + \beta_1 TPU^{j}_{s,t} + \beta_2 TPU^{j}_{s,t-1} + \beta_3 ln\tau^{us,j}_{s,t} + \beta_4 ln\tau^{j}_{s,t} + \beta_5 ln\left(\sum_{k\neq us} Y^{k,j}_{s,t}\right) + \epsilon^{j}_{s,t} \tag{1.8}$$

Notice that the estimation of equation (1.8) will rely on the concurrent and the lagged values of the TPU index in most specifications that we consider. It happens that the effects of TPU can affect contracts related to imports and exports with a temporal gap, and controlling for this lag can then be necessary, and our results show that this is the case. This approach is in line with Wanta and Hu (1993), who argue that news stories may have a strong agenda-setting impact, which, admittedly, seems to indicate the importance of intertemporal concerns relating the news to political and economic events.

We then expect that coefficients β_1 and β_2 in expression (1.8) are negative. Besides, it's worth noting that the coefficient β_3 in expression (1.8) equals $1-\sigma$, and therefore should be negative. The coefficient β_4 is expected to be positive since the higher the average export tariffs country j faces when exporting to other countries, the higher tends to be j's exports to the U.S. In this case, the idea is that country j will divert trade away from higher tariff locations. The coefficient β_5 is expected to be positive because it reflects country j's ability to compete in the international market.

We now turn to the derivation of an estimable equation for U.S. exports to a country j. In this case, the relationship between U.S. exports in industry s at time t to country j can be related to exports from country i by the following expression:

$$\frac{Y^{j,us}_{s,v,t}}{Y^{j,i}_{s,v,t}} = \left(\frac{m^{us}_{s,t}d^{us,j}\tau^{j,us}_{s,t}}{m^{i}_{s,t}d^{i,j}\tau^{j,i}_{s,t}}\right)^{1-\sigma} \tag{1.9}$$

where the ratio between $m^{us}_{s,t}$ and $m^{i}_{s,t}$ represents the relative marginal cost between the U.S. and country i in industry s at year t. We can manipulate expression (2.9) to write it in terms of U.S. exports $Y^{j,us}_{s,t}(= V^{us}_{s,t}Y^{j,us}_{s,v,t})$, and by log-linearizing this modified expression, we obtain the following equation for U.S. exports:

$$lnY^{j,us}_{s,t} = \theta^{us}_{s,t} + \gamma^{j}_{t} + \lambda^{j}_{s} + \beta_1 ln\tau^{j,us}_{s,t} + \beta_2 ln\tau^{j}_{s,t} + \beta_3 ln\left(\sum_{k\neq us} Y^{j,k}_{s,t}\right) + \epsilon^{j}_{s,t} \tag{1.10}$$

Equation (1.10) represents the export-equivalent of expression (1.7) for U.S. imports and its main explanatory variables then follow this pattern. Again, the term $\theta^{us}_{s,t}$ represents a set of industry-year fixed effects, while the terms γ^{j}_{t} and λ^{j}_{s} represent country-year and country-industry sets of fixed effects. The variable $\tau^{j,us}_{s,t}$ represents the average MFN import tariff imposed by country j on varieties of products exported by industry s based in the U.S. at year t, while $\tau^{j}_{s,t}{=}\sum_{i\neq us}\frac{Y^{j,i}_{s,t}}{\sum_{k\neq us}Y^{j,k}_{s,t}}\left(\tau^{j,i}_{s,t}\right)^{\sigma-1}$ stands for a measure of the average MFN import tariffs imposed by country j on varieties of goods from industry s originating in the rest of the world (i.e., excluding the U.S.). Likewise, the term $\sum_{k\neq us} Y^{j,k}_{s,t}$ represents country j's imports from countries other than the U.S.

As indicated above, we are mostly interested in investigating the effects of TPU on U.S. exports. Thus, we modify expression (1.10) by incorporating its concurrent and lagged values. Moreover, the U.S. economy exports to the vast majority of economies globally, and changes in these countries' trade policies affect it depending on their ability to change international prices. As such, we also modify expression (1.10) by controlling for the interaction between the TPU index and a binary measure that identifies countries and industries with significant levels of market power.

$$\begin{aligned} lnY^{j,us}_{s,t} \;=\;& \theta^{us}_{s,t} + \gamma^{j}_{t} + \lambda^{j}_{s} + \beta_1 TPU^{j}_{s,t} + \beta_2 TPU^{j}_{s,t-1} + \beta_3 TPU^{j}_{s,t} \times PWR67^{j}_{s} \\ & + \beta_4 TPU^{j}_{s,t-1} \times PWR67^{j}_{s} + \beta_5 ln\tau^{j,us}_{s,t} + \beta_6 ln\tau^{j}_{s,t} + \beta_7 ln\left(\sum_{k\neq us} Y^{j,k}_{s,t}\right) + \epsilon^{j}_{s,t} \end{aligned} \tag{1.11}$$

As discussed above, expression (1.11) controls for concurrent and lagged values of the TPU measure. Consequently, we also control for the interaction of these two variables with the binary variable that identifies countries and industries with low and high levels of market power ($PWR67_s^j$). Notice that our main results consider different threshold levels of market power to ensure that they are not sensitive to this binary variable's definition. Importantly, expression (1.11) does not control for the stand-alone value of the binary market power variable since the fixed effects at the country-industry level already control for it.

We expect that the coefficients β_1 and β_2 in expression (1.11) are insignificant since the effects of TPU for products where the importer has low market power should be muted. However, we then expect that coefficients β_3 and β_4 are negative since a high degree of market power tends to strengthen the negative effects of TPU on trade flows. Using previous arguments, we should find that β_5 is negative, β_6 is positive, and β_7 is positive.

1.3.2 Robustness Tests and Gravity

We consider numerous robustness tests to specifications (1.8) and (1.11). In this regard, we consider the robustness of the results by replacing MFN tariffs by bilateral tariffs that control for the presence of PTAs. Moreover, we investigate the effects of TPU on the margins of trade and consider the importance of controlling for the degree of preferential trade access in determining the effects of TPU on trade flows. Last, we consider modified versions of the TPU index by adding words to define the news related to trade policy and considering an alternative TPU index constructed with news from Canadian, Chinese, and Mexican newspapers. Below we discuss how we alter the baseline gravity model to account for the effects of trade margins and the preferential access margin.

Intensive and extensive margins of Trade

Hummels and Klenow (2005) show that trade flows between two countries can be decomposed into an intensive margin, an extensive margin, and the importer's total imports (from the world). The comprehensive set of fixed effects used in specifications (1.8) and (1.11) control for a country's total imports. Then, we investigate below the effects of TPU on U.S. trade flows' extensive and intensive margins. Specifically, we replace U.S. imports $lnY_{s,t}^{us,j}$ and exports $lnY_{s,t}^{j,us}$ with Hummels and Klenow's (2005) definitions of intensive and extensive margins of trade. We first follow Hummels and Klenow (2005) to measure the intensive margin for U.S. imports and exports as follows:

$$IM_{s,t}^{us,j} = \frac{\sum_{i \in S_{us,j}} Y_{it}^{us,j}}{\sum_{i \in S_{us,j}} Y_{it}^{us,ROW}} \qquad IM_{s,t}^{j,us} = \frac{\sum_{i \in S_{j,us}} Y_{it}^{j,us}}{\sum_{i \in S_{j,us}} Y_{it}^{j,ROW}} \tag{1.12}$$

where $IM_{s,t}^{us,j}$ ($IM_{s,t}^{j,us}$) represents the intensive margin for U.S. imports from (exports to) country j in industry s using products i in year t. In this case, $S_{us,j}$ ($S_{j,us}$) represents the set of 6-digit products in a 2-digit industry s where the U.S. imports from (exports to) country j in year t. Similarly, $Y_{it}^{us,j}$ ($Y_{it}^{j,us}$) stands for U.S. imports from (exports to) country j in the 6-digit product i. Instead, $Y_{it}^{us,ROW}$ ($Y_{it}^{j,ROW}$) represents U.S. (country j) imports from the rest of the world in product i.[32] As a result, the intensive margin focuses on country j's share of U.S. imports within the set of products exported by country j to the U.S. Notice that U.S. imports from country j in industry s at year t can be viewed as an unweighted version of the intensive margin of trade.

We can now focus on two alternative definitions of the extensive margin of trade. First, we consider an extensive margin of trade based on Debaere and Mostashari (2010). Second, we focus on constructing an extensive margin of trade based on Hummels and Klenow (2005). Beginning with the former approach, we define the extensive margin of trade based on the number of 6-digit products i in a 2-digit industry s imported (exported) by the U.S. from (to) country j, or equivalently, $EM_{s,t}^{us,j} = \sum_{i \in S_{us,j}} N_{it}^{us,j}$ ($EM_{s,t}^{j,us} = \sum_{i \in S_{j,us}} N_{it}^{j,us}$). Regarding Hummels and Klenow's (2005) definition of an extensive margin, we can construct it for U.S. imports and exports using the following formulas:

$$EM_{s,t}^{us,j} = \frac{\sum_{i \in S_{us,j}} Y_{it}^{us,ROW}}{\sum_{i \in S} Y_{it}^{us,ROW}} \qquad EM_{s,t}^{j,us} = \frac{\sum_{i \in S_{j,us}} Y_{it}^{j,ROW}}{\sum_{i \in S} Y_{it}^{j,ROW}} \tag{1.13}$$

where $EM_{s,t}^{us,j}$ ($EM_{s,t}^{j,us}$) represents the extensive margin for U.S. imports from (exports to) country j in industry s using products i in year t. Key differences concerning expressions

[32]Note that in expression (1.12), ROW in $IM_{s,t}^{us,j}$ excludes j, ROW in $IM_{s,t}^{j,us}$ excludes U.S.

(1.12) are that trade flows with the world are used in the numerator, while the denominator controls for the set of all goods exported by the ROW to the U.S. (country j).[33] Thus, expressions (1.13) represent the share of products exported by country j (the U.S.) to the U.S. (country j) using as weights the importance of each product exported by the ROW to the U.S. (country j).[34]

To consider the effects of TPU on the margins of trade, we replace the dependent variables in expressions (1.8) and (1.11) by the log of the margins of trade described in equations (1.12) and (1.13) and can then obtain:

$$lnIM_{s,t}^{us,j} = \theta_{s,t} + \gamma_t^j + \lambda_s^j + \beta_1 TPU_{s,t}^j + \beta_2 TPU_{st-1}^j + \beta_3 ln\tau_{s,t}^{us,j} + \beta_4 ln\tau_{s,t}^j + \beta_5 ln\left(\sum_{k\neq us} Y_{s,t}^{k,j}\right) + \epsilon_{s,t}^j \tag{1.14}$$

$$\begin{aligned} lnIM_{s,t}^{j,us} = {} & \theta_{s,t} + \gamma_t^j + \lambda_s^j + \beta_1 TPU_{s,t}^j + \beta_2 TPU_{s,t-1}^j + \beta_3 TPU_{s,t}^j \times PWR67_s^j \\ & + \beta_4 TPU_{s,t-1}^j \times PWR67_s^j + \beta_5 ln\tau_{s,t}^{j,us} + \beta_6 ln\tau_{s,t}^j + \beta_7 ln\left(\sum_{k\neq us} Y_{s,t}^{j,k}\right) + \epsilon_{s,t}^j \end{aligned} \tag{1.15}$$

and similarly for the measures of extensive margin we have the following expressions:

$$lnEM_{s,t}^{us,j} = \theta_{s,t} + \gamma_t^j + \lambda_s^j + \beta_1 TPU_{s,t}^j + \beta_2 TPU_{st-1}^j + \beta_3 ln\tau_{s,t}^{us,j} + \beta_4 ln\tau_{s,t}^j + \beta_5 ln\left(\sum_{k\neq us} Y_{s,t}^{k,j}\right) + \epsilon_{s,t}^j \tag{1.16}$$

$$\begin{aligned} lnEM_{s,t}^{j,us} = {} & \theta_{s,t} + \gamma_t^j + \lambda_s^j + \beta_1 TPU_{s,t}^j + \beta_2 TPU_{s,t-1}^j + \beta_3 TPU_{s,t}^j \times PWR67_s^j \\ & + \beta_4 TPU_{s,t-1}^j \times PWR67_s^j + \beta_5 ln\tau_{s,t}^{j,us} + \beta_6 ln\tau_{s,t}^j + \beta_7 ln\left(\sum_{k\neq us} Y_{s,t}^{j,k}\right) + \epsilon_{s,t}^j \end{aligned} \tag{1.17}$$

[33] Notice that the ROW in the left-hand side expression of (1.13) excludes country j, while the ROW in the right-hand side expression excludes the U.S.

[34] As discussed above, notice that expressions (1.12) and (1.13) yield that $IM_{s,t}^{us,j} \times EM_{s,t}^{us,j} = \frac{Y_{s,t}^{us,j}}{\sum_{i\in S} Y_{it}^{US,ROW}}$. We can take the log on both sides and rearranging we get $lnY_{s,t}^{us,j} = lnIM_{s,t}^{us,j} + lnEM_{s,t}^{us,j} + ln(\sum_{i\in S} Y_{it}^{us,ROW})$.

TPU interacts with preference margin

As indicated in the introduction, trade agreements may assist members by promoting cooperation and increasing trade policies' predictability over time. Suppose WTO members decide to deepen their relations further by forming a PTA. In that case, this strategy presumably suggests that these additional rules should ensure members that their bilateral trade policy is less likely to change than their policy towards other WTO members. For instance, as part of the negotiations that led to the approval of the USMCA, Mexico received guarantees that its access to the U.S. automotive market would not change even if that country decides to impose additional tariffs on imports of cars from other WTO members. This strategy then implies that PTA formation can provide insurance against the effects of TPU.[35]

We then aim to measure the insurance effect represented by the presence of a PTA by constructing dummy variables that control for the presence of preferential access. First, we calculate the preference margin by taking the difference between the log of the average MFN and the log of average preferential tariff in industry s in year t applied by U.S. (country j) on imports from j (U.S.). Second, we then convert it into a binary variable, which takes on the value of one when the preference margin is greater than zero, and its value is zero otherwise. We label it $PTAMGN_{s,t}^{us,j}$ ($PTAMGN_{s,t}^{j,us}$) . Moreover, we create an additional binary variable that equals one if the preference margin is at least two percentage points, and its value is zero otherwise. In this case, we label it $PTAMGN2_{s,t}^{us,j}$ ($PTAMGN2_{s,t}^{j,us}$). Lastly, we include the variable $PTAMGN_{s,t}^{j}$ ($PTAMGN2_{s,t}^{j}$) that equals 1 if country j receives preferential access from another country (that is greater than 2 percentage points) in industry s at year t, and equals 0 otherwise. Intuitively, the interaction of the presence of positive preference margin and TPU is supposed to mitigate the effects of TPU on trade.

[35]See side letter sent by the United States Trade Representative's office to its Mexican counterpart at "https://ustr.gov/sites/default/files/files/agreements/FTA/USMCA/Text/MX-US_Side_Letter_on_232.pdf".

Thus, we modify our expressions (1.8) and (1.11) by incorporating this interaction as follows:

$$
\begin{aligned}
lnY_{s,t}^{us,j} &= \theta_{s,t} + \gamma_t^j + \lambda_s^j + \beta_1 TPU_{s,t-1}^j + \beta_2 PTAMGN_{s,t}^{us,j} + \beta_3 TPU_{s,t-1}^j \times PTAMGN_{s,t}^{us,j} \\
&+ \beta_4 PTAMGN_{s,t}^j + \beta_5 TPU_{s,t-1}^j \times PTAMGN_{s,t}^j + \beta_6 ln\tau_{s,t}^{us,j} + \beta_7 ln\tau_{s,t}^j \\
&+ \beta_8 ln\left(\sum_{k\neq us} Y_{s,t}^{k,j}\right) + \epsilon_{s,t}^j, \qquad (1.18)
\end{aligned}
$$

where we expect that β_1 is negative since TPU may have a deleterious effect on bilateral trade. On the other hand, we expect that β_2, β_3, and β_4 are positive since preferential access promotes bilateral trade and may provide insurance against TPU.

In the case of U.S. exports we have,

$$
\begin{aligned}
lnY_{s,t}^{j,us} &= \theta_{s,t} + \gamma_t^j + \lambda_s^j + \beta_1 TPU_{s,t-1}^j + \beta_2 PTAMGN_{s,t}^{j,us} + \beta_3 TPU_{s,t-1}^j \times PTAMGN_{s,t}^{j,us} \\
&+ \beta_4 TPU_{s,t-1}^j \times PWR67_s^j + \beta_5 TPU_{s,t-1}^j \times PTAMGN_{s,t}^{j,us} \times PWR67_s^j \\
&+ \beta_6 PTAMGN_{s,t}^{j,us} \times PWR67_s^j + \beta_7 ln\tau_{s,t}^{j,us} \\
&+ \beta_8 ln\tau_{s,t}^j + \beta_9 ln\left(\sum_{k\neq us} Y_{s,t}^{j,k}\right) + \epsilon_{s,t}^j \qquad (1.19)
\end{aligned}
$$

where we expect that β_1 and β_3 are insignificant since changes in trade policy for goods where the importer has low market power should not affect U.S. exports. Moreover, we expect that β_2 is positive using the same rationale applied for this variable in expression (1.18). However, we expect that β_4 is negative since changes in trade policy where the importer has high market power negatively affect U.S. exports. On the other hand, we expect that β_5 is positive since preferential access mitigates the effects of uncertainty under high levels of market power.

1.4 Estimation Results

We split our discussion of econometric results by first focusing on the findings related to U.S. imports. Next, we discuss the effects of TPU on U.S. exports. We dedicate an appendix to describing further robustness tests involving U.S. imports and exports.

1.4.1 Results on U.S. Imports

We now turn to our estimation results and first discuss the estimation of our baseline expression (1.8), which investigates the effects of U.S. TPU on U.S. imports. Table 1.3 reports the results. As we move from column (1) to column (5), we add explanatory variables one at a time, and, therefore, our baseline specification corresponds to column (5), which matches the explanatory variables described in expression (1.8). Notice that our concurrent and lagged measures of TPU are scaled by 0.0001. As indicated at the bottom of Table 1.3, all specifications control for country-year, industry-year, and country-industry fixed effects. Column (1) reports the estimated effect of $TPU^j_{s,t}$ on U.S. imports. The coefficient of $TPU^j_{s,t}$ is -0.016, and it is statistically significant at the 10% level. This result suggests that, a one-standard-deviation increase in this variable, is associated with an average decrease of 0.51 (-0.016 $\times$ 3172 (S.D. of $TPU^j_{s,t}$) $\times$ 0.0001 $\times$ 100 %) percent in U.S. imports.

Table 1.3: Structural model estimation (Import).

	Dependent Variable: US Import Value (log)				
	(1)	(2)	(3)	(4)	(5)
$TPU^j_{s,t}$	-0.016*	-0.016*	-0.016*	-0.017*	-0.016*
	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)
$TPU^j_{s,t-1}$		-0.019**	-0.019**	-0.019**	-0.019**
		(0.008)	(0.008)	(0.008)	(0.008)
$ln\tau^{us,j}_{s,t}$			-1.164***	-1.168***	-0.944***
			(0.113)	(0.113)	(0.107)
$ln\tau^j_{s,t}$				0.012**	0.010*
				(0.006)	(0.006)
$ln\left(\sum_{k\neq us} Y^{k,j}_{s,t}\right)$					0.613***
					(0.006)
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry-country fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	15.335***	15.336***	15.375***	15.369***	4.055***
	(0.003)	(0.003)	(0.005)	(0.005)	(0.116)
Observations	98,963	98,963	98,963	98,963	98,963
R-squared	0.935	0.935	0.936	0.936	0.942

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001

The specification used in column (2) adds the one-year lagged value of uncertainty ($TPU^j_{s,t-1}$) to the regression. The results in column (2) indicate that the coefficients of the concurrent and lagged values of TPU are negative and statistically significant. These results suggest that a one-standard-deviation increase in current and lagged TPU leads to a 0.51 percent and 0.63 (-0.019 × 3342 (S.D. of $TPU^j_{s,t-1}$) × 0.0001 × 100 %) percent decrease in U.S. imports, respectively. Adding up the effects of concurrent and lagged TPU values then suggests a total 1.14 percent decline in U.S. imports. The results in columns (3) - (5) show that including additional variables do not alter the total effect of TPU on U.S. imports. Moreover, the results confirm our expectations discussed in Section 3.1. More specifically, the specification used in column (3) adds the tariff imposed by the U.S. on country j ($ln\tau^{us,j}_{s,t}$). Its coefficient is -1.164, has the expected negative sign, and is statistically significant. Moreover, the specification used in column (4) adds the average export tariff country j faces when exporting goods to the rest of the world (i.e., excluding the U.S. ($ln\tau^j_{s,t}$)). The results suggest that this variable positively affects U.S. imports, confirming then our expectations that exporters divert their sales away from higher tariff markets. Finally, the specification in column (5) adds country j's exports to the rest of the world in a particular industry ($ln\left(\sum_{k\neq us} Y^{j,k}_{s,t}\right)$). In line with our discussion in Section 3.1, this variable's coefficient is positive since it shows how competitive that country is in this particular industry. The results in column (5) confirm our expectations regarding specification (1.8), and we use it below as our baseline model.[36][37]

Our baseline results and general strategy are useful and can be applied to alternative relevant economic scenarios. For instance, Figure 1.3 reveals the striking contrast in the evolution of U.S. TPU towards China and the E.U. In this case, it is clear that U.S. TPU relative to China (E.U.) rises (falls) from 2001 to 2017. An interesting question is how an

[36] We also perform a robustness test for columns (1) through (5) by replacing the MFN tariffs with the minimum between them and preferential tariffs. These changes affect terms $ln\tau^{us,j}_{s,t}$ and $ln\tau^j_{s,t}$ in specification (1.8). Table A.1 in the Appendix reports the results, and it is then clear that using preferential tariffs does not affect the main conclusions derived from Table 1.3.

[37] Another robustness test for columns (1) through (5) is replacing the concurrent and the lagged values of TPU index with binary variables where it equals 1 when the index is positive and 0 otherwise. Table A.3 in the Appendix reports the results which are consistent with our conclusions derived from Table 1.3.

increase in TPU from the E.U.'s to China's level would affect (on average) U.S. imports. Figure A.1 in the appendix shows that the U.S. TPU gap between these two important trade partners has increased in the early 2000s and remained reasonably stable since the great recession. The average TPU gap since then has fluctuated around 1500 points. The evolution in this TPU gap is consistent with the intensification of the trade relationship between China and the U.S. discussed in the Introduction section. Our baseline results suggest that an increase in the average TPU by 1500 points would decrease U.S. imports, on average, by 0.53 percent $((0.016+0.019)\times 1500 \times 0.01)$, representing an economically meaningful number in line with our baseline analysis.

As discussed in Section 3.2, the drivers of bilateral trade at the industry level can affect imports through the intensive and the extensive margins. In Table 1.4, we rely on the estimation of specifications (1.14) and (1.16) to investigate how TPU affects the intensive and extensive margins of U.S. bilateral imports. The specification used in column (1) shows the estimation of specification (1.8), which corresponds to our baseline specification, whose results are found in column (5) of Table 1.3. Notice that bilateral imports can be interpreted as the unweighted intensive margin of trade, which can be seen by inspecting the numerator of expression (1.12) for U.S. imports. Instead, the specification used in column (2) corresponds to expression (1.14), which uses Hummels and Klenow's (2005) definition of intensive margin of trade (see expression (1.12)). In column (3), we find the results of the estimation of expression (1.16) where the dependant variable uses Debaere and Mostashari's (2010) definition of the extensive margin of trade. However, column (4) shows the estimation of expression (1.16) using instead the definition of extensive margin described in Hummels and Klenow (2005).

A comparison of the results shown in columns (1) and (2) of Table 1.4 reveals that our baseline results are driven by the interplay between U.S. TPU and the intensive margin of trade. This fact is true since the coefficients of the concurrent and lagged values of TPU in column (2) are negative, and their summation is statistically identical to the summation of these coefficients found in column 1. Moreover, the results shown in columns (3) and (4) make it clear that both the concurrent and lagged values of TPU have no statistically

Table 1.4: TPU and margins of trade (Import).

	Dependent Variable			
	$IM^j_{s,t}(1)$	$IM^j_{s,t}(2)$	$EM^j_{s,t}(1)$	$EM^j_{s,t}(2)$
	(1)	(2)	(3)	(4)
$TPU^j_{s,t}$	-0.016*	-0.012	0.002	-0.004
	(0.008)	(0.011)	(0.003)	(0.009)
$TPU^j_{s,t-1}$	-0.019**	-0.025**	0.004	0.008
	(0.008)	(0.010)	(0.003)	(0.008)
$ln\tau^{us,j}_{s,t}$	-0.944***	-0.838***	0.125**	-0.184
	(0.107)	(0.141)	(0.044)	(0.112)
$ln\tau^{j}_{s,t}$	0.010*	-0.000	-0.000	0.011*
	(0.006)	(0.007)	(0.002)	(0.006)
$ln\left(\sum_{k\neq us} Y^{k,j}_{s,t}\right)$	0.613***	-0.228***	0.102***	-0.109***
	(0.006)	(0.008)	(0.003)	(0.007)
Industry-year fixed effects	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes
Industry-country-year fixed effects	Yes	Yes	Yes	Yes
Constant	4.055***	2.320***	-0.041	1.136***
	(0.116)	(0.158)	(0.048)	(0.126)
Observations	98,963	95,553	98,963	95,553
R-squared	0.942	0.785	0.945	0.688

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) The superscripts "us,j" and "k,j" are used for both imports and exports
(5) $IM^j_{s,t}(1)$ is log of US imports
(6) $IM^j_{s,t}(2)$ is log of intensive margin constructed by Hummels and Klenow (2005)
(7) $EM^j_{s,t}(1)$ is the log of number of HS 6-digit products in 2-digit industry
(8) $EM^j_{s,t}(2)$ is the log of extensive margin (Hummels and Klenow, 2005)

significant effects on the extensive margin of trade. As such, the message behind the results shown in columns (1)-(4) is that U.S. TPU affects U.S. imports by altering the intensive margin of trade. A rationale for this result is that a decrease in U.S. TPU leads to changes in exporters' investment decisions. In this case, as TPU decreases, that leads more exporters to update the technology used in their production processes.[38]

The presence of PTAs is an essential feature of the international economy's landscape. Section 3.2 suggests that these agreements may serve the purpose of deepening economic ties and offering additional assurances that bilateral trade policy will not change between member countries. We then investigate this issue by estimating expression (1.18), which controls for the presence of preferential access given by the U.S. to trade partners. The results of the

[38] Bustos (2011) shows that decreases in trade costs may lead firms to upgrade their technology, which increases export levels and reduce export prices (FOB). In the context of uncertainty, Handley and Limão (2017) explain that the reduction in U.S. TPU towards China caused exporters based in that country to upgrade their technology, increasing firm export levels (internal margin).

estimation of expression (1.18) can be found in Table 1.5. More specifically, column (1) defines the binary variable $PTAMGN^{us,j}_{s,t}$ to equal 1 if the U.S. MFN tariff is greater than the preferential tariff, while column (2) controls for the presence of U.S. preference margins equal or greater than 2 percentage points ($PTAMGN2^{us,j}_{s,t}$).

Table 1.5: TPU and preference margins (Import).

	Independent variable: US import value (log)					
	(1)	(2)	(3)	(4)	(5)	(6)
$TPU^{j}_{s,t-1}$	-0.030***	-0.023***	-0.036***	-0.035***	-0.036***	-0.035***
	(0.008)	(0.008)	(0.011)	(0.011)	(0.011)	(0.011)
$TPU^{j}_{st-1} \times PTAMGN^{us,j}_{s,t}$	0.057***		0.048**	0.050***		
	(0.019)		(0.021)	(0.021)		
$PTAMGN^{us,j}_{s,t}$	0.058***		0.058***	0.058***		
	(0.013)		(0.013)	(0.013)		
$TPU^{j}_{st-1} \times PTAMGN2^{us,j}_{s,t}$		0.055**			0.042	0.043
		(0.028)			(0.029)	(0.029)
$PTAMGN2^{us,j}_{s,t}$		0.030**			0.030**	0.030**
		(0.014)			(0.014)	(0.014)
$TPU^{j}_{st-1} \times PTAMGN^{j}_{s,t}$			0.015		0.026	
			(0.017)		(0.016)	
$PTAMGN^{j}_{s,t}$			0.011		0.011	
			(0.008)		(0.008)	
$TPU^{j}_{st-1} \times PTAMGN2^{j}_{s,t}$				0.013		0.024
				(0.017)		(0.016)
$PTAMGN2^{j}_{s,t}$				0.009		0.009
				(0.008)		(0.008)
$ln\tau^{us,j}_{s,t}$	-0.961***	-0.956***	-0.962***	-0.961***	-0.957***	-0.957***
	(0.107)	(0.107)	(0.107)	(0.107)	(0.107)	(0.107)
$ln\tau^{j}_{s,t}$	0.010*	0.010*	0.010*	0.010*	0.009*	0.009*
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$ln\left(\sum_{k\neq us} Y^{k,j}_{s,t}\right)$	0.612***	0.612***	0.612***	0.612***	0.612***	0.612***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry-country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.059***	4.055***	4.058***	4.059***	4.055***	4.055***
	(0.116)	(0.116)	(0.116)	(0.116)	(0.116)	(0.116)
Observations	98,963	98,963	98,963	98,963	98,963	98,963
R-squared	0.942	0.942	0.942	0.942	0.942	0.942

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) $PTAMGN^{us,j}_{s,t}$ is 1 if $\text{MFN}^{us,j}_{s,t}$ > Preferential $\text{Tariff}^{us,j}_{s,t}$ and 0 otherwise
(5) $PTAMGN2^{us,j}_{s,t}$ is 1 if $\text{MFN}^{us,j}_{s,t}$ > Preferential $\text{Tariff}^{us,j}_{s,t}$ by 2 percentage points and 0 otherwise
(6) $PTAMGN^{j}_{s,t}$ is 1 if $\text{MFN}^{j}_{s,t}$ > Preferential $\text{Tariff}^{j}_{s,t}$ and 0 otherwise
(7) $PTAMGN2^{j}_{s,t}$ is 1 if $\text{MFN}^{j}_{s,t}$ > Preferential $\text{Tariff}^{j}_{s,t}$ by 2 percentage points and 0 otherwise
(8) The superscripts "us,j" means US imports from country j and "k,j" means non-US country k imports from j

The results shown in these two columns confirm that PTAs promote bilateral trade and, importantly, serve as insurance against the effects of TPU given that the interaction between the one-year lagged value of TPU and the variable $PTAMGN_{s,t}^{us,j}$ is positive and significant. Using the results from column (1), we conclude that a one-standard-deviation increase in TPU tends to increase U.S. imports, on average, by 0.9 percent ($0.027 \times 3342 \times 0.0001 \times 100$) for goods that receive preferential access. However, a Wald test for the sum of the coefficients of the one-year lagged TPU and its interaction with $PTAMGN_{s,t}^{us,j}$ yields that it is not different from zero. In comparison, it decreases U.S. imports by roughly 1 percent ($-0.03 \times 3342 \times 0.0001 \times 100$) for goods that do not receive preferential access. The results shown in column (2) suggests that the presence of large preferential margins also provides cover against the effects of TPU. However, the Wald test of the sum of the one-year lagged TPU and its interaction with $PTAMGN2_{s,t}^{us,j}$ suggests that the TPU effect is not statistically different from zero for countries that receive large preferential margins to assess the U.S. markets. In sum, the formation of PTAs tends to eliminate the deleterious effects of TPU on U.S. imports.[39]

The specifications in columns (3)-(6) of Table 1.5 additionally control for preferences received by the U.S. trade partner j in the ROW (i.e., all partners except the U.S.). In this case, the variable $PTAMGN_{s,t}^{j}$ equals 1 if country j receives preferential access from another country in industry s at year t and equals 0 otherwise. Instead, the variable $PTAMGN2_{s,t}^{j}$ equals 1 if the preference margin received by country j from other countries is greater than 2 percentage points. The results in these columns confirm the results found in columns (1) and (2), i.e., preferences granted by the U.S. tend to boost U.S. imports and tend to counter the negative effects of TPU on imports. Moreover, they show that U.S. imports are not affected by preferential access granted to country j in the ROW, regardless of the size of preferences received by country j's exporters. The other predictions suggested by specification (1.18)

[39] Prusa and Teh (2010) explain that the formation of PTAs either rule out or significantly constraint the use of temporary trade barriers (Anti-dumping duties, countervailing duties, and safeguard measures) across member countries relative to the WTO negotiations. These agreements then decrease uncertainty relative to applying these measures as well. Tabakis and Zanardi (2019) show that, by constraining the use of these temporary trade protection between members, PTA formation also leads to fewer applications of these tools against non-member countries.

regarding the effects of tariffs and country j's exports to other countries are also confirmed by the results shown in Table 1.5.

Section 2.1 explains how we construct our TPU index based on uncertainty-related terms (see Step 1). For comparison purposes, we follow the same steps detailed in that section while relying on the uncertainty words selected by Caldara et al. (2020). The estimation results using this alternative approach can be found in Table 1.6. The specifications used in columns (1)-(5) follow the same sequence of specifications used in Table 1.3. In this case, column (1) relies on the most parsimonious model where we only control for the concurrent TPU index, and we continuously increase the number of control variables until we reach column (5), where we estimate expression (1.8). The results shown in Table 1.6 are broadly consistent with the results found in Table 1.3. However, the results show a smaller effect of TPU on U.S. imports. In this case, we conclude that a one-standard-deviation increase in TPU leads to a 0.6 percent (-0.013 $\times$ 4615 $\times$ 0.0001 $\times$ 100) decline in U.S. imports according to column (5). This alternative TPU measure confirms the robustness of our results.

We also test our main specification outlined in expression (1.8) while constructing our TPU index controlling for terms related to imports. In this case, our variable $U^j_{i,s,t}$, which is outlined in Step 1 of Section 2.1, also includes a binary variable that indicates the presence of the word "import/imports" in conjunction with a combination of words such as "quota" and "change," "quota" and "decrease," or "quota" and "reduce." The results using this alternative TPU index can be found in Table 1.7. Again, we use specifications that mimic the ones used in Table 1.3. In this case, we focus our analysis on the more comprehensive specification used in column 5. The results suggest that both concurrent and one-year lagged TPUs are important in determining U.S. imports. More specifically, we find that a one-standard-deviation increase in the concurrent and one-year lagged TPU leads to a total decrease in U.S. imports of 1.38 percent. Again, these results confirm the plausibility of our original TPU index to changes to its implementation design.

Table 1.6: TPU based on Caldara et al.'s (2020) words (Import).

	Dependent Variable: US Import Value (log)				
	(1)	(2)	(3)	(4)	(5)
$TPU^j_{s,t}$	-0.004	-0.005	-0.005	-0.005	-0.004
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$TPU^j_{s,t-1}$		-0.013**	-0.013**	-0.013**	-0.013**
		(0.006)	(0.006)	(0.006)	(0.006)
$ln\tau^{us,j}_{s,t}$			-1.164***	-1.168***	-0.944***
			(0.113)	(0.113)	(0.107)
$ln\tau^{j}_{s,t}$				0.012**	0.010*
				(0.006)	(0.006)
$ln\left(\sum_{k\neq us} Y^{k,j}_{s,t}\right)$					0.613***
					(0.006)
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry-country fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	15.335***	15.335***	15.375***	15.368***	4.055***
	(0.003)	(0.003)	(0.005)	(0.005)	(0.116)
Observations	98,963	98,963	98,963	98,963	98,963
R-squared	0.935	0.935	0.936	0.936	0.942

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001

1.4.2 Results on U.S. Exports

We can now focus on the effects of U.S. TPU on U.S. exports. In this case, two main concerns drive our analysis. First, the U.S. economy is the largest and one of the largest exporters globally, implying that it is economically powerful and deals with many importers with shockingly different levels of market power. We define market power as the inverse of the rest-of-the-world's export supply elasticity faced by the importer, which is a common measure in the literature. It captures the importing country's ability to improve its terms of trade by imposing a tariff. As detailed in Nicita, Olarreaga, and Silva (2018), the U.S. and the E.U. are the most powerful economic entities in the world, followed by Japan and China. On the other hand, the degree of market power of many developing and developed economies dwarfs the U.S. by at least an order of magnitude. As such, the effects of TPU on U.S. exports should depend on how powerful the importing economy is and should have

Table 1.7: TPU based on import-related words (Import).

	Dependent Variable: US Import Value (log)				
	(1)	(2)	(3)	(4)	(5)
$TPU^{j}_{s,t}$	-0.010**	-0.011**	-0.011**	-0.011**	-0.010**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)
$TPU^{j}_{s,t-1}$		-0.015***	-0.015***	-0.015***	-0.014***
		(0.005)	(0.005)	(0.005)	(0.004)
$ln\tau^{us,j}_{s,t}$			-1.165***	-1.168***	-0.944***
			(0.113)	(0.113)	(0.107)
$ln\tau^{j}_{s,t}$				0.012**	0.010*
				(0.006)	(0.006)
$ln\left(\sum_{k\neq us} Y^{k,j}_{s,t}\right)$					0.613***
					(0.006)
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry-country fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	15.335***	15.336***	15.375***	15.369***	4.056***
	(0.003)	(0.003)	(0.005)	(0.005)	(0.116)
Observations	98,963	98,963	98,963	98,963	98,963
R-squared	0.935	0.935	0.936	0.936	0.942

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001

a petite or negligent effect for importers with low levels of market power.

Second, the effects of TPU on U.S. exports may depend on the degree of economic uncertainty more generally. The adverse economic shocks produced by the great recession of 2008-2010 have left many governments concerned about sudden changes in their citizens' income levels. The remarkably large and heterodox responses from many governments in all parts of the world are a testament to it.[40] As we consider the effects of TPU on U.S. exports, it may then become important to account for this inflection point represented by the great recession, where the effects of TPU uncertainty may have been magnified.

We consider these important points as we estimate our structural gravity equation for

[40]For instance, the European System of Central Banks (ECB) had assets of 1.5 trillion Euros in 2006, which ballooned to 4.5 trillion Euros in 2017. In particular, the ECB's holdings of securities issued by the E.U. residents skyrocketed from 143 million euros to more than 2.66 trillion euros during that period, which clarifies the unprecedented degree of economic support offered by monetary and fiscal policymakers after 2006. Find details at "https://www.ecb.europa.eu/pub/annual/balance/html/index.en.html"

U.S. exports outlined in expression (1.11). The estimation results can be found in Table 1.8. The specification used in column (1) of Table 1.8 uses our entire sample and does not control for the binary variable indicating high levels of market power ($PWR67_s^j$ and $PWR75_s^j$). The results shown in column (1) do not suggest that TPU affects U.S. exports as the coefficients of the concurrent and one-year lagged TPU variables are not significant. The specification used in column (2) controls for high levels of market power by using the $67th$ percentile of the distribution of market power (1/ROW's export supply elasticity). The interactions of the degree of market power ($PWR67_s^j$) and the TPU indexes are negative as expected, but they are not statistically significant. Instead, the specification used in column (3) controls for market power using the $75th$ percentile of the distribution. Again, the interactions between the TPU indexes and this binary measure of market power are negative but not statistically significant.

The specifications used in columns (4) and (5) control for the degree of market power and use observations for the year 2008 and beyond, i.e., they control for years after the great recession. The results shown in columns (4) and (5) confirm that the interactions between the concurrent and the one-year lagged TPU indexes with the market power binary variable are negative and statistically significant. On the other hand, the controls for TPU without the interaction are not statistically significant. These results imply that TPU has no effects on U.S. exports when the importing country has low levels of market power. On the other hand, we find that a one-standard-deviation increase of the TPU indexes leads to a decline in U.S. exports of 2.32 percent ((-0.031$\times$ 3495 $\times$ 0.0001 $\times$ 100)+(-0.034$\times$ 3634 $\times$ 0.0001 $\times$ 100)) for cases where the importer has high levels of market power, according to the results shown in column (5). As discussed above, the effects of TPU should be important only if the importer has high levels of market power and for years where income uncertainties may have magnified the effects of TPU. Notice that the other variables' economic effects are confirmed by the results shown in Table 1.8. In particular, tariffs applied on U.S. goods ($ln\tau_{s,t}^{j,us}$) decrease U.S. exports, while tariffs applied to other exporters ($ln\tau_{s,t}^{j}$) tend to promote U.S.

Table 1.8: Structural model estimation with market power interactions (Export).

	Dependent Variable: US Export Value (log)				
	(1)	(2)	(3)	(4)	(5)
$TPU^j_{s,t}$	0.002	0.003	0.005	0.012	0.013
	(0.005)	(0.007)	(0.007)	(0.010)	(0.009)
$TPU^j_{s,t-1}$	0.006	0.010	0.010	0.014	0.012
	(0.005)	(0.007)	(0.007)	(0.009)	(0.008)
$TPU^j_{s,t} \times PWR67^j_s$		-0.003		-0.028**	
		(0.010)		(0.013)	
$TPU^j_{s,t-1} \times PWR67^j_s$		-0.008		-0.034***	
		(0.010)		(0.012)	
$TPU^j_{s,t} \times PWR75^j_s$			-0.006		-0.031**
			(0.010)		(0.013)
$TPU^j_{s,t-1} \times PWR75^j_s$			-0.009		-0.034***
			(0.010)		(0.012)
$ln\tau^{j,us}_{s,t}$	-1.024***	-1.135***	-1.135***	-1.265***	-1.265***
	(0.072)	(0.076)	(0.076)	(0.103)	(0.103)
$ln\tau^j_{s,t}$	0.099***	0.104***	0.104***	0.132***	0.133***
	(0.013)	(0.013)	(0.013)	(0.019)	(0.019)
$ln\left(\sum_{k\neq us} Y^{j,k}_{s,t}\right)$	0.208***	0.264***	0.264***	0.246***	0.246***
	(0.006)	(0.007)	(0.007)	(0.009))	(0.009)
Sample selected in the sample	Full sample	Full sample	Full sample	After year 2007	After year 2007
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry-country fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	11.217***	10.453***	10.452***	10.913***	10.913***
	(0.111)	(0.132)	(0.132)	(0.186)	(0.186)
Observations	114,742	92,497	92,497	56,608	56,608
R-squared	0.943	0.948	0.948	0.962	0.962

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) $PWR67^j_s$ is 1 if the market power of an industry in a country is above 67 percentile of such variations and 0 otherwise
(5) $PWR75^j_s$ is 1 if the market power of an industry in a country is above 75 percentile of such variations and 0 otherwise

exports.[41][42]

In Table 1.9, we consider the role of TPU on U.S. exports' intensive and extensive margins. The estimation of specifications (1.15) and (1.17) guides our analysis, and they differ only concerning the dependent variables' definitions of intensive and extensive trade margins discussed in Section 3.2, respectively. Following the same strategy used in Table 1.4, columns (1) and (2) of Table 1.9 correspond to the results obtained in columns (4) and (5) of Table

[41] We also perform a robustness test for columns (1) through (5) by replacing the MFN tariffs with the minimum between them and preferential tariffs. These changes affect terms $ln\tau^{j,us}_{s,t}$ and $ln\tau^j_{s,t}$ in specification (1.11). Table A.2 in the Appendix reports the results, and it is then clear that using preferential tariffs does not affect the main conclusions derived from Table 1.8.

[42] Another robustness test for columns (1) through (5) is replacing the concurrent and the lagged values of TPU index with binary variables where it equals 1 when the index is positive and 0 otherwise. Table A.4 in the Appendix reports the results which are consistent with our conclusions derived from Table 1.8.

1.8. Then, the specifications used in columns (3)–(8) try to rationalize the results obtained in columns (1) and (2) in terms of the trade margins. The results for the estimation of expression (1.15) can be found in columns (3) and (4), which only differ in the binary variable of high levels of market power. These results suggest that TPU adversely affects the intensive margin of trade only for countries with high market power levels. These results are in line with the results found in columns (1) and (2). Moreover, the results for the estimation of expression (1.17) can be found in columns (5)–(8), where the differences are related to the binary measure of market power and the measure of external margin of trade. These results suggest that TPU does not affect the external margin of trade, regardless of the importing country's degree of market power. In sum, we find that the TPU affects U.S. exports through the intensive margin and only for importers with high market power levels. This result resembles our findings for U.S. imports summarized in Table 1.4.

Table 1.9: TPU and margins of trade (Export).

	Dependent Variable							
	$IM^j_{s,t}(1)$	$IM^j_{s,t}(1)$	$IM^j_{s,t}(2)$	$IM^j_{s,t}(2)$	$EM^j_{s,t}(1)$	$EM^j_{s,t}(1)$	$EM^j_{s,t}(2)$	$EM^j_{s,t}(2)$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$TPU^j_{s,t}$	0.012	0.013	0.023*	0.023*	-0.006	-0.006	-0.019**	-0.017*
	(0.010)	(0.009)	(0.012)	(0.012)	(0.004)	(0.004)	(0.009)	(0.009)
$TPU^j_{s,t-1}$	0.014	0.012	0.008	0.006	0.000	0.000	0.006	0.007
	(0.009)	(0.008)	(0.011)	(0.011)	(0.004)	(0.003)	(0.008)	(0.008)
$TPU^j_{s,t} \times PWR67^j_s$	-0.028**		-0.034**		0.006		0.006	
	(0.013)		(0.017)		(0.005)		(0.012)	
$TPU^j_{s,t-1} \times PWR67^j_s$	-0.034***		-0.031**		-0.001		-0.008	
	(0.012)		(0.015)		(0.005)		(0.011)	
$TPU^j_{s,t} \times PWR75^j_s$		-0.031**		-0.037**		0.005		0.003
		(0.013)		(0.017)		(0.005)		(0.012)
$TPU^j_{s,t-1} \times PWR75^j_s$		-0.034***		-0.029*		-0.001		-0.010
		(0.012)		(0.015)		(0.005)		(0.011)
$ln\tau^{j,us}_{s,t}$	-1.265***	-1.265***	-1.339***	-1.339***	-0.044	-0.044	0.121	0.121
	(0.103)	(0.103)	(0.133)	(0.133)	(0.043)	(0.043)	(0.099)	(0.099)
$ln\tau^j_{s,t}$	0.132***	0.133***	0.143***	0.143***	0.010	0.010	-0.013	-0.013
	(0.019)	(0.019)	(0.025)	(0.025)	(0.008)	(0.008)	(0.019)	(0.019)
$ln\left(\sum_{k\neq us} Y^{j,k}_{s,t}\right)$	0.246***	0.246***	-0.109***	-0.109***	0.032***	0.032***	-0.063***	-0.063***
	(0.009)	(0.009)	(0.012)	(0.012)	(0.004)	(0.004)	(0.009)	(0.009)
Year	After year 2007	After year 2007	After year 2007	After year 2007	After year 2007	After year 2007	After year 2007	After year 2007
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	10.913***	10.913***	-0.223	-0.222	1.860***	1.860***	0.490***	0.490***
	(0.186)	(0.186)	(0.241)	(0.241)	(0.078)	(0.078)	(0.179)	(0.179)
Observations	56,608	56,608	56,403	56,403	56,608	56,608	56,403	56,403
R-squared	0.962	0.962	0.870	0.870	0.967	0.967	0.769	0.769

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) $PWR67^j_s$ is 1 if the market power of an industry in a country is above 67 percentile of such variations and 0 otherwise
(5) $PWR75^j_s$ is 1 if the market power of an industry in a country is above 75 percentile of such variations and 0 otherwise
(6) $IM^j_{s,t}(1)$ is log of US imports
(7) $IM^j_{s,t}(2)$ is log of intensive margin constructed by Hummels and Klenow (2005)
(8) $EM^j_{s,t}(1)$ is the log of number of HS 6-digit products in 2-digit industry
(9) $EM^j_{s,t}(2)$ is the log of extensive margin (Hummels and Klenow, 2005)

Table 1.10 focuses on the role played by preferential trade in mitigating the effects of TPU on U.S. exports. In this case, we focus on the estimation of specification (1.19). Column (1) shows the results of the estimation of this specification using the concurrent level of TPU, while column (2) relies on the one-year lagged value of the TPU index. Instead, columns (3) and (4) control for the concurrent and the one-year lagged TPU indexes simultaneously. The results in columns (1)-(4) confirm that the presence of a significant preferential margin ($PTAMGN2^{j,us}_{s,t}$) offered to U.S. exporters tends to increase U.S. exports. Likewise, the coefficient of the interaction between the TPU index and the binary variable indicating high levels of market power ($PWR67^{j}_{s}$) has a negative sign as expected in all columns of Table 1.10. This result resembles the conclusion of Table 1.8, where only trade partners with a high level of market power affect U.S. exports. An important point of specification (1.19) is that preferential access mitigates the effects of TPU for importers with high levels of market power. We would then expect that the (triple) interaction among the TPU index and the indicators of high market power and significant preferential access levels should be positive. Indeed, the coefficient of these variables' interaction is positive in all columns of this table. However, these results tend not to be statistically significant, although they affect U.S. exports in their predicted direction.

The introduction section outlines that some papers have described the policy space where uncertainty resides based on tariff gaps. Bagwell, Bown and Staiger (2016) survey a growing literature examining the difference between applied MFN tariffs and bound tariffs across countries. The literature refers to this tariff gap as tariff water or tariff overhang. The enabling clause established under the GATT allowed many developing countries to set high tariff bindings, thereby leading today to the pervasive presence of tariff water in these countries' tariff schedules. Additionally, some developed countries (Canada, Australia, and New Zealand) also display average tariff water levels of at least five percentage points. In Table 1.11, we control for the presence of tariff water across countries to which the U.S. export. More precisely, we define a binary variable $Water^{j}_{st}$ that equals one if the tariff water is two percentage points or higher and zero otherwise.

We augment the specification used in column 5 of Table 1.8 by including the interactions of tariff water with U.S. TPU, the importing country's market power, and the triple

Table 1.10: TPU, preference margin, and market power (Export).

	Dependent Variable: US Export (log)			
	(1)	(2)	(3)	(4)
$TPU^{j}_{s,t}$	-0.002		-0.002	-0.003
	(0.008)		(0.008)	(0.006)
TPU^{j}_{st-1}		0.003	-0.004	0.003
		(0.008)	(0.006)	(0.008)
$TPU^{j}_{st} \times PTAMGN2^{j,us}_{s,t} \times PWR^{j}_{s}$	0.173		0.173	
	(0.381)		(0.381)	
$TPU^{j}_{st-1} \times PTAMGN2^{j,us}_{s,t} \times PWR^{j}_{s}$		0.175		0.175
		(0.495)		(0.495)
$TPU^{j}_{st} \times PWR^{j}_{s}$	-0.001		-0.001	
	(0.009)		(0.009)	
$TPU^{j}_{st-1} \times PWR^{j}_{s}$		-0.013		-0.013
		(0.009)		(0.009)
$TPU^{j}_{st} \times PTAMGN2^{j,us}_{s,t}$	-0.015		-0.015	
	(0.081)		(0.081)	
$TPU^{j}_{st-1} \times PTAMGN2^{j,us}_{s,t}$		-0.043		-0.043
		(0.084)		(0.084)
$PTAMGN2^{j,us}_{s,t} \times PWR^{j}_{s}$	0.056	0.056	0.056	0.056
	(0.041)	(0.041)	(0.041)	(0.041)
$PTAMGN2^{j,us}_{s,t}$	0.035	0.036	0.035	0.036
	(0.033)	(0.033)	(0.033)	(0.033)
$ln\tau^{j,us}_{s,t}$	-1.271***	-1.271***	-1.271***	-1.271***
	(0.103)	(0.103)	(0.103)	(0.103)
$ln\tau^{j}_{s,t}$	0.131***	0.131***	0.131***	0.131***
	(0.019)	(0.019)	(0.019)	(0.019)
$ln\left(\sum_{k\neq us} Y^{j,k}_{s,t}\right)$	0.246***	0.246***	0.246***	0.246***
	(0.009)	(0.009)	(0.009)	(0.009)
Year	after 2007	after 2007	after 2007	after 2007
Industry-year fixed effects	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes
Industry-country fixed effects	Yes	Yes	Yes	Yes
Constant	10.912***	10.912***	10.912***	10.912***
	(0.186)	(0.186)	(0.186)	(0.186)
Observations	56,608	56,608	56,608	56,608
R-squared	0.962	0.962	0.962	0.962

Notes:
(1) Standard errors in parentheses
(2) *** $p<0.01$, ** $p<0.05$, * $p<0.1$
(3) TPU measures scaled by 0.0001
(4) PWR^{j}_{s} is the market power constructed by Nicita, Olarreaga, and Silva, 2018
(5) $PTAMGN2^{j,us}_{s,t}$ is 1 if $\text{MFN}^{j,us}_{s,t} >$ Preferential $\text{Tariff}^{j,us}_{s,t}$ by 2 percentage points and 0 otherwise

Table 1.11: TPU, tariff water, and market power (Export).

	Dependent Variable: US Export Value (log)					
	(1)	(2)	(3)	(4)	(5)	(6)
$TPU^j_{s,t-1}$	0.015*	0.012	0.012	0.013*	0.009	0.009
	(0.008)	(0.010)	(0.010)	(0.007)	(0.010)	(0.010)
$TPU^j_{s,t-1} \times PWR67^j_s \times Water^j_{s,t}$			0.028			
			(0.173)			
$TPU^j_{s,t-1} \times PWR75^j_s \times Water^j_{s,t}$						0.027
						(0.173)
$TPU^j_{s,t-1} \times Water^j_{s,t}$		0.018	0.017		0.029	0.028
		(0.053)	(0.053)		(0.052)	(0.052)
$TPU^j_{s,t-1} \times PWR67^j_s$	-0.028**	-0.026**	-0.027**			
	(0.012)	(0.013)	(0.013)			
$TPU^j_{s,t-1} \times PWR75^j_s$				-0.026**	-0.023*	-0.023*
				(0.012)	(0.013)	(0.013)
$Water^j_{s,t} \times PWR67^j_s$	-0.494***	-0.495***	-0.495***			
	(0.111)	(0.111)	(0.111)			
$Water^j_{s,t} \times PWR75^j_s$				-0.692***	-0.693***	-0.693***
				(0.131)	(0.131)	(0.131)
$Water^j_{s,t}$	0.220***	0.220***	0.220***	0.218***	0.218***	0.218***
	(0.046)	(0.046)	(0.046)	(0.045)	(0.045)	(0.045)
$ln\tau^{j,us}_{s,t}$	-0.833***	-0.833***	-0.833***	-0.811***	-0.811***	-0.811***
	(0.110)	(0.110)	(0.110)	(0.110)	(0.110)	(0.110)
$ln\tau^j_{s,t}$	0.102***	0.102***	0.102***	0.098***	0.098***	0.098***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
$ln\left(\sum_{k\neq us} Y^{j,k}_{s,t}\right)$	0.236***	0.236***	0.236***	0.236***	0.236***	0.236***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Sample selected in the sample	After year 2007	After year 2007	After year 2007	After year 2007	After year 2007	After year 2007
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry-country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	11.491***	11.491***	11.491***	11.485***	11.485***	11.485***
	(0.193)	(0.193)	(0.193)	(0.193)	(0.193)	(0.193)
AIC	54287.82	54289.68	54291.65	54279.25	54280.89	54282.86
BIC	54357.15	54367.68	54378.32	54348.59	54358.9	54369.54
Observations	42,933	42,933	42,933	42,933	42,933	42,933
R-squared	0.970	0.970	0.970	0.970	0.970	0.970

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) $PWR67^j_s$ is 1 if the market power of an industry in a country is above 67 percentile of such variations and 0 otherwise
(4) $PWR75^j_s$ is 1 if the market power of an industry in a country is above 75 percentile of such variations and 0 otherwise
(5) $Water^j_{s,t}$ is the difference between bound tariff and applied MFN for country j industry s and year t
(6) For column (1), $p(\beta_{Water^j_{s,t-1}}+\beta_{Water^j_{s,t-1}\times PWR67^j_s}=0)=0.0087$
(7) For column (3), $p(\beta_{Water^j_{s,t-1}}+\beta_{Water^j_{s,t-1}\times PWR75^j_s}=0)=0.0002$

interaction between tariff water, TPU, and market power. Columns (1) and (4) report the results by including the terms $Water^j_{st} \times PWR67^j_s$ and $Water^j_{st} \times PWR75^j_s$, respectively. The coefficients in column (1) show that the results we obtained in Table 1.8 are robust to this specification, i.e. higher TPU levels reduce exports to countries with high market power levels. Besides, the coefficient for $Water^j_{st} \times PWR67^j_s$ is negative and significant, suggesting that U.S. exports tend to be lower when importing countries display high levels of market power and tariff water. Columns (2) and (5) show the results for specifications that also add the interaction term between TPU and tariff water. The coefficient for this interaction is not statistically significant. In columns (3) and (6), we add the three-way interaction term between TPU, tariff water, and market power. The coefficient is also not statistically significant. However, we note that the AIC and BIC criteria for model selection suggest that the specification used in column (1) is selected compared to the specifications used in columns (2) and (3). The same applies to the specification used in column (4) relative to the specifications used in columns (5) and (6).

As discussed in Section 2.1, we also consider the robustness of our results by measuring the degree of uncertainty faced by U.S. exporters using published information by well-established media outlets from the three largest U.S. trade partners, namely Canada, China, and Mexico. We believe this approach is warranted since U.S. exporters very likely assess the degree of TPU by closely monitoring foreign newspapers. Table 1.12 shows the results for the effects of the TPU index based on news from these three major trade partners on U.S. export to these countries. In this case, the variable $TPU^j_{s,t}$ used in this table has a mean of 100 and a standard deviation of 2342.111. The specifications used in columns (1) and (2) control for the presence of TPU without accounting for the degree of market power. In columns (3)-(5), we estimate specification (1.11). The difference among these columns focuses on the binary variable indicating industries where the importer has a high market power level. As expected, the results in columns (1) and (2) show that the effect of TPU on U.S. exports is not significant without controlling for the degree of market power. Instead, the results in columns (3)-(5) confirm that TPU may be deleterious to U.S. exports only for sectors where the importer has high market power levels. Focusing on column (5), we find that a one-standard-deviation increase in TPU leads to a 0.33 percent ($0.014 \times 2342.111 \times 0.0001 \times 100$) decline in U.S. exports in industries where the importer has a degree of market power greater than the 75 percentile of the distribution. These results reassure us about the robustness of the results described in Table 1.8.

Following the step of our analysis in Section 4.1, we also test our main specification outlined in expression (1.11) while constructing our TPU index controlling for terms related to exports. In this case, our variable U^j_{ist}, which is outlined in Step 1 of Section 2.1, also

Table 1.12: TPU based on news from China, Canada, and Mexico (Export).

	Dependent Variable: US Export Value (log)				
	(1)	(2)	(3)	(4)	(5)
$TPU_{s,t}^{j}$	0.004	0.006	0.028**	0.014	0.014*
	(0.007)	(0.012)	(0.012)	(0.009)	(0.009)
$TPU_{s,t-1}^{j}$	0.008	0.017	0.030**	0.016*	0.011
	(0.007)	(0.011)	(0.013)	(0.009)	(0.009)
$TPU_{s,t}^{j} \times PWR50_{s}^{j}$			-0.034**		
			(0.015)		
$TPU_{s,t-1}^{j} \times PWR50_{s}^{j}$			-0.032**		
			(0.015)		
$TPU_{s,t}^{j} \times PWR67_{s}^{j}$				-0.023*	
				(0.014)	
$TPU_{s,t-1}^{j} \times PWR67_{s}^{j}$				-0.022	
				(0.014)	
$TPU_{s,t}^{j} \times PWR75_{s}^{j}$					-0.028*
					(0.014)
$TPU_{s,t-1}^{j} \times PWR75_{s}^{j}$					-0.010
					(0.015)
$ln\tau_{s,t}^{j,us}$	-0.275	-0.301	-0.303	-0.296	-0.297
	(0.200)	(0.314)	(0.200)	(0.201)	(0.201)
$ln\tau_{s,t}^{j}$	0.047	0.030	0.048	0.047	0.047
	(0.030)	(0.048)	(0.030)	(0.030)	(0.030)
$ln\left(\sum_{k\neq us} Y_{s,t}^{j,k}\right)$	0.636***	0.586***	0.654***	0.646***	0.647***
	(0.028)	(0.037)	(0.029)	(0.029)	(0.029)
Country	CA, CHN, MEX	CA, CHN, MEX	CA, CHN, MEX	CA, CHN, MEX	CA, CHN, MEX
Year	2001-2017	2008-2017	2001-2017	2001-2017	2001-2017
Constant	5.761***	6.948***	5.378***	5.557***	5.531***
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry-country fixed effects	Yes	Yes	Yes	Yes	Yes
	(0.596)	(0.798)	(0.607)	(0.606)	(0.606)
Observations	4,398	2,688	4,379	4,379	4,379
R-squared	0.985	0.990	0.985	0.985	0.985

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) $PWR50_{s}^{j}$ is 1 if the market power of an industry in a country is above 50 percentile of such variations and 0 otherwise
(5) $PWR67_{s}^{j}$ is 1 if the market power of an industry in a country is above 67 percentile of such variations and 0 otherwise
(6) $PWR75_{s}^{j}$ is 1 if the market power of an industry in a country is above 75 percentile of such variations and 0 otherwise

includes a binary variable that indicates the presence of the word "export/exports" in conjunction with a combination of words such as "export license" and "revoke," "quota" and "change," "quota" and "reduce", and "quota" and "decrease." The results using this alternative export-specific TPU index can be found in Table 1.13. Again, we use specifications that mimic the ones used in Table 1.8. The specification used in column (1) does not control for market power and uses observations for all years. Instead, the models used in columns (2) and (3) follow expression (1.11), where we control for industries in which the importer has varying degrees of market power. Still, these specifications rely on information for all years in our sample. The results for the specifications used in columns (4) and (5) also follow specification (1.11) but focuses on the sample for the years 2008 onwards.

Table 1.13: TPU based on export-related words (Export).

	Dependent Variable: US Export Value (log)				
	(1)	(2)	(3)	(4)	(5)
$TPU^{j}_{s,t}$	0.006	0.004	0.004	0.015	0.017
	(0.008)	(0.008)	(0.008)	(0.016)	(0.015)
$TPU^{j}_{s,t-1}$	-0.010	-0.005	-0.005	-0.001	-0.000
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
$TPU^{j}_{s,t} \times PWR67^{j}_{s}$		-0.007		-0.002	
		(0.019)		(0.024)	
$TPU^{j}_{s,t-1} \times PWR67^{j}_{s}$		-0.030		-0.025	
		(0.019)		(0.018)	
$TPU^{j}_{s,t} \times PWR75^{j}_{s}$			-0.007		-0.008
			(0.020)		(0.025)
$TPU^{j}_{s,t-1} \times PWR75^{j}_{s}$			-0.036*		-0.034*
			(0.020)		(0.019)
$ln\tau^{j,us}_{s,t}$	-1.024***	-1.136***	-1.137***	-1.265***	-1.266***
	(0.072)	(0.076)	(0.076)	(0.103)	(0.103)
$ln\tau^{j}_{s,t}$	0.099***	0.103***	0.103***	0.132***	0.131***
	(0.013)	(0.013)	(0.013)	(0.019)	(0.019)
$ln\left(\sum_{k\neq us} Y^{j,k}_{s,t}\right)$	0.208***	0.264***	0.264***	0.246***	0.246***
	(0.006)	(0.007)	(0.007)	(0.009))	(0.009)
Sample selected in the sample	Full sample	Full sample	Full sample	After year 2007	After year 2007
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry-country fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	11.217***	10.445***	10.454***	10.913***	10.913***
	(0.111)	(0.132)	(0.132)	(0.186)	(0.186)
Observations	114,742	92,497	92,497	56,608	56,608
R-squared	0.943	0.948	0.948	0.962	0.962

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) $PWR67^{j}_{s}$ is 1 if the market power of an industry in a country is above 67 percentile of such variations and 0 otherwise
(5) $PWR75^{j}_{s}$ is 1 if the market power of an industry in a country is above 75 percentile of such variations and 0 otherwise
(6) Five countries including EU, JP, CHN, CA, MEX have largest market power (Nicita, Olarreaga, and Silva, 2018)

In this case, the results shown in column (1) mimic the findings of column (1) of Table 1.8. They imply that the effects of TPU without controlling for market power and using all sample do not significantly affect U.S. exports. Instead, the results in columns (2) and (3) confirm the negative impact of high market power levels on U.S. exports, even using information covering all years in our sample. Likewise, the results shown in columns (4) and (5) confirm the deleterious effects of high market power levels, even constraining the sample for 2008 and onwards. In a sense, these results broaden the importance of controlling for market power in evaluating the effects of bilateral export-specific TPU on U.S. exports. These results show the robustness of our baseline findings, which rely on a TPU index that does not control for export-specific words.

1.5 Conclusion

This paper provides a novel way to study the effects of TPU on U.S. trade flows. Our baseline results rely on constructing a TPU index based on articles published by four major U.S. newspapers. This index controls for the presence of a broad array of policy tools that include standard tariff gaps, temporary barriers to trade, and measures based on national security concerns. Our baseline specification shows that an increase in TPU tends to reduce U.S. imports. Moreover, these results are economically meaningful. We find that a one-standard-deviation increase in U.S. TPU leads to a combined decline of 1.14 percent in U.S. imports.

Likewise, our results involving the effects of TPU on U.S. exports seem policy-relevant. Our baseline results highlight that TPU hurts exports if the importing country displays high market power levels. Moreover, this effect is significant during years of heightened economic uncertainty, such as during and after the great recession. In this case, we find that a one-standard-deviation increase of U.S. TPU decreases U.S. exports (on average) by 2.32 percent for importers with high levels of market power. At the same time, the effect becomes insignificant for importers with low market power levels. Indirectly, our study contributes to a growing literature that investigates the impact of market power on policy outcomes.[43] Additionally, we find that the TPU effects on U.S. exports operate through the intensive margin, which resembles our findings for U.S. imports.

Notice that these results on U.S. imports and exports are robust to a more demanding set of trade-related words that tightens each TPU index directly to imports or exports as

[43] Interestingly, Amiti, Redding, and Weinstein (2019) find that the U.S. tariffs applied during the second year of President Trump's administration did not have any statistical effects on U.S. terms of trade. Moreover, Amiti, Redding, and Weinstein (2020) find similar results while extending the data for an additional year, except for significant international price declines in U.S. imports of steel products.

required by our analysis. It also seems robust in adopting the uncertainty set of words used in Caldara et al. (2020). Likewise, the economic effects of TPU on U.S. trade flows may mildly vary as we change the set of words used to construct the TPU index. Additionally, the results are robust to using newspapers based in the largest U.S. trading partners. Moreover, Tables A.3 and A.4 in the appendix replaces our continuous measure of TPU with a binary measure identifying above and below median bilateral levels of U.S. TPU across industries and years. These two tables confirm our baseline results for a setting where business may not know the exact level of uncertainty but have an idea about its significance. The sum of these findings gives us confidence about the reasonableness of our baseline TPU index and its flexibility in considering the sources of TPU for U.S. imports and exports alike.

Chapter 2

General Trade Policy Uncertainty and Trade Flows of China, Canada, Mexico, and the EU

2.1 Introduction

The volume of international trade has grown dramatically in the last five decades. Imports have risen from 291.959 billion to 21.735 trillion and exports from 294.771 billion to 22.64 trillion between 1970 and 2020. Canada, Mexico, China and the EU are among the largest contributors to this staggering growth. They jointly represent 45 percent of the increase in imports and 48 percent of the growth in exports[1]. In the last 50 years, Canada's imports (and exports) have grown 6,709 percent (and 6,500 percent), Mexico's 26,430 percent (and 33,012 percent), China's 89,045 percent (and 105,812 percent) and the EU's 12,178 percent (and 14,321 percent) [2].

The growing internationalization and globalization may intensify uncertainty in the world

[1]Canada has contributed 2 percent to the increase, Mexico has contributed 2 percent, China has contributed 11 percent, and the EU has contributed 30 percent. Among the total increase in the exports in the world, it includes a 2 percent increase from Canada, a 2 percent increase from Mexico, a 12 percent increase from China, and a 32 percent increase from the EU.

[2]Our calculation is based on data provided by the World Bank. More details can be found at "https://data.worldbank.org/."

(Mills and Blassfeld, 2003). Moreover, trade policy uncertainty (TPU) could be heightened by tensions among trade partners (Baker et al., 2016). Although the World Trade Organization (WTO) aims to promote smooth and predictable trade flows by enforcing trade restrictions and partnerships across countries, the rising trade policy uncertainty (TPU) has produced uneven bilateral trade flows among countries and made trade less efficient and more difficult to predict. The GATT's principles of most-favored-nation (MFN) treatment and reciprocity and preferential trade agreements (PTAs) have been implemented among countries as tools to promote cooperation for international trade, in hope of mitigating the deleterious impacts of TPU (Estevadeordal et al., 2008; Bagwell and Staiger, 1999, 2012 and 2016; Maggi and Rodriguez-Clare, 1998 and 2007). It is then imperative to factor TPU in predicting trade flows, especially among the large global importers and exporters, and identify whether the cooperation tools (e.g. PTAs) can help overcome such uncertainties.

The TPU literature tends to focus on its effects measured in terms of tariff gaps on the decision to export (Pierce and Schott, 2016, 2018; Crowley, Meng, and Song, 2018), on trade volumes (Handley and Limão 2015), and on labor market outcomes (Erten et al., 2019). These papers are more likely to study trade uncertainties for a single country or group (e.g., the European Union) and its trade partners. We adopt a different approach by constructing a general index of TPU at the bilateral (i.e., 141 trading partners) and industry levels (i.e., 2-digit of the Harmonized System or HS, in short) with information spanning 17 years from 2001 to 2017 for four representative groups - Canada, Mexico, China, and the EU, which include two developed economies and two developing economies. We focus on the four groups' bilateral imports and exports with the rest of the world. The idea is that the dominant importers and exporters may be able to reinterpret rules to pursue particular trade initiatives [3] and this sentiment can be captured by our TPU measures. According to Ahir, Bloom, and Furceri (2018) who created the World Uncertainty Index (WUI), between trade partners who have tighter bonds in terms of trade and financial relationship or within countries with advanced economies, the WUI is more likely to be

[3] In this case, we refer to U.S. 45th President Donald Trump's announcement of imposing tariffs on steel and aluminum products due to national security concerns in March of 2018, which resulted in retaliation from its trade partners, such as China and the EU.

synchronized. Among developing countries, the level of uncertainty is significantly larger. It increases with economic policy uncertainty and stock price volatility, but diminishes with GDP growth. Additionally, the difference in uncertainty levels among countries is also associated with the countries' institutional quality and financial constraints. It is therefore insightful to study the TPU impact from not only one but several countries who highly contribute to the global trade market. This could help determine their differences and similarities in terms of TPU, as well as identify the TPU effect on world-wide trade flows.

The TPU indices are designed to capture the multitude of channels through which trade uncertainty would affect the trade flows of Canada, Mexico, China, and the EU from 2001 to 2017. Each group's TPU index is constructed by collecting news information from the newspapers released in all four groups but must include the corresponding group's name such that these TPU indices vary among the four selected groups. Strong evidence in the previous chapter shows that such a broad measure of U.S. TPU has significantly affected U.S. imports and exports at the bilateral and industry level, which motivates us to investigate whether the TPU index of other countries also affects their trade flows. In this case, we follow the text mining approach and keywords utilized by Baker, Bloom, and Davis (2016). Focusing on aggregate indexes of Economic Policy Uncertainty (EPU) among several select countries, Baker, Bloom, and Davis (2016) find that employment, investment, and firm decisions are adversely affected by EPU in sectors with greater exposures to government regulations. It is interesting to note that Davis (2016) applies the same measure to the construction of Global Economic Policy Uncertainty (GEPU) and finds that the average value of the GEPU Index has been getting much higher after 2008-2009, especially since 2011. Nelson and Katzenstein (2014) also emphasize that the financial crisis culminating in 2008 draws their attention to reexamine the role of uncertainty and to make decisions in the presence of uncertainty. We consider the financial crisis of 2008 as a critical point in our analysis, and our results demonstrate that it did sharpen the adverse effects of TPU on trade flows.

Based on their unique economic status and the outstanding domestic economic events, the TPU indices in our paper capture the heterogeneity of the significant bilateral and sectoral trends of the four selected groups over time (e.g., Brexit has a stronger impact on

British and the EU). However, the general trends could be similar because of their trade partnerships and interactions with one another. This is consistent with our findings that will be described in Section 2.2. All four groups' TPU indices tend to increase following the great recession years (2008-2009). Among them, the TPU indices for Canada and Mexico increased right after 2008, followed by the EU and then China. The results can be well explained by the relationship between these four groups and the U.S. Canada and Mexico are the closest countries to the U.S. geographically, and all three are co-members of NAFTA. The TPU index for the EU increased after the recession and continuously rose in response to the successive shock of European debt crisis. In contrast, China's reaction to the global financial crisis seems less pronounced in comparison to the other three groups, and there is only a moderate increase in TPU after 2008. In fact, China's TPU only reaches its peak in 2017 due to the heightened tension led by the U.S. previous President Donald Trump, who initiated the formal investigation into Chinese trade and intellectual property rights practices. Likewise, the Trump Administration also threatened other NAFTA members by withdrawing its economy from this agreement [4]. In turn, these treats have been reflected by Canada and Mexico's TPU indices at that time. In addition, our indices also show the evolution of the aggregate level of TPU from the sectoral perspective by countries, revealing the important industries with relatively high TPU across countries over time (i.e., edible fruits and nuts, certain fabrics, iron and steel, vehicles). For instance, the soar in TPU of iron and steel in 2002 for all four groups reveals the impact of the U.S. application of Safeguard measures under the WTO Safeguard agreement. News mentions of this event included all four groups (e.g., China and the EU were directly influenced by such an application; meanwhile, Canada and Mexico also drew newspapers attention because they were exempted from the application).

Moreover, we utilized TPU indices with variation at the bilateral, industry, and year levels for each of the four groups to identify the relation between trade policy uncertainties and the four groups' trade flows based on 141 countries at the 2-digit level of the HS.

[4] For example please refer to the relevant article originating from our collected news information: https://www.macleans.ca/news/canada/if-nafta-dies-all-hell-will-break-loose/

Following the industry-level gravity model constructed by Feenstra, Ma, and Xu (2019), we modified the model by controlling for bilateral tariffs and trade agreements at an importer - exporter - industry - year level, given that we are dealing with more than one group and their bilateral trade partners. Based on our baseline model at this level, we find a negative relationship between TPU and the trade flows of these four groups. It is worth noting that the negative effect of TPU only becomes significant after the global financial crisis for both imports and exports in this study, indicating that the uncertainties got intensified by the economic recession and its worldwide repercussions. Specifically, our model shows that after the year of 2007, a one-standard-deviation increase in TPU leads to a 0.78 percent decline in the imports of the four selected groups. Likewise, for the same period, a one-standard-deviation increase in TPU leads to a 0.51 percent decline in the exports of these groups. In line with this argument, we also find that increases in a TPU index tend to decrease each of the four groups' imports and exports after the financial crisis. Our results are also robust to additional tests with alternative TPU measures, including using keywords selected by Caldara et al. (2020), and more demanding sets of words with direct references to imports and exports to construct TPU indices.

Two further investigations are following to extend our empirical model. We first compare our baseline model with the intensive and extensive margins of trade developed by Hummels and Klenow (2005) and Debaere and Mostashari (2010). Our results suggest that the TPU indices of the four selected groups only significantly affect their imports via the intensive margin. We then analyze the potential protection impact of preferential trade agreements (PTAs) on the imports and exports of these four groups. As of April 2021, WTO has implemented 343 PTAs in order to promote tariff liberalization and overcome trade barriers among members. As expected, our models present strong evidence of PTAs' insurance effect in tariff setting since they tend to mitigate the negative TPU effects on both the imports and exports of the four groups.

The remainder of this chapter proceeds as follows. Section 2 introduces our data, the construction of our TPU index, and the description of its main economic characteristics across the four groups, their trade partners, sectors, and years. We then describe our econometric approach, which is based on the gravity model of trade in Section 3, including the extensions of our gravity equation to control for the effects of TPU on trade margins, and the effects of PTAs in determining the impact of TPU. Following that section, we report our main results in Section 4, including Section 4.1 discussing several results related to the imports of the four groups, and Section 4.2 discussing the results related to the exports. In addition, we discuss robustness tests for the two directions of the four groups' trade flows. Section 5 is the conclusion of the chapter.

2.2 Data

This section introduces the dataset used in our paper. We start with explaining the construction of the TPU indices for the four selected countries, and then providing the four groups' evolution of trade uncertainties across time, examples of industries subject to high uncertainty levels on average across the four groups, and the four groups' trade partners with the most significant changes in uncertainty during the time window relevant to our data. The TPU-related illustrations in this section strongly suggest that bilateral- and industry-level characteristics over time play significant roles in explaining the effects of uncertainty on international trade flows.

2.2.1 Trade Policy Uncertainty Index

Baker, Bloom, and Davis (2016) construct economic policy uncertainty (EPU) index to capture the economic changes at micro- and macro-level and to reflect the strong association between U.S. EPU and the stock price volatility for U.S. firms with intensive exposure to government and its purchases. Their EPU also negatively affects firm-level decisions by industries, such as defense, health, and finance industries. Caldara et al. (2020) also construct a TPU index using firm-level and aggregate data and show that TPU reduces business investment. Informed by their results, we previously found that U.S. TPU at industry-country-year level presents a significant factor in predicting trade flows between U.S. and its trade partners. As an extension to that paper and following the same steps, we construct TPU indices for Canada, Mexico, China, and the EU at country- and industry-level across time.

We generated TPU indices for the four selected groups based on the approach of Baker, Bloom, and Davis (2016) but focused on variations at the industry and bilateral levels. We generated the index based on international trade-related news articles' frequency in several representative newspapers circulating in Canada, Mexico, China, and the EU. Canadian news information is from Financial Post, Mclean, and Winnipeg Free Press.[5] Mexican news articles are from The Yucatan Times, Banderas News, and Mexico News Daily.[6] Newspapers issued in China are from China Daily, Ecns.cn, and SHINE.[7] EU news information is from Euronews, Euro Weekly News, and The Guardian (U.K. edition).[8]

All news articles in use are collected through the websites of the newspapers mentioned above. We parse and download the specific information, such as news title, time, author, and news content, from html source codes using Python and the Selenium platform, shown in Figure 2.1 as an example. In addition, Figure 2.1 also shows that this example includes the steel industry (code 72 of the 2-digit of the HS) and bilateral trade partners – China and the U.S. We use Stata to extract key words (e.g., country names and industries) and count their frequencies for TPU construction in the next step. Considering that this news article mentioned China and the U.S. as well as the steel industry, the associated TPU can be used to analyze Chinese imports and exports to U.S. Overall, we downloaded 156,719 news articles from Canada, Mexico, China, and the EU covering the duration of January 2001 to December 2017 to match other dataset elements, including trade flows and tariff

[5] Financial Post is a Canadian business newspaper which started publication in 1907; Maclean is a Canadian news magazine founded in 1905 reporting Canadian politics and current events; and Winnipeg Free Press is a Canadian local newspaper founded in 1872 providing coverage of national and international news.

[6] The Yucatan Times began operations in 2010 as an English language news website with weekly updates; Banderas News is Puerto Vallarta's liveliest website; and Mexico News Daily was a digital publication launched in 2014 offering news and current affairs in Mexico in English.

[7] China Daily was founded in 1981 and has the widest print circulation of any English-language newspaper in China; Ecns.cn is the official English-language website of China News Service (CNS) established in 1952; and SHINE was launched in 1999 and powered by Shanghai Daily as the largest English-language newspaper in East China.

[8] Euronews is an international news media launched in 1993 providing worldwide audience the news with a European perspective; Euro Weekly News is the largest group of free English-language newspapers in Spain established in 2002 concentrating on local, European, and international news and issues; and The Guardian (U.K. edition) is a global news organization founded in 1821 delivering its coverage of politics, the environment, science, social justice, sport and culture.

data.

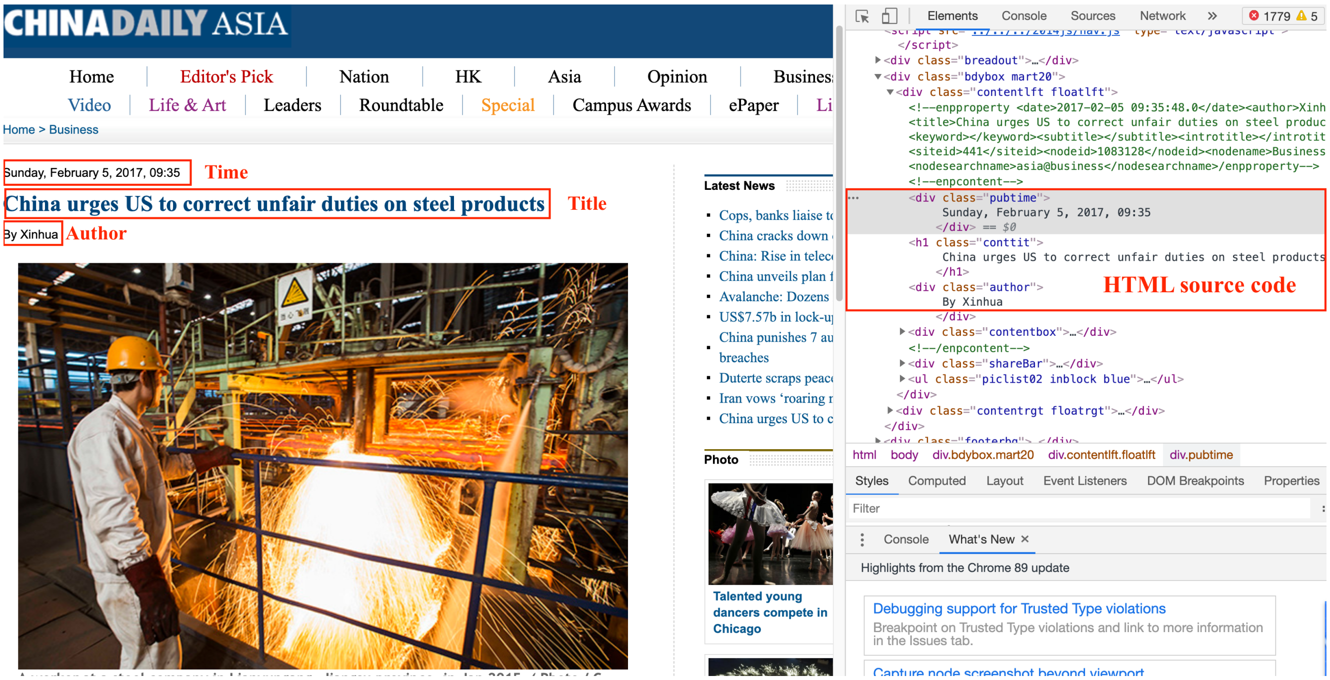


Figure 2.1: Example of parsing news article using HTML source

We include several trade-specific news examples that are collected from the news websites in 2.1. This table shows which country these news articles are released from, which news source they are reported by, and when they are released. The table also reports the key information from the news body, indicating that the news articles are related to uncertainty if the news body includes any words of the following word list: "uncertainty," "uncertain," "not certain," "unsure," "not sure," "unpredictable," "unknown," "Brexit," "war," "trade war," "tariff hike," and "increase in tariff.", and which countries and industries are involved in the trade. For example, Financial Post, the Canadian news source, reported a piece of trade news article, mentioning "risks" and "uncertainty" (in bold) and also includes trade partners "Russia" and "Canada" as well as industries of "forestry" (industry code 6) and "energy and mining" (industry code 27) in 2011. We only count a piece of news article towards the four groups' TPU indices at bilateral- and industry-level if it includes the specific country and industry names as well as uncertainty-related key words. The list of 141 countries we included in this study is presented in Table B.7, and the list of 97 industries are presented in Tables

B.8 and B.9 of the Appendix.

In the previous chapter, we followed Baker, Bloom, and Davis (2016) in constructing a TPU index for the U.S. economy with variation in the industry (s), country (j), and year (t) levels. In this paper, we construct the TPU indices for the four groups with the same method and denote them TPU_t^m, $TPU_{s,t}^m$, $TPU_t^{m,j}$, and $TPU_{s,t}^{m,j}$ for imports and TPU_t^x, $TPU_{s,t}^x$, $TPU_t^{j,x}$, and $TPU_{s,t}^{j,x}$ for exports, where m indicates the four groups as importers, and x represents exporters for the same four groups. The steps are briefly introduced as follows.

Step 1: We collected news articles from newspapers issued by Canada, Mexico, China, and the EU. For each of the four groups, we selected the articles which mentioned both trade and the name of the specific group. For example, to construct Canada's TPU index, we only selected news articles from all downloaded news information that mentioned "trade" as well as "Canada" or "Canadian". We generate the frequency of news that contains TPU related words for each newspaper and year. As indicated above, we consider the following set of uncertainty-related words: uncertainty, uncertain, not certain, unsure, not sure, unpredictable, unknown, Brexit, war, trade war, tariff hike, and increase in tariff. We can then measure the frequency with which trade policy uncertainty news appears by newspaper, industry, trade partner, and year for importer m, applying the following formula:

$$U_{i,s,t}^{m,j} = \sum_q U_{q,i,t}^m F_{q,i,t}^{m,j} F_{q,i,s,t}^m, \tag{2.1}$$

where $U_{q,i,t}^m$ represents the number of times that uncertainty-related words appear in each article q published in newspaper i which mentions importer m at year t. The binary variable $F_{q,i,t}^{m,j}$ equals 1 if country j is mentioned in article q published in newspaper i at year t for importer m, and equals 0 otherwise. Meanwhile, the binary variable $F_{q,i,s,t}^m$ equals 1 if industry s is mentioned in article q published in newspaper i at year t for importer m, and equal 0 otherwise.

Step 2: Following Baker, Bloom, and Davis (2016) strategy, we then scale the variable $U_{i,s,t}^{m,j}$ described in expression (2.1) by the total number of articles published by the same newspaper which mentioned importer m in a particular year. Next, we standardize it to the unit standard deviation from 2001 to 2017. Lastly, we take the average across the selected newspapers by industry, country, and year for importer m.

$$z_{s,t}^{m,j} = \frac{1}{N^m} \sum_{i=1}^{N^m} \left[\frac{\frac{U_{i,s,t}^{m,j}}{T_{i,t}^m}}{std\left(\frac{U_{i,s,t}^{m,j}}{T_{i,t}^m}\right)} \right], \tag{2.2}$$

where $T_{i,t}^m$ stands for the total number of articles published by newspaper i which mentioned importer m at year t, and N^m represents the number of newspapers we selected for importer m.

Step 3: Finally, we normalize the variable $z_{s,t}^{m,j}$ described in expression (2.2) to a mean of 100 from 2001 to 2017.

$$TPU_{s,t}^{m,j} = \frac{100 z_{s,t}^{m,j}}{\frac{1}{K^m}\sum_{k^m=1}^{K^m} z_{s,t}^{m,j}}, \tag{2.3}$$

where K^m is the total number of observations for importer m included in our analysis. In order to test the robustness of effects of the index $TPU_{s,t}^{m,j}$ on trade flows, we followed the same steps, but relying on the uncertainty-related words used in Caldara et al. (2020) to construct an alternative $TPU_{s,t}^{m,j}$. In other words, we continue using expressions (2.1)-(2.3) except that, in step 1, we use Caldara et al.'s (2020) words in capturing the frequency of uncertainty-related words to measure the binary variable $U_{q,i,t}^m$.[9] Likewise, we follow exactly the same approach to construct $TPU_{s,t}^{j,x}$ for the four exporters x, including Canada, Mexico, China, and the EU. Besides, the steps of constructing TPU at industry-year level $TPU_{s,t}^m(TPU_{s,t}^x)$, at country-year level $TPU_t^{m,j}$ ($TPU_t^{j,x}$), and at year level TPU_t^m (TPU_t^x) are introduced in the appendix.

Figure 2.2 shows the yearly evolution of the TPU index (${TPU_t}^m$ or ${TPU_t}^x$) from 2001 to 2017 for the four selected groups where m/x represents Canada, Mexico, China, and the EU as importers/exporters. The information in Figure 2.2 shows a relatively low degree

[9] The set of words related to uncertainty used in Caldara et al. (2020) is the following: "risk*," "threat*", "cautio*", "uncertain*", "propos*", "future", "worr*", "concern*", "volatil*", "tension*", "likel*", "probabil*", "possibil*", "chance*", "danger*", "fear*", "expect*", "potential*", "rumor*", and "prospect*".

of this index before 2008, but we find two waves of TPU growth for all four groups: one occurred between 2008 to 2009 and the other one happened between 2016 and 2017. These two waves, therefore, capture most of our attention to changes in the TPU index at the year level between 2008 and 2017.

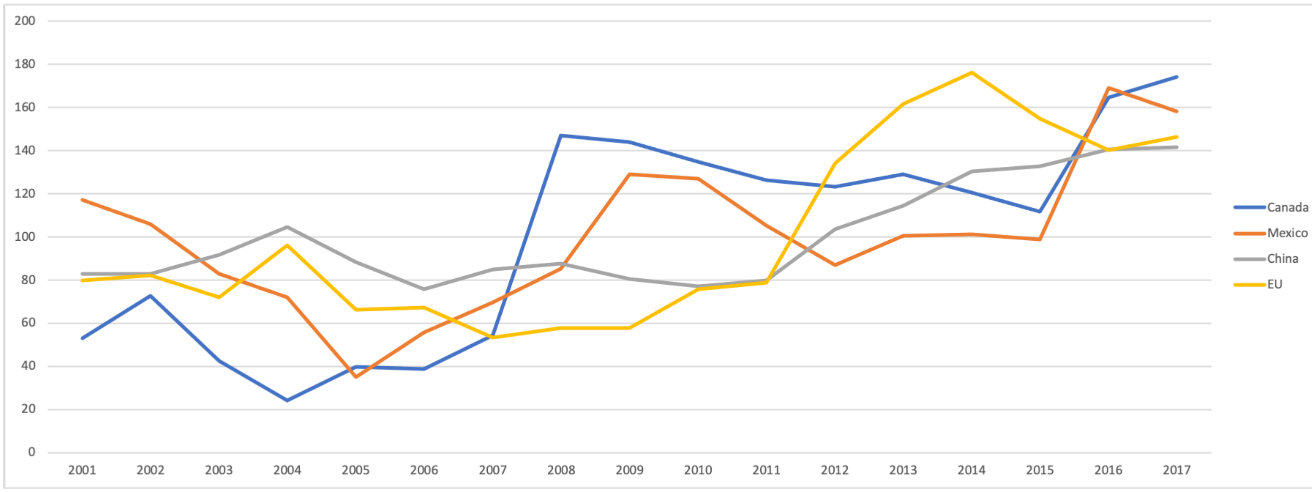


Figure 2.2: TPU by year from 2001 to 2017 for four countries

The global financial crisis broke out in September and October 2008 after several years of worldwide prosperous economic growth due to three major reasons: the housing bubble, unfolding credit crisis, and the decline of the U.S. dollar compared to other currencies in the world (Soros, 2008; Earle, 2009; Avgouleas, 2009). This global turmoil originally dragged down the economy in the most developed countries, but then spread around the world along with the heightened uncertainties of the possibility that worldwide economy could suffer serious damages. Massive measures have been taken across countries, but they could not be implemented within a short time. The financial turmoil in the U.S. first shocked its direct neighbors, Canada and Mexico, as reflected by the sudden surge in their TPU curves after 2007. The spillover effects were later found in European economies and the economies of some developing countries, such as China. This widespread influence seems to be majorly contributed by U.S. leading status in the global economy and international trade. Moreover, the failure of the Doha Round of multilateral trade negotiations in the middle of 2008 did not improve the financial crisis but brought world trade to an even worse situation (Bouet and

Laborde, 2009). Unlike developed countries, China and other emerging markets were able to "decouple" such economic shock due to their strong macroeconomic fundamentals [10]and the increasing South-South trade and investment flows[11]. Therefore, the uncertainty of the spillover effect in China had been offset. This is reflected by the downward sloping curve of China's TPU between 2008 and 2010 after a slight increase in TPU in 2008. However, the TPU curves for other three countries were staying at the peak or even increasing for years due to the loss of trust and confidence, the restoration of financial organizations, the unemployment rate, the firms' attitudes towards investment, and the growth of GDP (Amer 2009, Cassidy 2010, Geithner 2011).

Since 2009, the world economy has started to slowly recover. Between the years 2009 and 2010, GDP growth (measured in percentage) in Canada increased from -2.9 percent to 3.1 percent; the rate in Mexico increased from -5.3 percent to 5.1 percent; and the rate in China increased from 9.4 percent to 10.6 percent. It's worth noting that GDP growth in the EU increased from -4.3 percent to 2.2 percent between 2009 and 2010, but the sovereign debt crisis in several European countries starting from the end of 2009 hindered its recovery and deteriorated its situation after 2009 [12]. The uncertainty of the EU sovereign debt crisis pushes its index up to a considerable high level in 2010. Moreover, the uncertainty of the EU growth and trade were escalated ever since 2010 because, like what the U.S. experienced, the policymakers in the EU failed to solve the unemployment crisis and the debt crisis, and could not complete the financial organizations' restoration in a timely manner. The spillover effects originating from both the EU and U.S. were likely to increase the uncertainties of the recovery process of the global economy and international trade, which is reflected by the increase in TPU index for the other three countries after 2012.

After a short time of either decreasing or stable TPU among the four groups between 2014 and 2015, the TPU indices for three of the countries - Mexico, Canada, and China

[10]For an example of the healthier macroeconomic fundamentals in emerging Asia see "https://www.economist.com/finance-and-economics/2008/01/24/an-independent-streak."

[11]The trade performances of East Asian economies are highly related to the increasing importance of South-South trade and investment flows. See "https://internationalbanker.com/finance/south-south-trade-and-its-implications-for-the-world-economy/."

[12]Data of GDP growth is provided by the World Bank "https://data.worldbank.org/indicator."

went up again after 2015, except for the EU. This could be explained by the construction of the new regional trade agreement - Transatlantic Trade and Investment Partnership (TTIP) between the U.S. and the EU. It is assumed that such regional trade agreements (RTAs) could lead to the marginalization and impact on the competitiveness of other countries, if they are not RTA members (Abugattas, 2004). This explains the increase in TPU index in three other countries between 2015 and 2016.

Several things happened in 2016, which triggered the TPU indices of three of the selected four groups to reach their peak. First, the U.K. decided to leave the EU in June 2016. Uncertainties regarding the future trade, financial strategies, and migration arrangements were raised between U.K. and the EU countries [13]. Second, the U.S. former president Donald Trump announced plans to tax Chinese imports by 45% in his 2016 presidential campaign. He also frequently criticized the North American Free Trade Agreement (NAFTA) as well as the Trans-Pacific Partnership (TPP). The uncertainty of ad hoc tariff barriers to the key U.S. trade partners could bring in more uncertainties, such as the difficulties of recovering the global growth, and the retaliations from trade partner countries [14].

In order to verify our assumptions regarding the major causes leading to the great increase in TPU indices for all four groups during a) 2008-2009 and b) 2016-2017, we did a further investigation by using the Word Cloud technique with Python codes to capture the most important events which these four groups encountered during the two periods. Essentially, the Word Cloud is used to display the importance degree of words in a given context. The words that were most frequently mentioned are displayed with the largest size. The least important or useless information can be either ignored or removed. The panel at the top in Figure 2.3 shows that global financial crisis/recession, economy, trade, government, policy, cooperation are mentioned the most frequently. This suggests that the dramatic increase in

[13] For example of relationship between uncertainty and Brexit, see "https://migrationobservatory.ox.ac.uk/resources/commentaries/project-unclear-uncertainty-brexit-and-migration/."

[14] China, the European Union (EU), and NAFTA (Canada and Mexico) responded to the increase in U.S. import tariff with retaliatory tariffs which were worth over $120 billion of U.S. exports in 2017. See "https://www.brookings.edu/research/which-us-communities-are-most-affected-by-chinese-eu-and-nafta-retaliatory-tariffs/."

TPUs during 2008 and 2009 was mainly caused by the global financial crisis. In addition, U.S. and China are two outstanding countries in the word cloud, where the former is related to the financial crisis and the latter was the host of the 2008 Summer Olympics, a major international multi-sport event. The bottom panel in Figure 2.3 shows the Word Cloud between 2016 and 2017 which makes three things prominent as the key sources of trade policy uncertainty: Trump's tariff threats on steel products to the rest of the world, the intensified use of temporary trade barriers (i.e. anti-dumping measures), and uncertainty from Brexit which is reflected in the middle part of the figure. Therefore, controlling time-variant events is necessary to identify TPU effects on trade flows. Additionally, identifying the TPU effects on trade flows between 2008 and 2017 is crucial in our study.

Figure 2.4 shows the industry-specific TPU index ($TPU_{s,t}^{m,j}$) for four representative industries with the average high TPU by country with pooled data in (a) and panel data in (b). The four industries include the agriculture sector which is the most protected sector for these four groups, textile sector that takes a substantial portion of trade volume between these four groups and the rest of the world, the iron and steel industry that reflects the trade protection mechanism between these four groups and the most powerful country in the global trade market- the U.S., and the auto industry that is a strong economic force in the international market and consumes almost half of the world's oil [15]. According to the pooled data in (a), the TPU index on average over time for each of these four industries is similar across all four groups, even though variations do exist across countries. The panel data in (b) gives us more details [16]. First of all, we can see that TPUs for iron and steel are quite high for all four countries in 2002. This is related to the anti-dumping measures of placing tariffs on imports of steel products by George W. Bush in 2002 to protect the domestic steel industry. Among the four groups, China and the EU were both affected by this tariff policy and reacted by taking retaliatory actions and filing cases at the Dispute Settlement Body of the WTO. The relevant news information also reveals that Canada and

[15] For more details, see "https://www.industryweek.com/the-economy/article/21958422/the-automotive-industry-economic-impact-and-location-issues."

[16] Mexico's TPU index for the iron and steel industry in 2002 is 7035. For the purpose of clearly displaying TPU indices across countries and industries, we omitted that point in Panel (b) of Figure 2.4.

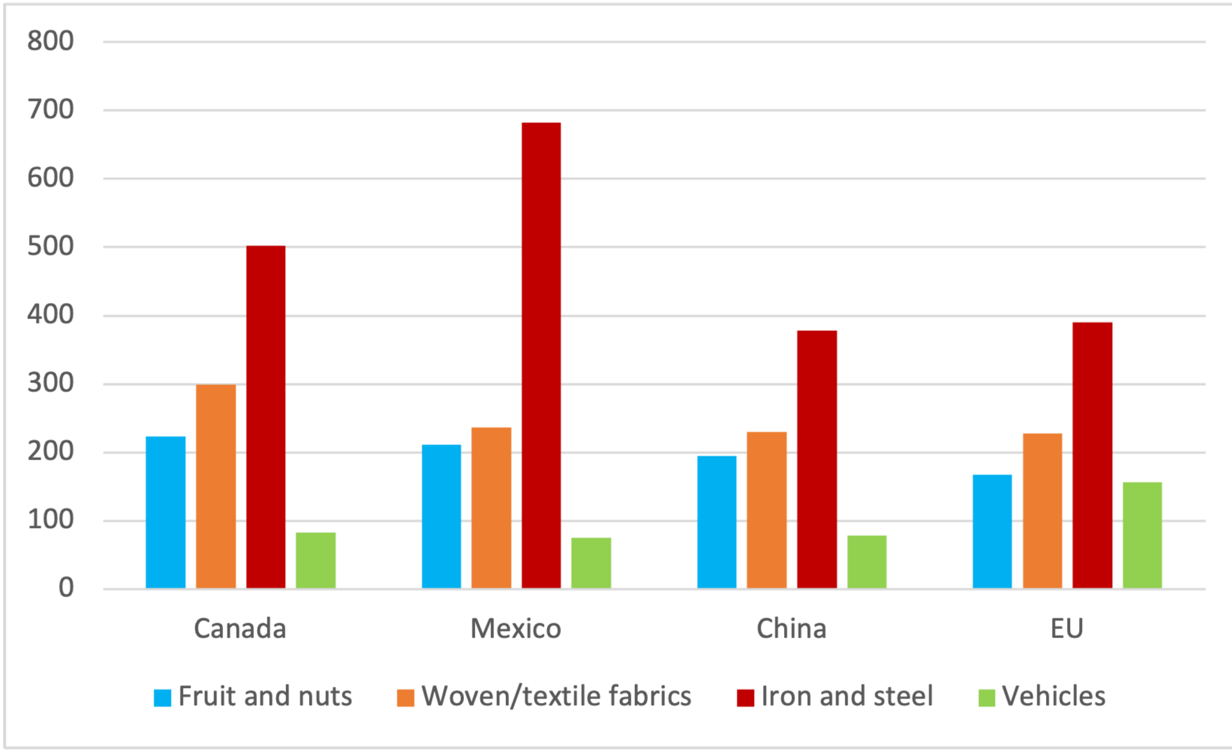
(a) Word cloud between 2008 and 2009

(b) Word cloud between 2016 and 2017

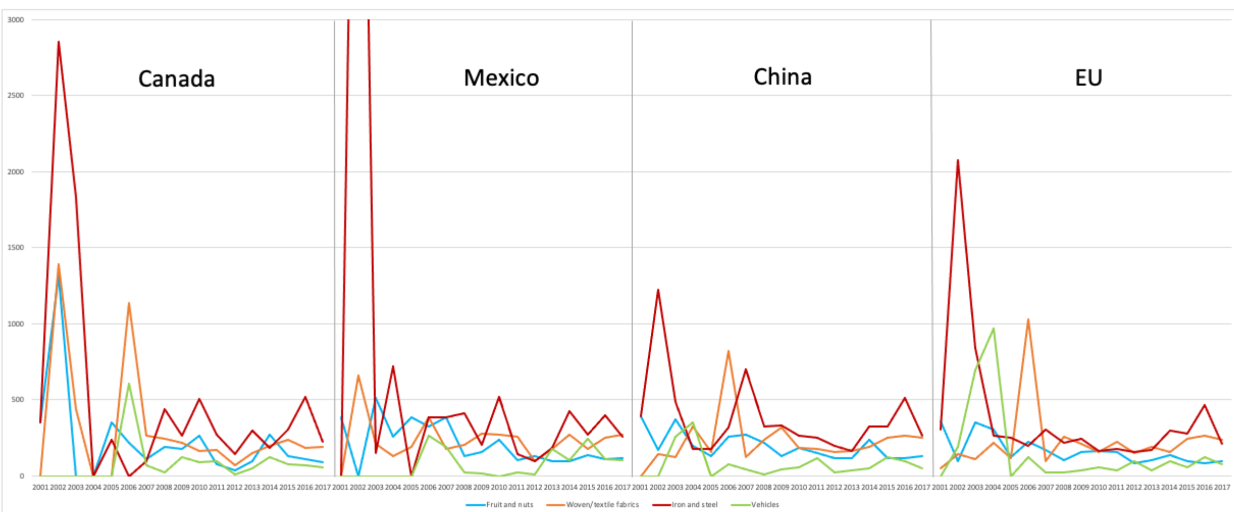
Figure 2.3: Word cloud from news during two important time frame

Mexico were exempt from the steel tariffs due to the potential punishments the U.S. would face under the North American Free Trade Agreement (NAFTA). After 2002, the steel industry's TPU indices vary differently across countries until they culminated around 2016 to 2017 for all four countries, which were again triggered by U.S. safeguard tariffs initiated by the former president Donald Trump to the major trade partners, including all the four selected groups in this chapter. We can also find that the spike of TPU of fabrics in 2002 was driven by Canada and Mexico, which seems to be related to China's accession to WTO since China had developed its strongly competitive apparel export industries and provided relatively lower price to the rest of the world (Gruben, 2006). Beside these variations across the four groups, we can see that the TPU indices of the four industries had changed at a similar pace across the four groups. For example, all the industries but the iron and steel increased more or less in 2005 and 2006 for all four groups, which can be accounted for by the suspension of Doha Round of Trade Talks in 2006 due to the opposition from the U.S. and the EU where the former refused to reduce agricultural subsidies and the latter failed to increase the agriculture market access. In addition, all these four industries were affected by the financial crisis reflected by higher TPU around 2007 to 2009. Moreover, both steel TPU and fabric TPU increased after 2016 due to the tariff threats from Trump Administration. During the same time frame, however, the other two industries were not affected too much. These facts indicate that industry-level fixed effects are also important elements of our econometric strategy to study the effect of TPU on trade flows.

Figure 2.5 provides the maps to report country-level TPU ($TPU_t^{m,j}$) for Canada, Mexico, China, the EU, and their global trade partners. Three portions are presented from the top-down, corresponding to the beginning year (2001), the year when the global financial crisis started (2008), and the last year covered by our dataset (2017).



(a) 4 industries with average high level of TPU (pooled data)



(b) 4 industries with average high level of TPU (panel data)

Figure 2.4: Examples of TPU index by industry over years

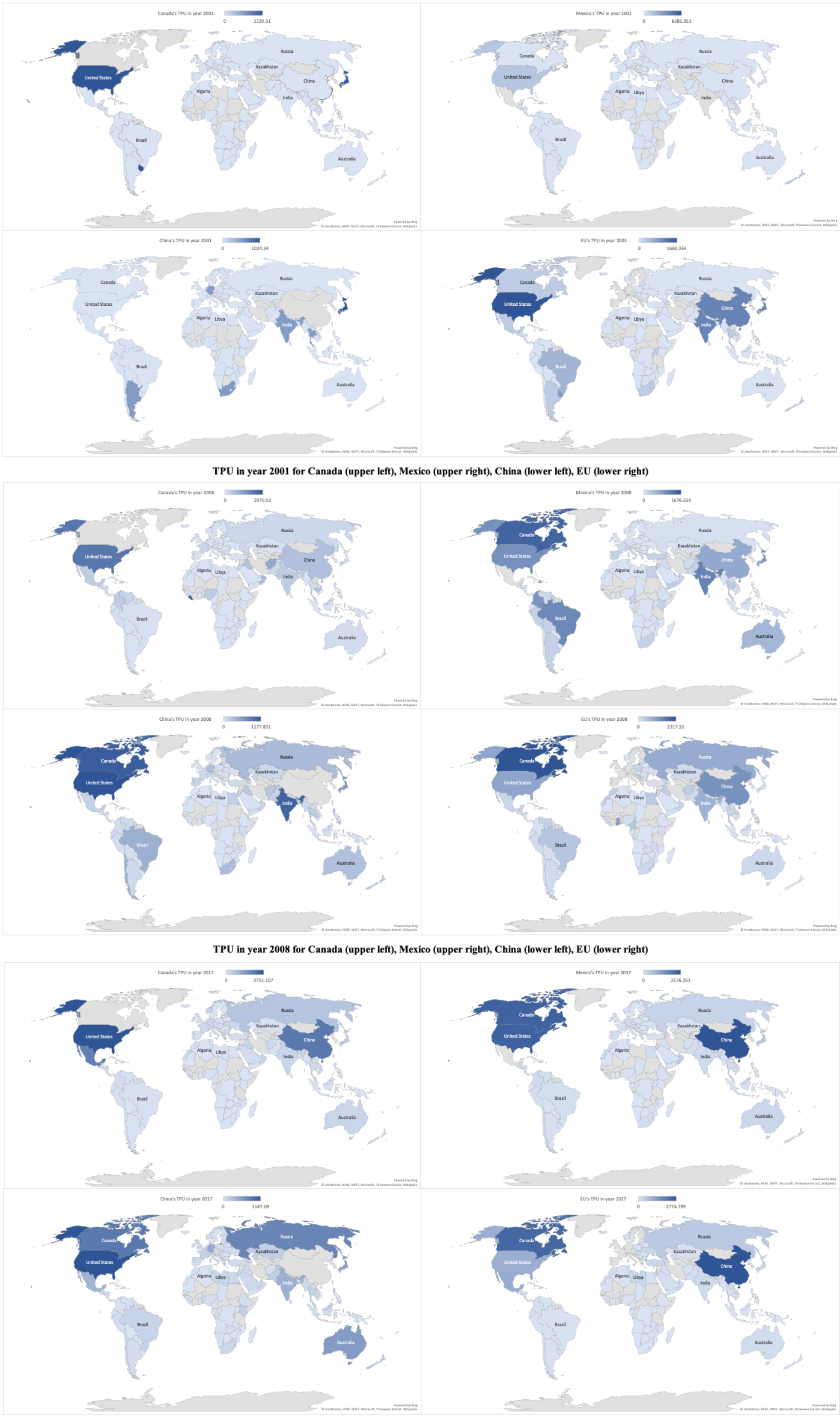


Figure 2.5: Change in TPU index at country-year level in 2001, 2008, and 2017

For each of the years we selected, there are four panels of maps, corresponding to Canada (upper left corner), Mexico (upper right corner), China (lower left corner), and the EU (lower right corner). In general, we find that the TPUs at the country level of these four groups were fairly low in 2001, doubled or even tripled in 2008 due to the global financial crisis, and became close to or slightly higher than 2008 at the end of the period covered by our dataset. The color of a specific area on the maps is deepened from one year to another if the TPU indices of the corresponding area get higher. Among these four groups, the largest increases in TPU indices highlight two of them: China and Canada. China has been a WTO member since 2001. Its market power has increased dramatically over time. In addition, it provides relatively cheap prices for products in labor-intensive industries to the rest of the world and attracts many foreign direct investments. Therefore, China is considered as a big threat to the large export countries and their domestic labor market. These four groups' TPU indices to Canada are high in 2008 and 2017, which would be explained by Canada's close relationship with the U.S. Besides the four groups' TPU indices to each other, their TPU indices to U.S., especially since 2008, have been considerably high. There are a few reasons explaining the high trade uncertainty between the U.S. and its partners. First, the U.S. has maintained the largest market power in the world, and therefore has attracted most other countries close attention. Second, the global financial crisis originated in the U.S. and then spread over to the rest of the world where all the four selected groups were adversely affected. Third, safeguard measures applied by the Trump Administration caused trade uncertainty among its major trade partners to culminate between 2016 and 2017. All these economic and political factors could account for the surge in TPU indices in the four groups to the U.S. Besides China, Canada and the U.S., Russia, Brazil, and India are also highlighted by the maps. Since 2008, trade restrictions have been shifted eastwards to Russia, China, Brazil, and India deriving from deteriorating performance of emerging economies and their gradually important role of economic governance in the global environment (Barone and Bendini 2015), which could be the main reason to consider these countries as red flags among the four selected groups. We, therefore, also consider controlling for country-fixed effects in our models.

It is worth noting that figures 2.2, 2.4, and 2.5 are generated based on import data. The export data provides similar figures with little variations. Hence, we omitted them in this chapter.

Table 2.2 shows summary statistics for the TPU index across the four selected countries with different levels of aggregation. We have a total 387,732 measures of our main variable $TPU_{s,t}^{m,j}$ for import dataset, including 93,399 measures of $TPU_{s,t}^{j}$ for Canada, 72,968 measures of $TPU_{s,t}^{j}$ for Mexico, 84,571 measures of $TPU_{s,t}^{j}$ for China, and 136,794 measures of $TPU_{s,t}^{j}$ for the EU. Regarding exports, we have a total 544,356 measures of our main variable $TPU_{s,t}^{j,x}$, including 111,691 measures of $TPU_{s,t}^{j}$ for Canada, 70,819 measures of $TPU_{s,t}^{j}$ for Mexico, 176,454 measures of $TPU_{s,t}^{j}$ for China, and 185,392 measures of $TPU_{s,t}^{j}$ for the EU. Based on the distribution of $TPU_{s,t}^{j}$ across these four selected groups, we could clearly see the heterogeneity in the TPU over them. For instance, the EU has the highest level of $TPU_{s,t}^{j}$ for both imports and exports among the four groups, which could be attributed to four main reasons: the Global Financial Crisis, the European Debt Crisis, the safeguard measures applied by the U.S., and the Brexit. Besides the EU, $TPU_{s,t}^{j}$ for China exports is also quite large compared to Canada and Mexico, which could be possibly triggered by other countries' anti-dumping safeguards and countervailing measures and the trade war with U.S., in addition to the Global Financial Crisis and the U.S. tariff threats which were also the main sources of uncertainties that the other two countries encountered.

Table 2.1: News examples

Country News Released from	News Source	Year	News body	Country	HS 2-digit industry
Canada	Financial Post	2011	...Russia will soon be a member of the world trade organization, which will reduce the **risks** and **uncertainty** of trade and investment for Canadians and Canadian companies with a framework in place that creates greater certainty and a fair basis for dispute resolution, companies in forestry, energy and mining from both countries will have endless opportunities to trade and to combine	Russia, Canada	6, 27
Canada	Maclean	2013	...and to those who share them when we look out onto a horizon filled with **uncertainty**...while commenting on the potential comprehensive economic trade agreement between Canada and Europe, Mulcair talked about erasing trade barriers that serve no purpose he pointed to the gradual evolution of the European coal and steel community into...	Canada, Europe	72
Mexico	Banderas News	2012	...manufacturers are focusing on their ability to offer flexibility and fast turnaround times, especially as US buyers appear increasingly reluctant to source high volumes of clothing from China due to the continuing **uncertainty** in the U.S. market...data from the Mexican apparel industry as sociation, 'Canaive,' has pointed to figures showing that the gap in overall manufacturing wages between Mexico and China has shrunk dramatically over recent years...	US, China, Mexico	61, 62
Mexico	Mexico News Daily	2017	...The binational trade of denim products consists mostly in US firms sending the prepared fabric to Mexican textile assembly plants... there is a widespread sense of **uncertainty** — a widely-held sentiment in Mexico, these days...	US, Mexico	58
China	China Daily	2005	...Both sides want to solve the problem currently the most contentious in bilateral trade and reduce **uncertainties** for enterprises in the sector. ..In Europe there is already a call for easing the 8-12.5 per cent growth limit stipulated in the China-EU agreement. In the United States, traders advocate no less than a 20 per cent limit for Chinese textile export growth....US textile groups made a strong case in the first few months of the Sino-US dispute...	China, EU	58, 59, 63
China	ECNS	2014	...in the TPP free trade negotiations to be more specific, Tokyo and Washington have been at loggerheads over what Japan describes as its five "sacred sectors" - rice, wheat, sugar, dairy products, and beef and pork.. the TPP negotiations also involve Australia, Brunei, Canada, Chile, Malaysia, Mexico, New Zealand, Peru, Singapore and Vietnam...it could force the US to make concessions in the tpp negotiations, but whether Japan and the US can reach an agreement this year is still **uncertain**...	US, Japan, Australia, Brunei, Canada, Chile, Malaysia, Mexico, New Zealand, Peru, Singapore Vietnam	2, 4, 17
EU	Euro News	2016	...Support that in the eyes of many, does not lift the **uncertainties** over the economic future of the region....The United States imposes tariffs of 236% on Chinese steel imports, against 20% in the European Union...	US, EU, China	72
EU	The Guardian (EU)	2017	...Most of UK's fruit and veg is from other EU nations, so Brexit impact may be dramatic...uncertainties associated with **Brexit** are weighing on domestic activity...	EU	8, 14

2.2.2 Other Important Data

The other important data includes trade values collected from UN Comtrade Database and tariff information obtained through the World Integrated Trade Solution (WITS). Our tariff data cover from January 2001 to December 2017, and we consider it as the main impact factor to investigate the role of TPU on the trade flows of Canada, Mexico, China, and the EU at the industry level. According to Table 2.2, the simple average MFN tariff ($\ln(1+t_{s,t}^{m,j}) = \ln \tau_{s,t}^{m,j}$)) is 4.7 log points for Canada, 10.7 log points for Mexico, 9.1 log points for China, and 3.7 log points for the EU; while the average MFN tariff faced by these four groups' trade partners in other markets for similar goods ($\ln(1+t_{s,t}^{j}) = \ln \tau_{s,t}^{j}$)) is 49.3, 47.8, 45.1, 54.0 log points, respectively[17]. In general, the simple average MFN tariffs in the four groups are much lower than in the rest of the world. Likewise, the average MFN tariff applied to each of these four groups' exported products ($\ln(1+t_{s,t}^{j,x}) = \ln \tau_{s,t}^{j,x}$)) is 6.7 log points for Canada, 6.9 log points for Mexico, 8.6 log points for China, and 9.2 log points for the EU, however, the same measures for their trade partners in other market are 43.8, 43.7, 48.1, 55.8 log points, respectively[18].

[17]We aggregate the MFN tariffs for these four groups at the product level (6-digit of the HS) to the industry level (2-digit of the HS) by taking a simple average of the tariffs. Similar process is used to aggregate the MFN for other countries.

[18]Still, the MFN tariffs applied by the four groups are, on average, lower than MFN tariffs applied by trade partners on their products. This is consistent with our finding regarding U.S. MFN tariffs in the first chapter.

Table 2.2: Summary statistics

	N	Mean	SD	Min	Max
TPU for Canada Imports					
$TPU^{j}_{s,t}$	93,399	100.000	1,558.961	0.000	157,733.400
TPU for Canada Exports					
$TPU^{j}_{s,t}$	111,691	100.000	2,185.114	0.000	208,874.000
TPU for Mexico Imports					
$TPU^{j}_{s,t}$	72,968	100.000	1,406.669	0.000	115,828.100
TPU for Mexico Exports					
$TPU^{j}_{s,t}$	70,819	100.000	1,787.101	0.000	159,441.600
TPU for China Imports					
$TPU^{j}_{s,t}$	84,571	100.000	1,075.422	0.000	126,888.100
TPU for China Exports					
$TPU^{j}_{s,t}$	176,454	100.000	1,375.696	0.000	228,060.100
TPU for EU Imports					
$TPU^{j}_{s,t}$	136,794	100.000	1,386.392	0.000	97,174.530
TPU for EU Exports					
$TPU^{j}_{s,t}$	185,392	100.000	1,498.439	0.000	119,329.500
TPU for Imports for Four Countries					
$TPU^{m,j}_{s,t}$	387,732	100.000	1,374.112	0.000	157,733.400
TPU for Exports for Four Countries					
$TPU^{j,x}_{s,t}$	544,356	100.000	1,665.328	0.000	228,060.100
TPU for Imports for Four Countries (1st alternative)					
$TPU^{m,j}_{s,t}$	387,732	100.000	1,314.890	0.000	147,291.300
TPU for Exports for Four Countries (1st alternative)					
$TPU^{j,x}_{s,t}$	544,356	100.000	1,441.287	0.000	187,895.300
TPU for Imports for Four Countries (2nd alternative)					
$TPU^{m,j}_{s,t}$	387,732	100.000	1,369.703	0.000	159,152.500
TPU for Exports for Four Countries (2nd alternative)					
$TPU^{j,x}_{s,t}$	544,356	100.000	1,498.523	0.000	222,958.100
Import Tariffs for Canada					
$ln\tau^{m,j}_{s,t}$	88,526	0.047	0.102	0.000	1.383
$ln\tau^{j}_{s,t}$	87,951	0.493	0.852	0.000	16.701
Export Tariffs for Canada					
$ln\tau^{j,x}_{s,t}$	94,154	0.067	0.084	0.000	3.434
$ln\tau^{j}_{s,t}$	92,963	0.438	0.590	0.000	18.614
Import Tariffs for Mexico					
$ln\tau^{m,j}_{s,t}$	69,204	0.107	0.091	0.000	1.131
$ln\tau^{j}_{s,t}$	68,857	0.478	0.841	0.000	16.624
Export Tariffs for Mexico					
$ln\tau^{j,x}_{s,t}$	62,406	0.069	0.090	0.000	3.221
$ln\tau^{j}_{s,t}$	61,888	0.437	0.561	0.000	18.779
Import Tariffs for China					
$ln\tau^{m,j}_{s,t}$	71,554	0.091	0.067	0.000	0.761
$ln\tau^{j}_{s,t}$	79,730	0.451	0.846	0.000	15.745
Export Tariffs for China					
$ln\tau^{j,x}_{s,t}$	149,659	0.086	0.088	0.000	2.785
$ln\tau^{j}_{s,t}$	140,284	0.481	0.577	0.000	18.780
Import Tariffs for EU					
$ln\tau^{m,j}_{s,t}$	132,811	0.037	0.042	0.000	0. 559
$ln\tau^{j}_{s,t}$	115,210	0.540	0.728	0.000	17.976
Export Tariffs for EU					
$ln\tau^{j,x}_{s,t}$	136,970	0.092	0.101	0.000	3.341
$ln\tau^{j}_{s,t}$	124,197	0.558	0.631	0.000	18.442
Trade Values for Canada					
Import Values (log)	93,393	13.568	2.780	9.210	24.585
Export Values (log)	111,685	13.117	2.541	9.210	25.518
Trade Values for Mexico					
Import Values (log)	72,951	13.769	2.784	9.210	24.150
Export Values (log)	70,798	13.372	2.553	9.210	25.137
Trade Values for China					
Import Values (log)	84,556	14.521	3.142	9.210	25.191
Export Values (log)	176,446	14.941	2.856	9.210	25.949
Trade Values for EU					
Import Values (log)	136,773	14.862	3.186	9.210	25.821
Export Values (log)	185,385	15.468	2.820	9.210	25.108

Notes:
(1) m represents four importers: China, Canada, Mexico, and EU.
(2) x represents four exporters: China, Canada, Mexico, and EU.

Notice that the evaluations of the four groups' trade flows follow the patterns for TPU identified in the maps of Figure 2.5. First, China has become a major source of other countries' imports. For Canada, its imports from China represented 3.85 percent of total Canada's imports in 2001, while they skyrocketed over the last two decades, turning that country into the major source of Canada's imports, representing 12.89 percent of total imports in 2017. We can also see such a mushrooming of Mexico imports and EU imports from China between 2001 and 2017. Specifically, China's exports to Mexico in 2001 took 2.44 percent of Mexico's total imports, while its exports were 18.03 percent in 2017. China's exports were growing from 8.56 percent in 2001 to 17.66 percent of the EU's total imports in 2017. Besides imports from China, Canada's imports from Mexico had also gone up during the same period, from 3.64 percent of its total imports in 2001 to 6.45 percent in 2017. Meanwhile, Russia has started to provide more of its exports to the world. From 2001 to 2017, Russia's export to China had gone up from 2.67 percent to 6.28 percent and its export to the EU had also increased from 3.99 percent to 4.83 percent. In addition, the trade partnership and the trade uncertainties along with it between China and Australia have been outstanding recently. According to WITS (World Integrated Trade Solution), Australia was China's 8th largest exporter in 2001 (i.e., making up 2.67 percent of China's total import) but became the 5th largest exporter in 2017 (i.e., making up 6.29 percent of China's total import). It is worth noting that the U.S. has always been among the top 3 importers of all these four groups over time, which brings in more controversies and uncertainties between it and the other countries.

Our analysis controls for other important variables such as the presence of a preferential trade agreement (PTA). We construct a binary variable ($PTAMGN_{s,t}^{m,j}$) that equals one if the preference margin, i.e., difference between the importer m's MFN at the industry level and its preferential tariff ($\ln(1 + t_{s,t}^{prefm,j}) = \ln \tau_{s,t}^{prefm,j})$), is greater than zero. Otherwise, the value of this variable is zero. In addition to this point and following the method of Estevadeordal, Freund, and Ornelas (2008), we also test for the degree of market access by setting the value of preference margin to equal one if it is greater than two percentage points. Likewise, we control for the presence of preferential access granted by the trading partners of Canada, Mexico, China, and the EU to the four groups' exporters following a similar methodology.

2.3 Gravity Model

This section first develops our baseline model to predict imports and exports of Canada, Mexico, China and the EU following Feenstra, Ma, and Xu (2019). Next, we consider extensions of this model by incorporating the intensive and extensive margins of trade and controlling for preferential trade access.

2.3.1 Baseline Specification

The structural gravity model used in Feenstra, Ma, and Xu (2019) shows that, under symmetric CES utility functions, importer m (i.e., Canada, Mexico, China, the EU) imports ($Y_{s,v,t}^{m,j}$) of variety v from country j, originating in industry s at year t can be related to country i's imports of an identical product ($Y_{s,v,t}^{i,j}$) according to the following expression:

$$\frac{Y_{s,v,t}^{m,j}}{Y_{s,v,t}^{i,j}} = \left(\frac{mc_{s,t}^{j} d^{m,j} \tau_{s,t}^{m,j}}{mc_{s,t}^{j} d^{i,j} \tau_{s,t}^{i,j}}\right)^{1-\sigma} \frac{\left(P_{s,t}^{m}\right)^{\sigma-1} E_{s,t}^{m}}{\left(P_{s,t}^{i}\right)^{\sigma-1} E_{s,t}^{i}} \tag{2.4}$$

where we can cancel out county j's marginal costs in industry s, $mc_{s,t}^{j}$. Notice that $P_{s,t}^{m}$ and $P_{s,t}^{i}$ represent the aggregate price index in industry s for the importer and country i, respectively, while $E_{s,t}^{m}$ and $E_{s,t}^{i}$ represent the total expenditure in industry s for these countries. Moreover, $d^{m,j}$ and $d^{i,j}$ stand for the distance between the importer and country j and the distance between countries i and j, respectively. The MFN tariffs applied by the importer and by country i on varieties produced by industry s are labeled $\tau_{s,t}^{us,j}$ and $\tau_{s,t}^{i,j}$, respectively. At the same time, σ represents the elasticity of substitution among varieties of the same industry and is assumed to be greater than one.

We re-arrange equation (2.4) by multiplying both sides by $V_{s,t}^{j}$, which stands for the number of varieties produced by industry s located in country j. We can then sum across m's trading partners to obtain:

$$V^j_{s,t} Y^{m,j}_{s,v,t} \sum_{i \neq m} \left[\left(d^{i,j} \right)^{1-\sigma} \left(P^i_{s,t} \right)^{\sigma-1} E^i_{s,t} \right] = \left(d^{m,j} \tau^{m,j}_{s,t} \right)^{1-\sigma} \left(P^m_{s,t} \right)^{\sigma-1} E^m_{s,t} \sum_{i \neq m} \left[V^j_{s,t} Y^{i,j}_{s,v,t} \left(\tau^{i,j}_{s,t} \right)^{\sigma-1} \right] \tag{2.5}$$

Next, we multiply and divide the right-hand-side of expression (2.5) by $\sum_{k \neq m} Y^{k,j}_{s,t}$. We can then solve for solve for $Y^{m,j}_{s,t}$ $(=V^j_{s,t} Y^{m,j}_{s,v,t})$, which represents m's imports from country j in industry s at year t, and obtain the following expression:

$$Y^{m,j}_{s,t} = \left[\frac{(d^{m,j} \tau^{m,j}_{s,t})^{1-\sigma} \left(P^m_{s,t} \right)^{\sigma-1} E^m_{s,t}}{\sum_{i \neq m} (d^{i,j})^{1-\sigma} \left(P^i_{s,t} \right)^{\sigma-1} E^i_{s,t}} \right] \left(\sum_{k \neq m} Y^{k,j}_{s,t} \right) \sum_{i \neq m} \frac{Y^{i,j}_{s,t}}{\sum_{k \neq m} Y^{k,j}_{s,t}} \left(\tau^{i,j}_{s,t} \right)^{\sigma-1} \tag{2.6}$$

Following most of the literature, we rely on a log-linearized version of the gravity equation described by expression (2.6). We can then write our structural gravity equation for m's imports in the following manner:

$$lnY^{m,j}_{s,t} = \theta^m_{s,t} + \gamma^j_t + \lambda^j_s + \beta_1 ln\tau^{m,j}_{s,t} + \beta_2 ln\tau^j_{s,t} + \beta_3 ln \left(\sum_{k \neq m} Y^{k,j}_{s,t} \right) + \epsilon^j_{s,t} \tag{2.7}$$

In expression (2.7), the term $\theta^m_{s,t}$ represents a set of industry-year fixed effects, which absorb the aggregate price index $P^m_{s,t}$ and the total expenditure $E^m_{s,t}$. Likewise, the terms γ^j_t and λ^j_s stand for country-year and country-industry fixed effects that control for distance $d^{m,j}$ and any economic and political factors that affect imports at the country and industry levels. The variable $\tau^{m,j}_{s,t}$ represents the average MFN import tariff imposed by m on products exported by industry s from exporter j at time t. The variable $\tau^j_{s,t} = \sum_{i \neq m} \frac{Y^{i,j}_{s,t}}{\sum_{k \neq m} Y^{k,j}_{s,t}} \left(\tau^{i,j}_{s,t} \right)^{\sigma-1}$ is a measure of the average MFN export tariffs that country j faces when exporting varieties originating in industry s to the rest of the world (i.e., excluding impoerter m).[19] This term captures a possible diversion of trade since higher tariffs in the rest of the world may increase m's imports, ceteris paribus. The term $\sum_{k \neq m} Y^{k,j}_{s,t}$ includes all the export values from country j to countries other than importer m. The error term $\epsilon^j_{s,t}$ includes some unobserved factors,

[19]Notice that Tables B.3 and B.4 in the appendix test our baseline models for imports and exports replacing MFN tariffs by bilateral tariffs, which reflect the application of preferential tariffs between PTA members.

such as $-\ln\left[\sum_{i\neq m}(d^{i,j})^{1-\sigma}\left(P^{i}_{s,t}\right)^{\sigma-1}E^{i}_{s,t}\right]$.

We are interested in the impact of the TPU index generated from trade news (see expression (2.3)) on m's imports based on the structural model discussed above, and we have four importers to be included into our structural model in equation (2.7). Therefore, our baseline regression for the imports of the four groups can be written as follows:

$$lnY^{m,j}_{s,t} = \theta^{m}_{s,t} + \eta^{m,j}_{t} + \mu^{m,j}_{s} + \beta_1 TPU^{m,j}_{s,t} + \beta_2 ln\tau^{m,j}_{s,t} + \beta_3 ln\tau^{j}_{s,t} + \beta_4 ln\left(\sum_{k\neq m} Y^{k,j}_{s,t}\right) + \epsilon^{j}_{s,t} \quad (2.8)$$

Notice that $\theta^{m}_{s,t}$, $\eta^{m,j}_{t}$, and $\mu^{m,j}_{s}$ are industry-year fixed effects, importer-exporter-year fixed effects, and importer-exporter-industry fixed effects, respectively. These fixed effects cover the fixed effects in expression (2.7) and perfectly absorb the characters between importers and their trade partner countries as well as other features of each of the four importer groups.

We then expect that coefficient β_1 in expression (2.8) is negative. Besides, it's worth noting that the coefficient β_2 in expression (2.8) equals $1-\sigma$, and therefore should be negative. The coefficient β_3 is expected to be positive since the higher the average export tariffs country j faces when exporting to other countries, the higher tends to be j's exports to importer m. In this case, the idea is that country j will divert trade away from higher tariff locations. The coefficient β_4 is expected to be positive because it reflects country j's ability to compete in the international market.

We now turn to the derivation of an estimable equation for the exports of Canada, Mexico, China, and the EU which are denoted as exporter x to a country j. In this case, the relationship between exporter's exports in industry s at time t to country j can be related to exports from country i by the following expression:

$$\frac{Y^{j,x}_{s,v,t}}{Y^{j,i}_{s,v,t}} = \left(\frac{mc^{x}_{s,t} d^{x,j} \tau^{j,x}_{s,t}}{mc^{i}_{s,t} d^{i,j} \tau^{j,i}_{s,t}}\right)^{1-\sigma} \quad (2.9)$$

where the ratio between $mc^{x}_{s,t}$ and $mc^{i}_{s,t}$ represents the relative marginal cost between the exporter and country i in industry s at year t. We can manipulate expression (2.9) to write it in terms of exporter's exports $Y^{j,x}_{s,t} (= V^{x}_{s,t} Y^{j,x}_{s,v,t})$, and by log-linearizing this modified expression, we obtain the following equation for exporter's exports:

$$lnY_{s,t}^{j,x} = \theta_{s,t}^{x} + \gamma_t^j + \lambda_s^j + \beta_1 ln\tau_{s,t}^{j,x} + \beta_2 ln\tau_{s,t}^{j} + \beta_3 ln\left(\sum_{k\neq m} Y_{s,t}^{j,k}\right) + \epsilon_{s,t}^{j} \tag{2.10}$$

We can manipulate expression (2.10) to write it in terms of exports for all four groups, and by incorporating the value of TPU into this modified expression, we obtain the following equation:

$$lnY_{s,t}^{j,x} = \theta_{s,t}^{x} + \eta_t^{j,x} + \mu_s^{j,x} + \beta_1 TPU_{s,t}^{j,x} + \beta_2 ln\tau_{s,t}^{j,x} + \beta_3 ln\tau_{s,t}^{j} + \beta_4 ln\left(\sum_{k\neq x} Y_{s,t}^{j,k}\right) + \epsilon_{s,t}^{j} \tag{2.11}$$

Equation (2.11) represents the export-equivalent of expression (2.8) for U.S. imports and its main explanatory variables then follow this pattern. Again, the term $\theta_{s,t}^{x}$ represents a set of industry-year fixed effects, while the terms $\eta_t^{j,x}$ and $\mu_s^{j,x}$ represent importer-exporter-year and importer-exporter-industry sets of fixed effects. The variable $\tau_{s,t}^{j,x}$ represents the average MFN import tariff imposed by country j on varieties of products exported by industry s based in exporter x at year t, while $\tau_{s,t}^{j}=\sum_{i\neq us} \frac{Y_{s,t}^{j,i}}{\sum_{k\neq x} Y_{s,t}^{j,k}} \left(\tau_{s,t}^{j,i}\right)^{\sigma-1}$ stands for a measure of the average MFN import tariffs imposed by country j on varieties of goods from industry s originating in the rest of the world (i.e., excluding exporter x). Likewise, the term $\sum_{k\neq x} Y_{s,t}^{j,k}$ represents country j's imports from countries other than exporter x.

Likewise, we expect that the coefficients β_1 and β_2 in expression (2.11) are negative and the coefficients β_3 and β_4 are positive.

2.3.2 Robustness Tests and Gravity

We consider numerous robustness tests to specifications (2.8) and (2.11). In this regard, we consider the robustness of the results by replacing MFN tariffs by bilateral tariffs that control for the presence of PTAs. Moreover, we investigate the effects of TPU on the margins of trade and consider the importance of controlling for the degree of preferential trade access in determining the effects of TPU on trade flows. Last, we consider two robustness checks by a) constructing an alternative TPU index with uncertainty words selected by Caldara et al. (2020), and b) modifying the current TPU index by adding a more demanding set of trade-specific terms that narrow each TPU index down to imports/exports. Below we discuss how we alter the baseline gravity model to account for the effects of trade margins and the preferential access margin.

Intensive and extensive margins of Trade

Hummels and Klenow (2005) show that trade flows between two countries can be decomposed into an intensive margin, an extensive margin, and the importer's total imports (from the world). The comprehensive set of fixed effects used in specifications (2.8) and (2.11) control for a country's total imports. Then, we investigate below the effects of TPU on trade flows' extensive and intensive margins for the four groups. Specifically, we replace these four groups' imports $lnY_{s,t}^{m,j}$ and exports $lnY_{s,t}^{j,x}$ with Hummels and Klenow's (2005) definitions of intensive and extensive margins of trade. We first follow Hummels and Klenow (2005) to measure the intensive margin for imports and exports of Canada, Mexico, China, and the EU as follows:

$$IM_{s,t}^{m,j} = \frac{\sum_{i \in S_{m,j}} Y_{it}^{m,j}}{\sum_{i \in S_{m,j}} Y_{it}^{m,ROW}} \qquad IM_{s,t}^{j,x} = \frac{\sum_{i \in S_{j,x}} Y_{it}^{j,x}}{\sum_{i \in S_{j,x}} Y_{it}^{j,ROW}} \tag{2.12}$$

where $IM_{s,t}^{m,j}$ ($IM_{s,t}^{j,x}$) represents the intensive margin for importer m's imports from (exporter x's exports to) country j in industry s using products i in year t. In this case, $S_{m,j}$ ($S_{j,x}$) represents the set of 6-digit products in a 2-digit industry s where the m's imports from (x's exports to) country j in year t. Similarly, $Y_{it}^{m,j}$ ($Y_{it}^{j,x}$) stands for m's imports from (x's exports to) country j in the 6-digit product i. Instead, $Y_{it}^{m,ROW}$ ($Y_{it}^{j,ROW}$) represents m(j) imports from the rest of the world in product i.[20] As a result, the intensive margin focuses on country j's share of importer m's imports within the set of products exported by country j to m. Notice that m's imports from country j in industry s at year t can be viewed as an unweighted version of the intensive margin of trade.

We can now focus on two alternative definitions of the extensive margin of trade. First,

[20]Note that in expression (2.12), ROW in $IM_{s,t}^{m,j}$ excludes j, ROW in $IM_{s,t}^{j,x}$ excludes x.

we consider an extensive margin of trade based on Debaere and Mostashari (2010). Second, we focus on constructing an extensive margin of trade based on Hummels and Klenow (2005). Beginning with the former approach, we define the extensive margin of trade based on the number of 6-digit products i in a 2-digit industry s imported (exported) by m (x) from (to) country j, or equivalently, $EM^{m,j}_{s,t} = \sum_{i \in S_{m,j}} N^{m,j}_{it}$ ($EM^{j,x}_{s,t} = \sum_{i \in S_{j,x}} N^{j,x}_{it}$). Regarding Hummels and Klenow's (2005) definition of an extensive margin, we can construct it for the imports and exports of Canada, Mexico, China, and the EU using the following formulas:

$$EM^{m,j}_{s,t} = \frac{\sum_{i \in S_{m,j}} Y^{m,ROW}_{it}}{\sum_{i \in S} Y^{m,ROW}_{it}} \qquad EM^{j,x}_{s,t} = \frac{\sum_{i \in S_{j,x}} Y^{j,ROW}_{it}}{\sum_{i \in S} Y^{j,ROW}_{it}} \tag{2.13}$$

where $EM^{m,j}_{s,t}$ ($EM^{j,x}_{s,t}$) represents the extensive margin for m's imports from (x's exports to) country j in industry s using products i in year t. Key differences concerning expressions (2.12) are that trade flows with the world are used in the numerator, while the denominator controls for the set of all goods traded between each of the four groups (country j) and the ROW. [21] Thus, expressions (2.13) represents the share of products traded between each of the four groups (m or x) and country j using as weights the importance of each product on trade between the four groups (country j) and the world.[22]

To consider the effects of TPU on the margins of trade, we replace the dependent variables in expressions (2.8) and (2.11) by the log of the margins of trade described in equations (2.12) and (2.13) and can then obtain:

$$lnIM^{m,j}_{s,t} = \theta^{m}_{s,t} + \eta^{m,j}_{t} + \mu^{m,j}_{s} + \beta_1 TPU^{m,j}_{s,t} + \beta_2 ln\tau^{m,j}_{s,t} + \beta_3 ln\tau^{j}_{s,t} + \beta_4 ln\left(\sum_{k \neq m} Y^{k,j}_{s,t}\right) + \epsilon^{j}_{s,t} \tag{2.14}$$

[21] Notice that ROW in the left-hand side expression of (2.13) excludes j, while ROW in the right-hand side expression excludes x.

[22] As discussed above, notice that expressions (2.12) and (2.13) yield that $IM^{m,j}_{s,t} \times EM^{m,j}_{s,t} = \frac{Y^{m,j}_{s,t}}{\sum_{i \in S} Y^{m,ROW}_{it}}$. We can take the log on both sides and rearranging we get $lnY^{m,j}_{s,t} = lnIM^{m,j}_{s,t} + lnEM^{m,j}_{s,t} + ln(\sum_{i \in S} Y^{m,ROW}_{it})$.

$$lnIM^{j,x}_{s,t} = \theta^{x}_{s,t} + \eta^{j,x}_{t} + \mu^{j,x}_{s} + \beta_1 TPU^{j,x}_{s,t} + \beta_2 ln\tau^{j,x}_{s,t} + \beta_3 ln\tau^{j}_{s,t} + \beta_4 ln\left(\sum_{k\neq x} Y^{j,k}_{s,t}\right) + \epsilon^{j}_{s,t} \tag{2.15}$$

and similarly for the measures of extensive margin we have the following expressions:

$$lnEM^{m,j}_{s,t} = \theta^{m}_{s,t} + \eta^{m,j}_{t} + \mu^{m,j}_{s} + \beta_1 TPU^{m,j}_{s,t} + \beta_2 ln\tau^{m,j}_{s,t} + \beta_3 ln\tau^{j}_{s,t} + \beta_4 ln\left(\sum_{k\neq m} Y^{k,j}_{s,t}\right) + \epsilon^{j}_{s,t} \tag{2.16}$$

$$lnEM^{j,x}_{s,t} = \theta^{x}_{s,t} + \eta^{j,x}_{t} + \mu^{j,x}_{s} + \beta_1 TPU^{j,x}_{s,t} + \beta_2 ln\tau^{j,x}_{s,t} + \beta_3 ln\tau^{j}_{s,t} + \beta_4 ln\left(\sum_{k\neq x} Y^{j,k}_{s,t}\right) + \epsilon^{j}_{s,t} \tag{2.17}$$

TPU interacts with preference margin

The number of preferential trade agreements, one of the most important components of world-wide trade policies, is growing rapidly. Ever since World War II, the European Coal and Steel Community (ESSC) was established as the first major Regional Trade Agreement (RTA), which is now transformed into the European Union (EU). The current EU is a large-scale RTA with all EU members considering it as the Customs Union. The EU has also developed trade agreements with the rest of the world, such as the European Free Trade Agreement (EFTA) with Switzerland, Norway, and Iceland, the customs union with Turkey, the EU-Canada Comprehensive Economic and Trade Agreement (CETA) with Canada, EU-Mexico association agreement with Mexico, and Trade Partnership Agreements (TPAs) with Chile, Caribbean nations, African countries, etc. Besides the EU and its trade partners, there are hundreds of trade agreements established in the world. Mexico and Canada reached an agreement on the North American Free Trade Agreement with the United States in 1994. China has not been involved in many PTAs until the past two decades. In 2010, it joined the Association of Southeast Asian Nations (ASEAN)–China Free Trade Area to promote intergovernmental cooperation and other developments among the ten member states of the Association of Southeast Asian Nations (ASEAN) and China. Besides ASEAN, China also maintains FTAs with 16 trade partners, including some Asian countries and Latin American countries[23]. PTA brings huge benefits for trade partners. Koo, Kennedy, and Skripnitchenko (2006) found that the overall effects of regional preferential trade agreements (RPTA) significantly increase trade volume among member countries through both inter- and intra-industry trade. NAFTA seems a good example to show the positive effect of PTAs on trade flows. Mexico has been able to specialize more in labor-intensive industries after joining NAFTA, which particularly supports its net trade creation through the supply chains in textiles, autos, and electronics [24]. In addition, Baccini (2019) focuses on the micro-foundation of preferential liberalization with industry and firm-level data and shows that PTAs increase both trade flows and Foreign Direct Investment (FDI). For example, the numbers of FDI in Canada and Mexico have been extremely larger than original expectations after the creation of NAFTA [25]. Also, the free trade program in the EU helps it attract more FDI among European countries. Future trade agreements can mitigate the negative shock of Brexit on FDI between the EU and the U.K. (Carril-Caccia 2020). It is therefore reasonable to assume that PTA formation can provide insurance on trade against the effects of TPU.

We then aim to measure the insurance effect represented by the presence of a PTA by constructing dummy variables that control for the presence of preferential access. First, we calculate the preference margin by taking the difference between the log of the average MFN and the log of the average preferential tariff in industry s in year t applied by one of the four groups (country j) on imports from j (one of four groups). Second, we then convert it into a binary variable, which takes on the value of one when the preference margin is greater than zero, and its value is zero otherwise. We label it $PTAMGN_{s,t}^{m,j}$ $(PTAMGN_{s,t}^{j,x})$. Moreover, we create an additional binary variable that equals one if the preference margin is at least two percentage points, and its value is zero otherwise. In this case, we label it $PTAMGN2_{s,t}^{m,j}$

[23]For more details about the 16 FTA partners of China, see "https://www.trade.gov/knowledge-product/china-trade-agreements"

[24]More details can be found from https://www.dallasfed.org/-/media/Documents/research/pubs/nafta20/nafta20.pdf and https://www.usitc.gov/publications/332/pub4889.pdf

[25]For more details regarding the increases in FDI in Canada and Mexico after the creation of NAFTA, see "https://www.epi.org/publication/webfeatures_snapshots_archive_10271999/."

$(PTAMGN2^{j,x}_{s,t})$. Lastly, we include the variable $PTAMGN^{j}_{s,t}$ $(PTAMGN2^{j}_{s,t})$ that equals 1 if country j receives preferential access from another country (that is greater than 2 percentage points) in industry s at year t, and equals 0 otherwise. Intuitively, the interaction of the presence of positive preference margin and TPU is supposed to mitigate the effects of TPU on trade. Thus, we modify our expressions (2.8) and (2.11) by incorporating this interaction as follows:

$$\begin{aligned} lnY^{m,j}_{s,t} \;=\;& \theta^{m}_{s,t} + \eta^{m,j}_{t} + \mu^{m,j}_{s} + \beta_1 TPU^{m,j}_{s,t} + \beta_2 PTAMGN^{m,j}_{s,t} + \beta_3 TPU^{m,j}_{s,t} \times PTAMGN^{m,j}_{s,t} \\ & + \beta_4 PTAMGN^{j}_{s,t} + \beta_5 TPU^{m,j}_{s,t} \times PTAMGN^{j}_{s,t} + \beta_6 ln\tau^{m,j}_{s,t} + \beta_7 ln\tau^{j}_{s,t} \\ & + \beta_8 ln\left(\sum_{k\neq m} Y^{k,j}_{s,t}\right) + \epsilon^{j}_{s,t}, \end{aligned} \tag{2.18}$$

where we expect that β_1 is negative since TPU may have a deleterious effect on bilateral trade. On the other hand, we expect that β_2, β_3, and β_4 are positive since preferential access promotes bilateral trade and may provide insurance against TPU.

In the case of exports we have,

$$\begin{aligned} lnY^{j,x}_{s,t} \;=\;& \theta^{m}_{s,t} + \eta^{j,x}_{t} + \mu^{j,x}_{s} + \beta_1 TPU^{j,x}_{s,t} + \beta_2 PTAMGN^{j,x}_{s,t} + \beta_3 TPU^{j,x}_{s,t} \times PTAMGN^{j,x}_{s,t} \\ & + \beta_4 PTAMGN^{j}_{s,t} + \beta_5 TPU^{j,x}_{s,t} \times PTAMGN^{j}_{s,t} + \beta_6 ln\tau^{j,x}_{s,t} + \beta_7 ln\tau^{j}_{s,t} \\ & + \beta_8 ln\left(\sum_{k\neq x} Y^{j,k}_{s,t}\right) + \epsilon^{j}_{s,t}, \end{aligned} \tag{2.19}$$

where the coefficients of β_1 to β_4 are expected to be in line with what we have for expression (2.18).

2.4 Estimation Results

In this section, we divide our discussion of econometric results into two parts. We first present our findings for the imports of the combination of Canada, Mexico, China, and the EU. We then show the TPU effects on exports of these four groups as a whole. We also tested and include the separate results of TPU effect on each of the four groups in Tables

B.1 and B.2 in the appendix.

2.4.1 Results on Imports of Four Countries

Table 2.3 reports the estimation results of our baseline specification based on news articles released and collected from four groups: China, Canada, Mexico, and the EU. The specifications applied in column (1) to column (4) use our entire sample for the imports of the four groups. As we move from columns (1) - (4), we add explanatory variable one at a time, indicating that column (4) reports the result of expression (2.8) [26]. The specifications used in columns (5) - (8) are similar to those in columns (1) - (4) except that we use observations for the year 2008, and beyond, i.e., we control for years after the financial crisis, in columns (5) - (8). In this case, column (8) reports the results of our baseline specification from 2008 to 2017. Additionally, all specifications control for importer-exporter-year, importer-exporter-industry, and industry-year fixed effects. Moreover, our measure of TPU is scaled by 0.0001. Column (1) reports the estimated effects of $TPU_{s,t}^{m,j}$ on the imports of our four selected groups. The coefficient of $TPU_{s,t}^{m,j}$ is -0.017 but is not statistically significant. The results in columns (2) - (4) show that adding additional variables, including tariff imposed by each of these four countries on country j ($ln\tau_{s,t}^{m,j}$), the average export tariff country j faces when exporting goods to the rest of the world ($ln\tau_{s,t}^{j}$), and country j's exports to the rest of the world in a particular industry ($ln\left(\sum_{k\neq m} Y_{s,t}^{k,j}\right)$), do not alter the total effect of TPU on the imports of China, Canada, Mexico, and the EU when using the full sample. Moreover, we find that the coefficient of $ln\tau_{s,t}^{m,j}$ is significantly negative and the coefficient of $ln\left(\sum_{k\neq m} Y_{s,t}^{k,j}\right)$ if significantly positive, which are in line with our expectations. The coefficient of $ln\tau_{s,t}^{j}$ is insignificant. Columns (5) - (8) show that the TPU effect is particularly important during years of heightened economic uncertainty. The specification used in column (8) reports the coefficient of $TPU_{s,t}^{j,m}$ is -0.052 and statistically significant at the 10% level. This result suggests that, a one-standard-deviation increase in this variable, is associated with an average decrease of 0.71% (-0.052$\times$ 1374.112 (S.D. of $TPU_{s,t}^{j,m}$) $\times$ 0.0001 $\times$ 100

[26] Unlike Table 1.3 in Chapter 1, we didn't include the lagged value of TPU because it is not statistically significant in Chapter 2.

%) in the imports. The coefficients of other variables remain similar to those in columns (1) - (4). As such, we will only focus on the results covering years between 2008 and 2017 in the rest of the paper.

Table 2.3: Structural model estimation for four groups (Imports)

	Dependent Variable: Import Value (Log)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$TPU_{s,t}^{m,j}$	-0.017	-0.017	-0.017	-0.018	-0.052*	-0.052*	-0.052*	-0.052*
	(0.015)	(0.015)	(0.015)	(0.015)	(0.028)	(0.028)	(0.028)	(0.028)
$ln\tau_{s,t}^{m,j}$		-0.314***	-0.315***	-0.315***		-0.203***	-0.203***	-0.201***
		(0.049)	(0.049)	(0.049)		(0.060)	(0.060)	(0.060)
$ln\tau_{s,t}^{j}$			-0.002	-0.002			-0.002	-0.001
			(0.004)	(0.004)			(0.005)	(0.005)
$ln\left(\sum_{k\neq m} Y_{s,t}^{k,j}\right)$				0.161***				0.127***
				(0.003)				(0.004)
Importer-exporter-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-exporter-industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	14.556***	14.577***	14.577***	11.623***	14.713***	14.725***	14.726***	12.368***
	(0.002)	(0.004)	(0.004)	(0.054)	(0.002)	(0.004)	(0.005)	(0.077)
Sample	Full sample	Full sample	Full sample	Full sample	Year after 2007	Year after 2007	Year after 2007	Year after 2007
Observations	329,900	329,900	329,900	329,900	196,145	196,145	196,145	196,145
R-squared	0.918	0.918	0.918	0.919	0.943	0.943	0.943	0.943

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) The superscript "m, j" means one of the four selected importers imports from country j and "k, j" means non-selected importer country k imports from j

Additionally, Table B.1 in the appendix is based on the expression (2.7) but adding TPU index in the regression for each group. This table shows the TPU effect on imports for each of the four groups. The presence of negative coefficients of TPU for each of the four groups in this table confirms our baseline results in Table 2.3. The results tend not to be statistically significant except for Mexico, although they affect trade flows in their predicted direction.

To check if errors at importer-exporter-industry level are correlated overtime, we also conducted a first differencing regression based on the structural model in columns (5) - (8) of Table 2.3. The results reported in Table B.5 demonstrate that the negative effect of TPU on trade flows is robust.

A comparison of the results shown in columns (1) and (2) of Table 2.4 reveals that our baseline results are driven by the interplay between the four groups' TPU and the intensive margin of trade. This is confirmed by the coefficient of the TPU in column (2) which is negative and statistically significant. The magnitude of this coefficient is almost equal to that of the coefficient of TPU in column (1). However, the TPU effect on $EM_{s,t}^{m,j}$ is insignificant, reported by columns (3) and (4). The results shown in Table 3 intuitively imply that the four selected groups' TPU indices affect their imports only by altering the intensive margin of trade.

Table 2.4: Intensive/ extensive margin for four groups (2008-2017 Imports)

	Dependent Variable: Import Value (Log)			
	$IM^{m,j}_{s,t}(1)$	$IM^{m,j}_{s,t}(2)$	$EM^{m,j}_{s,t}(1)$	$EM^{m,j}_{s,t}(2)$
	(1)	(2)	(3)	(4)
$TPU^{m,j}_{s,t}$	-0.052*	-0.057*	0.014	0.009
	(0.028)	(0.033)	(0.027)	(0.012)
$ln\tau^{m,j}_{s,t}$	-0.201***	- 0.093	-0.121**	0.100***
	(0.060)	(0.070)	(0.057)	(0.025)
$ln\tau^{j}_{s,t}$	-0.001	-0.001	-0.002	-0.001
	(0.005)	(0.006)	(0.004)	(0.002)
$ln\left(\sum_{k\neq m} Y^{k,j}_{s,t}\right)$	0.127***	0.084***	0.047***	0.043***
	(0.004)	(0.005)	(0.004)	(0.002)
Importer-exporter-year FE	Yes	Yes	Yes	Yes
Importer-exporter-industry FE	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
Constant	12.368***	-7.166***	-5.579***	1.155***
	(0.077)	(0.090)	(0.073)	(0.032)
Observations	196,145	196,145	196,145	196,145
R-squared	0.943	0.881	0.800	0.965

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) The superscript "m, j" means one of the four selected importers imports from country j and "k, j" means non-selected importer country k imports from j
(5) $IM^{j}_{s,t}(1)$ is the log of U.S. imports
(6) $IM^{j}_{s,t}(2)$ is the log of intensive margin (Hummels and Klenow, 2005)
(7) $EM^{j}_{s,t}(1)$ is the log of number of HS 6-digit products in 2-digit industry
(8) $EM^{j}_{s,t}(2)$ is the log of extensive margin (Hummels and Klenow, 2005)

In Table 2.5, we measure the insurance effect represented by the presence of a PTA by constructing dummy variables that control for the presence of preferential access. First, we calculate the preference margin by taking the difference between the log of the average MFN tariff and the log of average preferential tariff in industry s in year t applied by importer m (country j) on imports from j (m). Second, we convert it into a binary variable, which takes on the value of one when the preference margin is greater than zero, and its value is zero otherwise. We label it $PTAMGN^{m,j}_{s,t}$. Moreover, we create an additional binary variable that equals one if the preference margin is at least two percentage points, and its value is zero otherwise. In this case, we label it $PTAMGN2^{m,j}_{s,t}$. The results shown in columns (1) and (2) confirm that PTAs promote bilateral trade. In addition, preferences granted by an importer tend to boost its imports and counter the negative effects of TPU on imports, given that the interaction between TPU and the variable $PTAMGN^{m,j}_{s,t}$ is positive, although insignificant, and the coefficient of PTAMGN is significantly positive.

Table 2.5: Preference margins model for four groups (2008-2017 Imports)

	Independent Variable: Import Value (Log)					
	(1)	(2)	(3)	(4)	(5)	(6)
$TPU^{m,j}_{s,t}$	-0.058*	-0.054*	-0.071*	-0.046	-0.069*	-0.042
	(0.030)	(0.029)	(0.040)	(0.036)	(0.040)	(0.036)
$TPU^{m,j}_{st} \times PTAMGN^{m,j}_{s,t}$	0.039		0.037	0.042		
	(0.060)		(0.060)	(0.060)		
$PTAMGN^{m,j}_{s,t}$	0.021*		0.021*	0.021*		
	(0.012)		(0.012)	(0.012)		
$TPU^{m,j}_{s,t} \times PTAMGN2^{m,j}_{s,t}$		0.023			0.021	0.022
		(0.070)			(0.070)	(0.070)
$PTAMGN2^{j}_{s,t}$		0.034**			0.034**	0.034**
		(0.013)			(0.013)	(0.013)
$TPU^{m,j}_{s,t} \times PTAMGN^{j}_{s,t}$			0.019		0.021	
			(0.039)		(0.039)	
$PTAMGN^{j}_{s,t}$			0.005		0.005	
			(0.007)		(0.007)	
$TPU^{j}_{s,t} \times PTAMGN2^{j}_{s,t}$				-0.022		-0.020
				(0.035)		(0.035)
$PTAMGN2^{j}_{s,t}$				0.004		0.004
				(0.007)		(0.007)
$ln\tau^{m,j}_{s,t}$	-0.207***	-0.210***	-0.207***	-0.207***	-0.211***	-0.211***
	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)
$ln\tau^{j}_{s,t}$	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
$ln\left(\sum_{k\neq m} Y^{k,j}_{s,t}\right)$	0.127***	0.127***	0.127***	0.127***	0.127***	0.127***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry-country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	12.364***	12.364***	12.363***	12.363***	12.362***	12.363***
	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)
Observations	196,145	196,145	196,145	196,145	196,145	196,145
R-squared	0.943	0.943	0.943	0.943	0.943	0.943

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) $PTAMGN^{m,j}_{s,t}$is 1 if $\text{MFN}^{m,j}_{s,t}$ > Preferential $\text{Tariff}^{m,j}_{s,t}$ and 0 otherwise
(5) $PTAMGN2^{m,j}_{s,t}$ is 1 if $\text{MFN}^{m,j}_{s,t}$ > Preferential $\text{Tariff}^{m,j}_{s,t}$ by 2 percentage points and 0 otherwise
(6) $PTAMGN^{m,j}_{s,t}$ is 1 if $\text{MFN}^{m,j}_{s,t}$ > Preferential $\text{Tariff}^{m,j}_{s,t}$ and 0 otherwise
(7) $PTAMGN2^{m,j}_{s,t}$ is 1 if $\text{MFN}^{m,j}_{s,t}$ > Preferential $\text{Tariff}^{m,j}_{s,t}$ by 2 percentage points and 0 otherwise
(8) The superscript "m, j" means one of the four selected importers imports from country j and "k, j" means non-selected importer country k imports from j country k imports from j

The specifications in columns (3)-(6) of Table 2.5 additionally control for preferential access received by m (one of the four groups)'s trade partner j in the ROW. In this case, the variable $PTAMGN^{j}_{s,t}$ equals 1 if country j receives preferential access from another country in industry s at year t, and equals 0 otherwise. Instead, the variable $PTAMGN2^{j}_{s,t}$ equals 1 if the preference margin received by country j from other countries is greater than 2 percentage points. The results in these columns confirm the results found in columns (1) and (2). Importantly, we found that PTAs serve as insurance against the effects of TPU, which is consistent with our previous assumptions. Moreover, they show that the four groups' imports are not affected by preferential access granted to country j in the ROW, regardless of the size of preferences received by country j's exporters.

To make sure the TPU we constructed based on uncertainty-related words are effective in analyzing the four groups' imports, we followed the same steps detailed in section 2.1 but changed the uncertainty words based on two alternatives, respectively. We first used the uncertainty terms selected by Caldara et al. (2020). The estimation results using this alternative approach can be found in Table 2.6. The specifications used in columns (1) - (4) correspond to those used in columns (5) - (8) in Table 2.3. Likewise, we apply the most parsimonious model in column (1) and add one control variable at a time from columns (2) -(4) where the last column reports the results of the expression (2.8) from year 2008 to year 2017. The results presented in Table 2.6 imply the alternative TPU still has a negative effect on the four groups' imports, although the effect is not significant.

In addition to the first alternative approach, we also construct our TPU indices based on the import-specific terms to test our main specification outlines in expression (2.8). In this case, we modified our variable $U^{m,j}_{i,s,t}$ outlined in Step 1 of Section 2.2.1 by including a binary

Table 2.6: TPU based on Caldara et al.'s (2020) words (2008-2017 Imports)

	Dependent Variable: Export Value (Log)			
	(1)	(2)	(3)	(4)
$TPU_{s,t}^{m,j}$	-0.038	-0.038	-0.038	-0.039
	(0.029)	(0.029)	(0.029)	(0.029)
$ln\tau_{s,t}^{m,j}$		-0.203***	-0.203***	-0.202***
		(0.060)	(0.060)	(0.060)
$ln\tau_{s,t}^{j}$			-0.002	-0.002
			(0.005)	(0.005)
$ln\left(\sum_{k\neq m} Y_{s,t}^{k,j}\right)$				0.127***
				(0.004)
Importer-exporter-year FE	Yes	Yes	Yes	Yes
Importer-exporter-industry FE	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
Constant	14.713***	14.725***	14.726***	12.367***
	(0.002)	(0.004)	(0.005)	(0.077)
Observations	196,145	196,145	196,145	196,145
R-squared	0.943	0.943	0.943	0.943

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) The superscript "m, j" means one of our four selected importers' imports from country j and "k, j" means non-selected importer country k imports from j

variable that indicates the presence of the word "import/imports" in conjunction with a combination of words such as "quota" and "change," "quota" and "decrease," or "quota" and "reduce" . Table 2.7, following the same structure as Table 2.6, reports the results by using the second alternative approach. The results in Table 2.7 are generally in line with the results in columns (5)- (8) in Table 3 with slightly smaller effects of TPU on the imports of the four groups. Specifically in this case, a one-standard-deviation increase in TPU causes a 0.68 percent (-0.05$\times$ 1369.703 (S.D. of $TPU_{s,t-1}^{j,m}$) $\times$ 0.0001 $\times$ 100 %) drop in the four groups' imports, and this effect is statistically significant at the 10 percent threshold according to column (4). Based on the above two alternative tests, we are confident that our results for the imports of the four selected groups are robust.

Table 2.7: TPU based on import-related words (2008-2017 Imports)

	Dependent Variable: Export Value (Log)			
	(1)	(2)	(3)	(4)
$TPU_{s,t}^{m,j}$	-0.050*	-0.050*	-0.050*	-0.050*
	(0.029)	(0.029)	(0.029)	(0.029)
$ln\tau_{s,t}^{m,j}$		-0.203***	-0.203***	-0.202***
		(0.060)	(0.060)	(0.060)
$ln\tau_{s,t}^{j}$			-0.002	-0.001
			(0.005)	(0.005)
$ln\left(\sum_{k\neq m} Y_{s,t}^{k,j}\right)$				0.127***
				(0.004)
Importer-exporter-year FE	Yes	Yes	Yes	Yes
Importer-exporter-industry FE	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
Constant	14.713***	14.725***	14.726***	12.368***
	(0.002)	(0.004)	(0.005)	(0.077)
Observations	196,145	196,145	196,145	196,145
R-squared	0.943	0.943	0.943	0.943

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) The superscript "m, j" means one of our four selected importers' imports from country j and "k, j" means non-selected importer country k imports from j

2.4.2 Results on Exports of Four Countries

Following the specifications for the imports, we estimate similar models for the four groups' exports [27]. Therefore, columns (1) - (4) in table 2.8 correspond to columns (5) - (8) in table 2.3, table 2.9 corresponds to Table 2.4, and table 2.10 corresponds to table 2.5.

Similar to the baseline specifications for imports and controlling for year of 2008 and beyond, we add explanatory variables one at a time when moving from column (1) to (4) and the column (4) in table 8 reports the estimation results of our baseline specification in

[27] Unlike what we did in chapter 1 for U.S. exports, we didn't include the market power for the four groups' exports since the current results are better.

expression (2.11). We can then focus on the results in column (4). Importantly, the coefficient of TPU is negative and statistically significant at 10% level. This result suggests that, a one-standard-deviation increase in this variable, is associated with an average decrease of 0.62% (-0.037$\times$ 1665.328 (S.D. of $TPU_{s,t}^{j,x}$) $\times$ 0.0001 $\times$ 100 %) in the exports of four counties. It's worth noting that all the coefficients of other explanatory variables (i.e., average MFN import tariff imposed by country j on varieties of products exported by industry s based in exporter x at year t denoted by $\tau_{s,t}^{j,x}$, the average MFN import tariffs imposed by country j on varieties of goods from industry s originating in the rest of the world denoted by $\tau_{s,t}^{j}$, and country j's imports from countries other than exporter x denoted by $\sum_{k \neq x} Y_{s,t}^{j,k}$) are also statistically significant and consistent with our expectations for the exports.

Tables B.2 is similar to Table B.1 in the appendix, which are based on the expression (2.10) but adding TPU index for each of the four groups. This table shows the TPU effect on exports for each of the four groups. Again, the results confirm our baseline results in Table 2.8. Like what we did for Table B.5, Table B.6 reports the results of the first differencing regression based on the structural model in columns (1) - (4) of Table 2.8. The results demonstrate the negative effect of TPU on trade flows which are inline with the baseline model.

In Table 2.9, we consider the role of TPU on the exports' intensive and extensive margins based on the expressions (2.15) and (2.17). Following the same strategy used in Table 2.4, column (1) of Table 2.9 corresponds to the results obtained in column (4) of Table 2.8. These results suggest that TPU affects neither the intensive margin nor the extensive margin of the four countries' exports, except for the unweighted version of the intensive margin of trade in column (1).

Table 2.8: Structural model estimation for four groups (2008-2017 Exports)

	Dependent Variable: Export Value (Log)			
	(1)	(2)	(3)	(4)
$TPU_{s,t}^{j,x}$	-0.040**	-0.039**	-0.039**	-0.037*
	(0.020)	(0.020)	(0.020)	(0.020)
$ln\tau_{s,t}^{j,x}$		-0.697***	-0.804***	-0.814***
		(0.052)	(0.058)	(0.058)
$ln\tau_{s,t}^{j}$			0.050***	0.057***
			(0.011)	(0.011)
$ln\left(\sum_{k\neq x} Y_{s,t}^{j,k}\right)$				0.100***
				(0.005)
Importer-exporter-year FE	Yes	Yes	Yes	Yes
Importer-exporter-industry FE	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
Constant	14.933***	14.986***	14.970***	13.108***
	(0.001)	(0.004)	(0.005)	(0.085)
Observations	247,588	247,588	247,588	247,588
R-squared	0.948	0.948	0.949	0.949

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) The superscript "j, x" means one of our four selected exporters' exports to country j and "j, k" means non-selected exporter country k exports to j

Table 2.10 tests whether the role of preferential trade would be able to alleviate the negative effects of TPU on the exports of China, Canada, Mexico, and the EU according to the specifications in expression (2.19). Consistent with the results in Table 2.5 for imports, the preferential margin $PTAMGN_{s,t}^{j,x}$ offered to the exporters in the four groups is likely to increase the four groups' exports. In addition, the coefficient of the interaction between the TPU and the binary variable is positive as expected across almost all the columns of Table 2.10, although not statistically significant, indicating that the preferential access tends to mitigate the effects of TPU for exporters of the four groups. In line with imports, the preferential access granted by country j to the ROW does not affect the four groups' exports.

Table 2.9: Intensive/ extensive margin for four groups (2008-2017 Exports)

	Dependent Variable: Export Value (Log)			
	$IM_{s,t}^{j,x}(1)$	$IM_{s,t}^{j,x}(2)$	$EM_{s,t}^{j,x}(1)$	$EM_{s,t}^{j,x}(2)$
	(1)	(2)	(3)	(4)
$TPU_{s,t}^{j,x}$	-0.037*	0.036	0.001	-0.002
	(0.020)	(0.039)	(0.053)	(0.007)
$ln\tau_{s,t}^{j,x}$	-0.814***	-0.850***	-0.566***	-0.053**
	(0.058)	(0.116)	(0.156)	(0.022)
$ln\tau_{s,t}^{j}$	0.057***	0.070***	0.090***	-0.000
	(0.011)	(0.023)	(0.031)	(0.004)
$ln\left(\sum_{k\neq x} Y_{s,t}^{j,k}\right)$	0.100***	-0.092***	0.094***	0.023***
	(0.005)	(0.009)	(0.012)	(0.002)
Importer-exporter-year FE	Yes	Yes	Yes	Yes
Importer-exporter-industry FE	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
Constant	13.108***	-2.099***	-9.123***	1.763***
	(0.085)	(0.171)	(0.230)	(0.032)
Observations	247,588	247,588	247,588	247,588
R-squared	0.949	0.844	0.893	0.978

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) The superscript "j, x" means one of our four selected exporters' exports to country j and "j, k" means non-selected exporter country k exports to j
(5) $IM_{s,t}^{j}(1)$ is the log of US imports
(6) $IM_{s,t}^{j}(2)$ is the log of intensive margin (Hummels and Klenow, 2005)
(7) $EM_{s,t}^{j}(1)$ is the log of number of HS 6-digit products in 2-digit industry
(8) $EM_{s,t}^{j}(2)$ is the log of extensive margin (Hummels and Klenow, 2005)

The result resembles our findings for the four groups' imports reported in Table 2.5.

Like what we did for imports of the four groups, we also applied the same two alternative approaches to the construction of TPU to check the effectiveness of TPU on exports of the four groups. Table 2.11 shows that the alternative TPU is robust in adopting the uncertainty terms selected by Caldara et al. (2020). Specifically, the coefficient of TPU is negative and statistically significant at 5% for all columns. Additionally, the coefficients of all other

Table 2.10: Preference margins model for four groups (2008-2017 Exports)

	Independent Variable: Export Value (Log)					
	(1)	(2)	(3)	(4)	(5)	(6)
$TPU^{j,x}_{s,t}$	-0.044**	-0.037*	-0.047**	-0.077***	-0.043*	-0.077***
	(0.020)	(0.020)	(0.024)	(0.022)	(0.023)	(0.022)
$TPU^{j,x}_{s,t} \times PTAMGN^{j,x}_{s,t}$	0.106		0.104	0.004		
	(0.065)		(0.067)	(0.070)		
$PTAMGN^{j,x}_{s,t}$	0.021*		0.022*	0.022*		
	(0.012)		(0.012)	(0.012)		
$TPU^{j,x}_{s,t} \times PTAMGN2^{j,x}_{s,t}$		0.022			0.016	-0.030
		(0.117)			(0.118)	(0.117)
$PTAMGN2^{j,x}_{s,t}$		0.034**			0.035**	0.035**
		(0.016)			(0.016)	(0.016)
$TPU^{j,x}_{s,t} \times PTAMGN^{j,x}_{s,t}$			0.005		0.015	
			(0.030)		(0.030)	
$PTAMGN^{j,x}_{s,t}$			-0.009		-0.009	
			(0.007)		(0.007)	
$TPU^{j,x}_{s,t} \times PTAMGN2^{j,x}_{s,t}$				0.135***		0.136***
				(0.034)		(0.031)
$PTAMGN2^{j,x}_{s,t}$				-0.005		-0.006
				(0.007)		(0.007)
$ln\tau^{j,x}_{s,t}$	-0.818***	-0.818***	-0.818***	-0.818***	-0.817***	-0.818***
	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)
$ln\tau^{j,x}_{s,t}$	0.057***	0.058***	0.058***	0.058***	0.058***	0.058***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
$ln\left(\sum_{k\neq x} Y^{j,k}_{s,t}\right)$	0.100***	0.100***	0.100***	0.100***	0.100***	0.100***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Importer-exporter-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Importer-exporter-industry FE	Yes	Yes	Yes	Yes	Yes	Yes
ndustry-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	13.107***	13.107***	13.110***	13.109***	13.110***	13.109***
	(0.085)	(0.085)	(0.085)	(0.085)	(0.085)	(0.085)
Observations	247,588	247,588	247,588	247,588	247,588	247,588
R-squared	0.949	0.949	0.949	0.949	0.949	0.949

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) $PTAMGN^{j,x}_{s,t}$is 1 if $\text{MFN}^{j,x}_{s,t}$ > Preferential $\text{Tariff}^{j,x}_{s,t}$ and 0 otherwise
(5) $PTAMGN2^{j,x}_{s,t}$ is 1 if $\text{MFN}^{j,x}_{s,t}$ > Preferential $\text{Tariff}^{j,x}_{s,t}$ by 2 percentage points and 0 otherwise
(6) $PTAMGN^{j,x}_{s,t}$ is 1 if $\text{MFN}^{j,x}_{s,t}$ > Preferential $\text{Tariff}^{j,x}_{s,t}$ and 0 otherwise
(7) $PTAMGN2^{j,x}_{s,t}$ is 1 if $\text{MFN}^{j,x}_{s,t}$ > Preferential $\text{Tariff}^{j,x}_{s,t}$ by 2 percentage points and 0 otherwise
(8) The superscript "j, x" means one of our four selected exporters' exports to country j and "j,k" means non-selected exporter country k exports to j

variables are statistically significant, and the signs are as expected.

Following the step of constructing the alternative TPU with the second approach, we also test our main specification outlined in expression (2.11) while constructing our TPU index controlling for terms related to exports. In this case, our variable $U^{j,x}_{ist}$, which is outlined in Step 1 of Section 2.1, also includes a binary variable that indicates the presence of the word

Table 2.11: TPU based on Caldara et al.'s (2020) words (2008-2017 Exports)

	Dependent Variable: Export Value (Log)			
	(1)	(2)	(3)	(4)
$TPU_{s,t}^{j,x}$	-0.046**	-0.045**	-0.046**	-0.043**
	(0.020)	(0.020)	(0.020)	(0.020)
$ln\tau_{s,t}^{j,x}$		-0.698***	-0.804***	-0.814***
		(0.052)	(0.058)	(0.058)
$ln\tau_{s,t}^{j}$			0.050***	0.057***
			(0.011)	(0.011)
$ln\left(\sum_{k\neq x} Y_{s,t}^{j,k}\right)$				0.100***
				(0.005)
Importer-exporter-year FE	Yes	Yes	Yes	Yes
Importer-exporter-industry FE	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
Constant	14.933***	14.986***	14.971***	13.108***
	(0.001)	(0.004)	(0.005)	(0.085)
Observations	247,588	247,588	247,588	247,588
R-squared	0.948	0.948	0.949	0.949

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) The superscript "j, x" means one of our four selected exporters' exports to country j and "j, k" means non-selected exporter country k exports to j

"export/exports" in conjunction with a combination of words such as "export license" and "revoke," "quota" and "change," "quota" and "reduce", and "quota" and "decrease." Table 2.12 presents the results using this alternative export-specific TPU index. Again, we employ specifications that mimic the ones used in Table 2.8. The specification used in column (4) follow expression (2.11), where we control for the years 2008 onwards. In this case, the results confirm the deleterious effects of TPU on the exports of the four groups for 2008 and onwards. These results show the robustness of our baseline findings, which rely on a TPU index that does not control for export-specific words.

Table 2.12: TPU based on export-related words (2008-2017 Exports)

	Dependent Variable: Export Value (Log)			
	(1)	(2)	(3)	(4)
$TPU_{s,t}^{j,x}$	-0.039**	-0.038*	-0.039*	-0.036*
	(0.020)	(0.020)	(0.020)	(0.020)
$ln\tau_{s,t}^{j,x}$		-0.698***	-0.804***	-0.814***
		(0.052)	(0.058)	(0.058)
$ln\tau_{s,t}^{j}$			0.050***	0.057***
			(0.011)	(0.011)
$ln\left(\sum_{k\neq x} Y_{s,t}^{j,k}\right)$				0.100***
				(0.005)
Importer-exporter-year FE	Yes	Yes	Yes	Yes
Importer-exporter-industry FE	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
Constant	14.933***	14.986***	14.970***	13.108***
	(0.001)	(0.004)	(0.005)	(0.085)
Observations	247,588	247,588	247,588	247,588
R-squared	0.948	0.948	0.949	0.949

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) The superscript "j, x" means one of our four selected exporters' exports to country j and "j, k" means non-selected exporter country k exports to j

2.5 Conclusion

This chapter is novel in providing a unique way to identify the effects of TPU on global trade flows. By choosing four representative groups (i.e., two developed economies and two developing economies): Canada, Mexico, China, and the EU, we construct TPU indices based on articles published by the major newspapers in these four groups. The TPU index for each group relies on all the collected news information, which must include the specific group's name. Moreover, the index controls for temporary barriers to trade, standard tariff gaps, and measures based on national security concerns, as the presence of a broad array of trade policy tools. We built our baseline models on these TPU indices, and our results show that the increase in TPU reduces both the imports and exports of the four selected groups. Moreover, these results are economically meaningful. We find that a one-standard-deviation increase in U.S. TPU leads to a 0.71 percent decrease in imports and a 0.62 percent decrease in exports between 2008 (i.e., when the Great Recession occurred) and 2017.

Importantly, the results on the imports and exports of the four groups seem to be in line with the results by adopting the uncertainty set of words used in Caldara et al. (2020). It is also worth noting that our results are robust to a more demanding set of trade-specific terms that narrow each TPU index down to imports or exports in our robustness analysis. The negative effect of TPU in such an analysis is fairly close to the TPU effects in our baseline regressions. Additionally, we demonstrate that the TPU effect on the imports and exports of each of the four groups is negative. After we remove the potential correlation of errors at the importer-exporter-industry level over time, the TPU effect still seems to be consistent with our predicted direction. The presence of negative coefficients of TPU for each of the robustness checks confirm our baseline results in Table 2.3 and Table 2.8.

Last but not the least, our results are strong evidence showing that PTAs serve as a protection for trade among countries who encounter the adverse influence of TPU. The insurance effects of PTAs exist for both imports and exports, which is a significant signal for the WTO and leaders of each country to understand that the tools for cooperation in international trade should be encouraged and implemented to confront the raging increase in the uncertainties in a global setting.

Chapter 3

General Economic Uncertainty and U.S. Wages

3.1 Introduction

Uncertainty affects people's utility and changes their behavior. Several important articles have recently considered the effects of uncertainties in different fields: trade policy uncertainties are used to determine fluctuations in imports and exports (Pierce and Schott 2016, 2018); economic policy uncertainty is a good indicator of stock market dynamics (Liu and Zhang, 2015); and policy uncertainty is identified to be strongly and negatively associated with firm-level capital investment (Gulen and Ion, 2016). Economic uncertainty is considered as the risk factor leading to changes in labor market status, such as going from employment to unemployment or from full-time positions to part-time positions, changes in term-limited employment, and changes in the ease of entering the labor market for jobseekers (Blossfeld et al., 2006; Blossfeld and Hofmeister, 2006; Blossfeld et al., 2005; Mills and Blossfeld, 2003).

Economic uncertainty has been intensified by deregulation, internationalization, and globalization over the past several decades (Mills and Blassfeld, 2003). These uncertainties can be escalated by domestic and international events, such as the global financial crisis between 2008 and 2009 and European debt crisis between 2009 and 2010.

This paper studies the effect of economic uncertainty on the U.S. labor market with a focus on wages. Wage changes in the labor market can be affected by many factors, such as years of schooling and experience (Mincer, 1974), human capital factors (Goldin and Katz, 2008), and job tasks (Autor and Handel, 2013). However, one limitation of the literature, is that economic uncertainties are hardly taken into consideration. Economic uncertainty plays an important role in determining the future earnings and expected returns to education (Kodde, 1986; Levhari and Weiss, 1974; Paroush, 1976; Williams, 1979; Eaton and Rosen, 1980). It also affects immigrants' saving decisions in terms of the wage differentials between the host country and home country (Galor and Stark, 1990; Dustmann, 1997). Moreover, economic uncertainty influences women's wages and employment in the labor market and their fertility decisions (Kreyenfeld et al., 2012).

To investigate one channel through which economic uncertainty may affect wages, I constructed a general index of U.S. economic uncertainty at the industry level (aggregate level of 4-digit industries of IPUMS) with U.S. news information covering from 2001 to 2018. My baseline model shows that an increase in U.S. economic uncertainty has significant adverse effects on wages in the U.S. labor market at the industry level. Notably, the model shows that a one-standard-deviation increase in economic uncertainty leads to a 2.3 percent decline in wage. In line with this argument, I also showed that a set of robustness tests also supported the findings in the baseline model.

The rest of the paper proceeds as follows. Section 2 discusses briefly the relevant literature. Section 3 describes the data, the construction of the economic uncertainty index, and the description of its main economic characteristics across industries and years. Section 4 describes our econometric approach, which is based on the hedonic model from Autor and Handel (2013) which extended the most often used Mincer (1974) wage regression. Section 5 describes the main results, while Section 6 discusses several robustness tests. Section 7 concludes the paper.

3.2 Literature Review

3.2.1 Economic Uncertainty

According to Merton (1975), uncertainty generally involves five aspects: (1) uncertainty about future capital income from the investment in marketable assets; (2) uncertainty about the future labor income; (3) uncertainty about the length of life; (4) uncertainty about the opportunities of investments in the future; and (5) uncertainty about the consumptions in the future (relative prices, types of goods and their availabilities, and future tastes). Four of five of these aspects are related to economics, which means that economic uncertainty plays an important role in the study of uncertainty. Economic uncertainty has drawn much attention from policymakers and researchers for decades because economic activities can be held down by uncertainties and policymakers should take aggressive actions to stabilize the economy (Aastveit et al., 2013).

Economic uncertainty is closely linked with future earnings and therefore causes investment in human capital to be risky (Kodde, 1986). This uncertainty comes from the unpredictable conditions of demand and supply in the labor market, individuals' imperfect knowledge of the value of their abilities, the duration of their future earnings, uncertainties in job searching process, and the uncertain match between earning and education (Kodde, 1986). Economic uncertainty affects human capital investment in terms of the Earnings Tax. With fixed labor supply, a proportional Earnings Tax wouldn't affect human capital investment because the tax reduces both the cost of investment and the returns at the same rate. However, with economic uncertainty, human capital investment can be affected by the Earnings Tax in two ways. One way is through the change in the riskiness of human capital. The other one is through the generation of income effects which could influence the individual's willingness to take risks (Eaton and Rosen, 1980). In other words, economic uncertainty lowers the incentive for human capital investment.

Economic uncertainty could also influence temporary migrants behaviors of remittances and savings, which are different from the influence on permanent migrants or natives (Galor and Stark, 1990). Particularly, migrants save more than natives and the uncertainty of future incomes will increase the saving gap between them considering that lower future income will increase their marginal utility of wealth and they have higher marginal utility of consumption at home (Galor and Stark, 1990). Temporary migrants' decisions to go back to their home country from the host country will crucially depend on future income streams which are also affected by economic uncertainty (Dustmann, 1997). Particularly, economic uncertainty in the home country's labor market will encourage migrants to stay in the host country if wages in the host country is larger, and a higher level of economic uncertainty in the host country will push migrants back to their home country. From this perspective, U.S. economic uncertainty increases instability in the U.S. labor market.

Economic uncertainty may also postpone women's family plan based on their income condition (Erosa et al., 2002). Conceiving a child is considered to be a crucial life event which requires long-term commitment and emotional efforts from a family (Noguera et al., 2002). According to Kreyenfeld et al. (2012), uncertain economic conditions are negatively associated with fertility rates. Noguera et al. (2002) found that the labor force participation of women in countries with higher levels of economic uncertainty is extremely low and therefore, economic uncertainty imposes significant constraints on their parenthood decisions as well as their career plans. In addition, individuals are more likely to postpone having children in times of economic uncertainty (Hofmann and Hohmeye, 2013). This is more likely to happen to female workers who have relatively higher incomes (Caucutt et al., 2002). When more women begin to appear on the labor market, their wages and family plans are jointly affected by economic conditions and uncertainties. Germany, for example, has implemented family policy regulations to encourage females to join in the labor market before giving birth to children to mitigate the negative effects of economic uncertainties on them.

3.2.2 Online Data Mining

Online data is efficiently accessible to a great number of users who are interested in obtaining information or exchanging opinions through the Internet. In addition, the Internet provides real-time information for people to continuously collect, which outperforms questionnaires or surveys (Zhang and Verma, 2017). Researchers use online information for various reasons and provide fruitful results. Jang et al. (2018) recognize a number of hotel attributes extracting from online reviews of TripAdvisor to better understand consumer needs. Liu (2006) uses data collected from the Yahoo Movie Web site to examine the dynamic patterns of word-of-mouth (WOM) information. Dellarocas (2003) collects online information to study some important dimensions in the differences between Internet-based feedback mechanisms and traditional surveys. Tirunillai and Tellis (2012) aggregate user-generated content (UGC) from multiple websites to identify its potential relationship with stock market performance.

The newspaper is considered the oldest fashion of media being used and delivering the primary model of information contemporarily (Boczkowski, 2004; McQuail, 1994). Nowadays, online newspapers attract a number of readers that surpasses the number of readers who read paper-based newspapers, and this shift has transformed the newspaper industry dramatically (Seelye, 2005). Many online newspapers are accessible worldwide, such as China Daily from China, Financial Post from Canada, Mexico News Daily from Mexico, and U.S. News from U.S. These newspapers can be collected for free and provide a long time frame. Baker et al. (2014) collected news-based data from the 1960s to 1990s to construct economic policy uncertainty index (EPU), while I generated a general economic uncertainty index and the news articles covered from year 2001 to 2018 to match the corresponding labor data. Researchers also construct the EPU for other countries, such as Australia, Brazil, China, Canada, France, Germany, etc., with the same approach. (Cerda et al. 2016, Baker et al. 2013, Davis 2019). It's worth noting that newspapers may not only affect people's immediate behaviors but also take some time to be fully effective. Therefore, it is necessary to examine the time-lagged influence of the EU effect generated based on newspapers (Lee et al., 2014). In the paper, I used U.S. news-based economic uncertainty index and its one-year lag in baseline regressions . I then used news articles collected from Canada, Mexico and China and conducted U.S. economic uncertainty index and their own economic uncertainty index for robustness tests.

3.3 Data

In this section, I describe the dataset used in this paper. First, I explain the construction of the U.S. economic uncertainty index. In this case, I provide the change in the economic uncertainty index over the time frame covered by the data, examples of industries with the highest uncertainty levels, and wages changes among industries subject to the highest versus the lowest uncertainty levels. Second, I discuss the other information I gather to investigate the effects of U.S. economic uncertainty on U.S. labor. In this case, I discuss the relationship between U.S. economic uncertainty and individual yearly wage across industries and years.

3.3.1 Economic Uncertainty Index

Economic uncertainty has been shown to be an essential factor in explaining the changes in important micro- and macro-level variables. Baker, Bloom, and Davis (2016) show that the U.S. economic policy uncertainty index is strongly correlated with stock price volatility for U.S. firms intensely exposed to federal purchases. Moreover, they show that this effect is driven by sector-specific economic uncertainty related to firms in the defense, health, and finance industries, subject to comprehensive regulatory norms, and some are dependent on government purchases.[1] This result suggests that industry-specific economic uncertainty is essential to better understand the general effects of uncertainty across sectors. Thus, considering the effects of industry-specific is essential to understand economic parameters, such as U.S. labor at the industry level.

The general U.S. economic uncertainty index in the paper is created following the strategy

[1] They show that changes in economic policy uncertainty are negatively correlated to firm-level investment rates. This result applies to the average firm (i.e., beyond the firms in defense, health, and finance industries).

adopted by Baker, Bloom, and Davis (2016) while focusing on variations at industry and year levels. I generated the index based on economics-related news articles' frequency in four well-regarded newspapers circulating in the U.S. More specifically, I included information from news articles from the U.S. News (founded in 1933), The Guardian - U.S. edition (founded in 1821), Politico (founded in 2007), and Livingston (founded in 1945). I have several reasons for focusing on these four outlets. First, these outlets have only been accessible electronically over the years included in the research (2001-2018). Second, they do not have dynamic electronic addresses (HTML), forcing researchers to request the journals for specific articles. Third, these news outlets don't impose technical restrictions on parsing words, representing an essential feature to employ the text-mining approach. Last, these news outlets allow for the automatic selection of economics-related news articles, decreasing computational costs since the focus is to consider uncertainty effects of economics on U.S. labors at the industry and year levels.[2]

We developed a code using Python with the Selenium framework to parse and download the news data using the corresponding labels on the HTML source page, such as $< div >$, $< p >$, $< li >$. As indicated above, an essential point for us involves identifying the industry associated to economics-related news that occurred in the U.S. In this study, I defined an industry using the aggregate industries of Integrated Public Use Microdata Series (IPUMS). An example may help clarify how the parsing of words helps us determine the industry in

[2] Baker, Bloom, and Davis (2016) focus on more aggregate levels of economic policy uncertainty. Their index was constructed using information from USA Today, Miami Herald, Chicago Tribune, Washington Post, Los Angeles Times, Boston Globe, San Francisco Chronicle, Dallas Morning News, New York times, and Walls Street Journal. Many of these outlets have the aforementioned technical restrictions that would make the construction of an economic uncertainty index with industry variation very time-consuming. Not to mention that all these outlets require a subscription.

question. In the case of industry of "Finance and Insurance",[3] I labeled news related to this industry if it contains at least one of the combinations of words "finance" and "insurance" or any representative words/ phrases under its sub-categories. Figure 3.1 shows an example where the red rectangles indicate the title words parsed by the code. Instead, the green rectangles indicate the author and the pink rectangles indicate the time, where I only keep information from 2001 to 2018. The elements we parsed and extracted included the news' title, time, tags, content, and author. I downloaded 3,842 news articles from January 2001 to September 2019, but eventually only used the news articles from January 2001 to December 2018 to match other dataset elements, such as wages, employment information, industries, and demographic components.

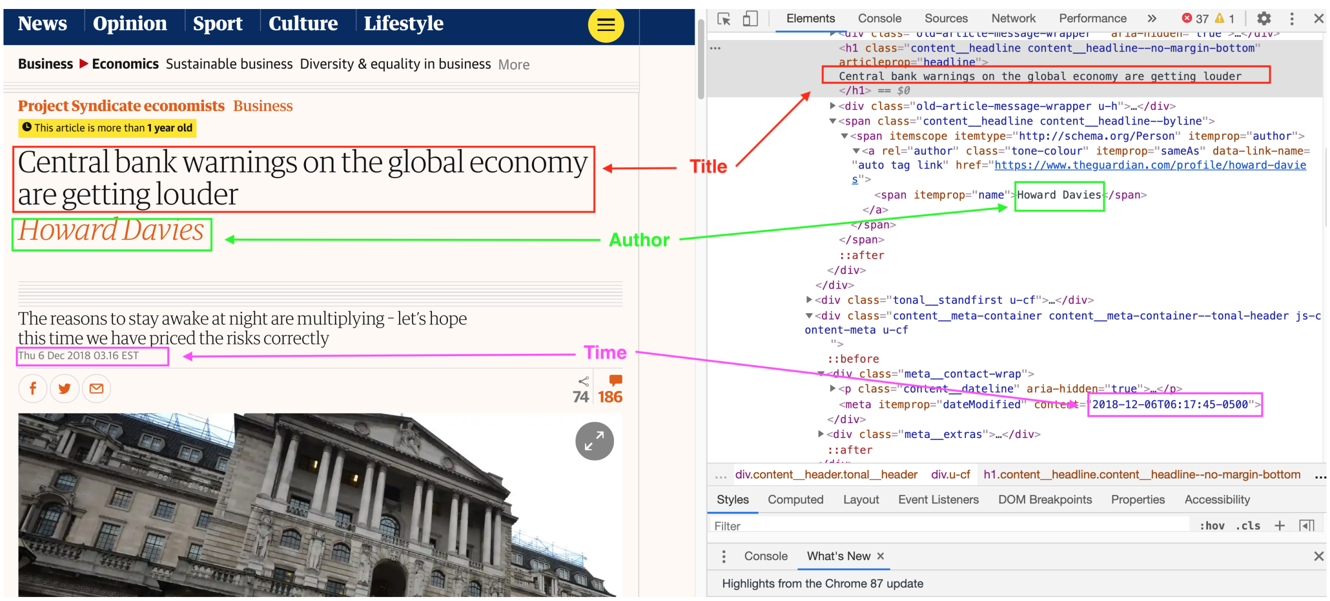


Figure 3.1: Labels on the HTML source page

Table 3.1 includes examples of economics-related articles downloaded from the selected

[3]The entire industry of "Finance and Insurance" includes Banking and related activities (code: 6870), Savings institutions, including credit unions (code: 6880), non-depository credit and related unions (code: 6890), Securities, commodities, funds, trusts, and other financial investment (code: 6970), and Insurance carriers and related activities (code: 6990).

four news sources in different years. The words in bold assist us in identifying industries mentioned in these news articles, such as real estate, education, health care, and agriculture.

Table 3.1: News examples.

News Source	**Year**	**News body**
The Guardian	2018	Since 1900, wine investments have outperformed cash, government bonds and **real estate**.
US News	2017	...according to the Department of Commerce, **education services** ranked seventh among all U.S. service exports in 2015, as international students enrolled in U.S. educational institutions brought in more than $35.7 billion for the economy via tuition and living expenses
POLITICO	2015	...but they ran into stiff opposition from Australia and five other countries who worried that would bust their **health care** budgets and keep the medicines out of reach for poorer patients by delaying the introduction of cheaper generic versions
Livingston	2015	For example, in 2012, WTO told the U.S. Department of **Agriculture** that labeling cuts of red meat with "Product of U.S." was no longer sufficient.

We followed the method from Baker, Bloom, and Davis (2016) to build this index at two levels, including $EU_{s,t}$ and EU_t. I will first introduce the steps to create $EU_{s,t}$.

Step 1: First, I use the automated system of each of the four news outlets mentioned above to select the economic-related articles. I then generate the frequency of news that contained uncertainty-related words in expression 3.1. These words are based on the uncertainty terms constructed by Caldara (2020), and some additional relevant words, such as "uncertainty", "uncertain", "not certain", "unsure", "not sure", "unpredictable", "unknown". It varies across newspapers, industries, and years.

$$U_{i,s,t} = \sum_q U_{q,i,t} F_{q,i,s,t}, \tag{3.1}$$

where $U_{q,i,t}$ is the number of news articles regarding U.S. economy with uncertainty-related words in each article q in newspaper i and year t; $F_{q,i,s,t}$ is 1 if industry s is mentioned in each article q in newspaper i and year t and is 0 otherwise.

Step 2: Then, following Baker, Bloom, and Davis (2016) strategy, I scaled the $U_{i,s,t}$ by the total number of articles in the same newspaper and year, then standardized it to unit standard deviation from 2001 to 2018, and lastly averaged across all the brands of newspapers I selected by industry and year.

$$z_{s,t} = \frac{1}{N} \sum_{i=1}^{N} \left[\frac{\frac{U_{i,s,t}}{T_{i,t}}}{std\left(\frac{U_{i,s,t}}{T_{i,t}}\right)} \right], \tag{3.2}$$

where $T_{i,t}$ is the total number of articles in newspaper i and year t; N is the number of newspapers I selected.

Step 3: Finally, I normalized the $z_{s,t}$ to a mean of 100 from 2001 to 2018.

$$EU_{s,t} = \frac{100 z_{s,t}}{\frac{1}{K} \sum_{k=1}^{K} z_{s,t}}, \tag{3.3}$$

where EU represents the economic uncertainty and K is the total number of observations in this analysis.

Generating an economic uncertainty index at year level should follow similar steps. The following 3 equations show the steps to construct the index at year level.

$$U_{i,t} = \sum_{q} U_{q,i,t} \tag{3.4}$$

$$z_t = \frac{1}{N} \sum_{i=1}^{N} \left[\frac{\frac{U_{i,t}}{T_{i,t}}}{std\left(\frac{U_{i,t}}{T_{i,t}}\right)} \right] \tag{3.5}$$

$$EU_t = \frac{100z_t}{\frac{1}{T}\sum_{t=1}^{T} z_t} \tag{3.6}$$

Figure 3.2 shows the top 5 industries with highest economic uncertainty index on average over the past 10 years in the U.S. These industries include "Arts, Entertainment, and Recreation", "Agriculture, Forestry, Fishing, and Hunting", "Manufacturing", "Finance and Insurance", and "Construction". Figure 3.3 shows the yearly evolution of economic uncertainty index at year level from 2001 to 2018. The overall tendency of this index implies an increase in economic uncertainties over time. Particularly, the index peaks in 2001 because of the September 11 terrorist attacks, and drastically falls during the following year. Likewise, it peaks again with the U.S. and its allies' invasion of Iraq in 2003-2004 and significantly falls in 2005. The index seems to increase considerably in early 2006 after Hurricane Katrina passed southeast of New Orleans and falls in 2007. However, the financial crisis has pushed the index up since 2008. In this case, the increase in economic uncertainty is likely related to several economic events and governments' concern with the increase in good prices and unemployment rates, and the temptation to use monetary policy and fiscal policy as remedies. The economic uncertainty index remained stable at high levels during 2008 to 2013 and reached another peak during the fiscal cliff and government shutdown in 2014. The economic tension was relieved after 2015 but deteriorated to its worst level ever in 2018 when the biggest trade war occurred between the U.S. and China.

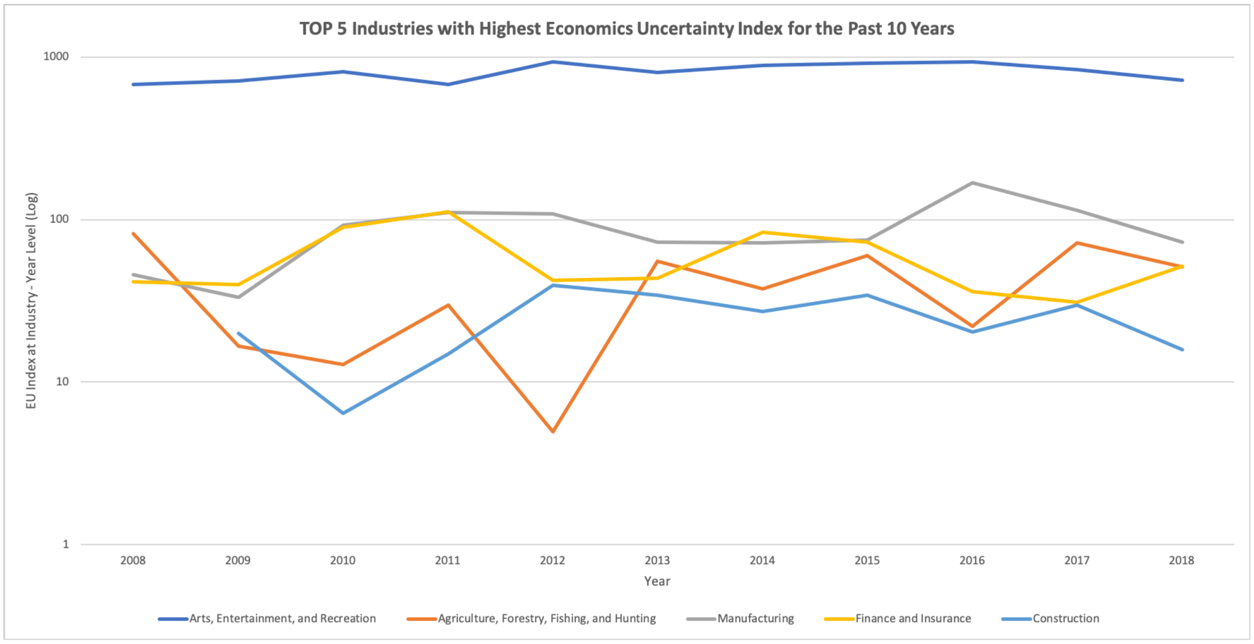


Figure 3.2: Top 5 industries with highest EU index for the past 10 years

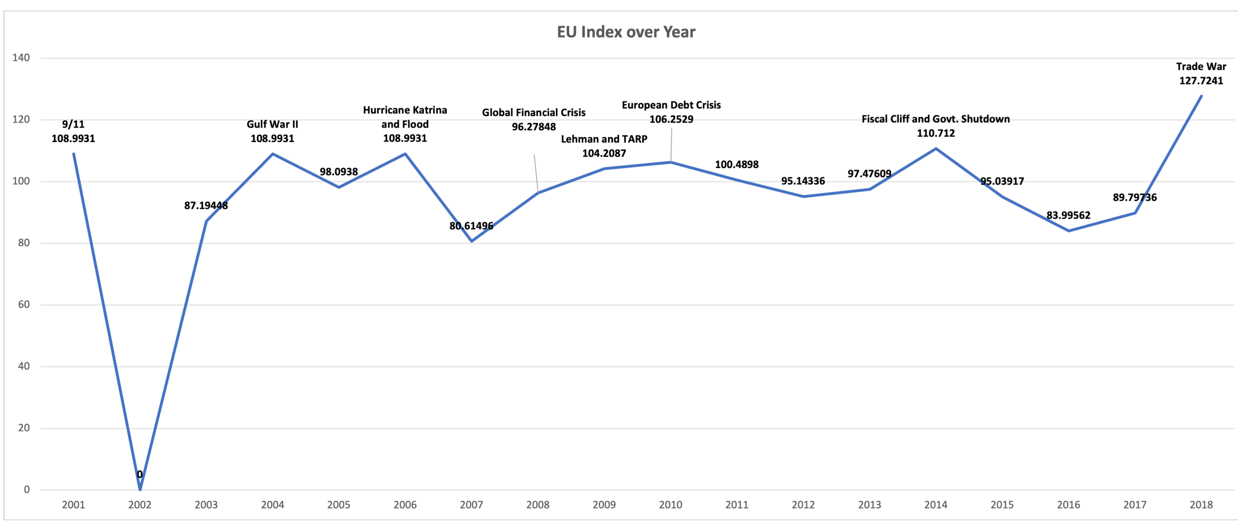


Figure 3.3: EU index between 2001 and 2018

3.3.2 Wage Data and other Labor Information

The U.S. labor-related information are collected from IPUMS USA (originally, the "Integrated Public Use Microdata Series"), including wages, employment information, industries, and demographic components, such as gender, race, ethnicity, etc. 19 industries at the aggregate level are selected from the aggregate level of 4-digit industries of IPUMS (see Appendix Table C.1). Figure 3.4 reports the yearly growth of wage for the industry with highest economic uncertainty index, the one with lowest index, and the mean wage of all selected individuals over time. The yearly growth of wage is computed based on the percentage change between two successive years and the data starts from 2001, so the figure covers from 2002 to 2018. I find that the change in wages is very much inline with the change in the economic uncertainty index. Specifically, wage changes are much more volatile in the industry with the highest economic uncertainty index (Arts, Entertainment, and Recreation) than are they in the industry with the lowest index (Public Administration).

Table 3.2 shows summary statistics for the U.S economic uncertainty index with industry-year levels of aggregations. I have a total of 342 measures of the main variable $EU_{s,t}$. Moreover, we control for the lagged values of economic uncertainty, given that the effects of this index may take some time to affect the contracts related to wage of labors. It is clear from the information available in Table 3.2 that the data on the index is a bit noisy as the standard deviation corresponds to around three times the standardized average values. Besides the economic uncertainty index and its lag which vary by year and industry only, all other variables vary by individual labor. In total, there are 26,011,025 observations, including 13,306,000 males and 12,705,025 females whose average age is 41.67 and average education

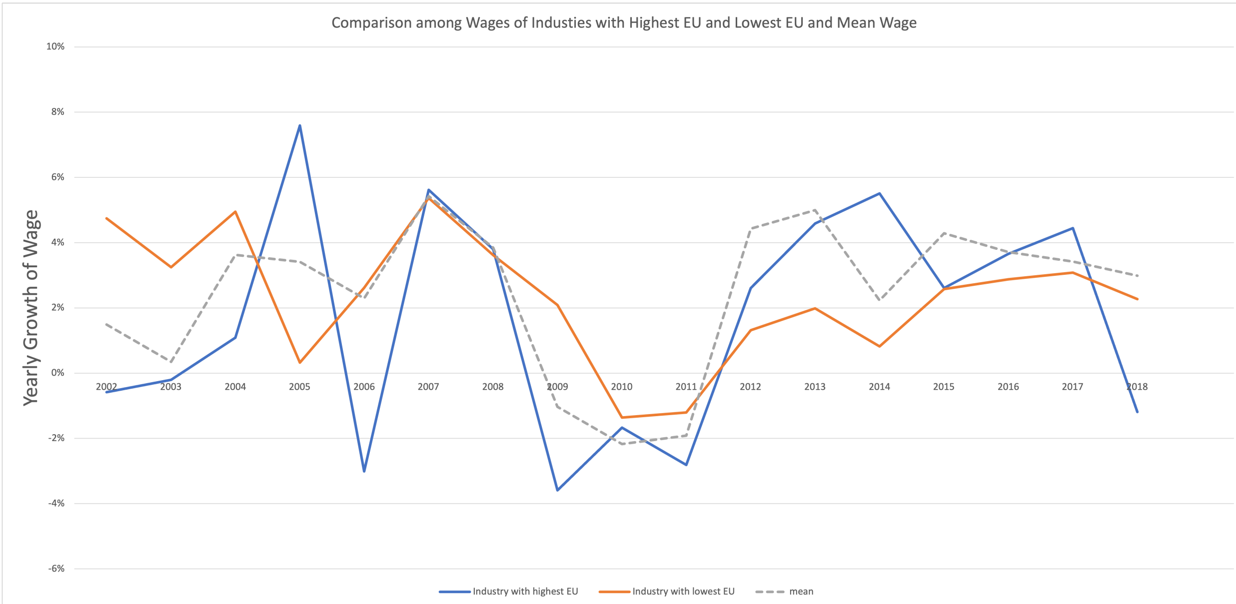


Figure 3.4: Wage changes among industries with highest/ lowest EU and mean

year is 13.28. The average yearly wage for all individuals in the data set is 34,882.48 U.S. dollars.

Table 3.2: Summary statistics.

	N	Mean	SD	Min	Max
Economic Uncertainty Indexes					
$EU_{s,t}$	342.000	100.000	314.713	0.000	1828.385
$EU_{s,t-1}$	323.000	99.601	315.036	0.000	1828.385
U.S. labor market after being weighted					
Age	26,011,025	41.665	14.878	16.000	97.000
Education Year	26,011,025	13.281	2.535	0.000	17.000
Potential experience	26,011,025	22.390	14.868	0	89.000
Yearly Wage (US Dollars)	26,011,025	34,882.480	48,399.130	0.000	736,000

3.4 Model

Originally, the Mincer (1974) wage regression studied the market return to human capital investment, which contributed the important concepts to successive empirical researches. Autor and Handel (2013) then provided a hedonic model of wages based on the Mincer

(1974) wage regression as follows:

$$lnW_i = \alpha + \beta_1 S_i + \beta_2 Exp_i + \beta_3 Exp_i^2 + \beta_4 X_i + \epsilon_i, \quad (3.7)$$

where lnW_i is the log wage for individual i, S_i is years of completed schooling for individual i, Exp_i is potential experience for individual i, X_i represents the demographic components for individual i, such as gender, race, ethnicity, etc. In addition, β_1 is the wage return to education and β_2 is the wage return to experience. Both β_1 and β_2 are expected to be positive. Considering the effect of economic uncertainty is enormous, it would be interesting to see how economic uncertainty would affect wages over time. I, therefore, modified this model by adding two more terms into the model:

$$lnW_{i,s,t} = \alpha_t + \theta_s + \lambda_1 EU_{s,t} + \lambda_2 EU_{s,t-1} + \beta_1 S_{i,s,t} + \beta_2 Exp_{i,s,t} + \beta_3 Exp_{i,s,t}^2 + \beta_4 X_{i,s,t} + \epsilon_{i,s,t}, \quad (3.8)$$

where $EU_{s,t}$ and $EU_{s,t-1}$ are the concurrent and lagged values of economic uncertainty, respectively, and they vary by industry and year, while all other variables vary by individual, industry, and year. α_t are year fixed effects and θ_s are industry fixed effects. I kept the standard errors to be robust to heteroskedasticity in all of the models and clustered the standard errors of the index at year - industry level considering that it may be constant within some industries across years while varying for other industries over time.

3.5 Result

We now turn to the estimation results and first discuss the estimation of the baseline expression, which investigates the effects of U.S. EU on wage. Table 3.3 reports the results.

Column (1) corresponds to expression (3.7) which is the hedonic model of wages from Autor and Handel (2013) serving as a benchmark from where I develop the specifications. Columns (2) and (3) include only the economic uncertainty variables. Columns (4) and (5) include both the economic uncertainty variables and all other variables used in the hedonic model of wages. Our baseline specification corresponds to column (5), which matches the explanatory variables described in expression (3.8). Notice that our concurrent and lagged measures of economic uncertainty are scaled by 0.0001. As indicated at the bottom of Table 3.3, all specifications control for industry and year fixed effects. Column (1) reports the estimated effect of education, potential experience, and other demographic factors, which are consistent with Autor and Handel (2013) results. Column (2) reports the estimated effect of $EU_{s,t}$ on wage. The coefficient of $EU_{s,t}$ is -0.513, and it is statistically significant at the 1% level. This result suggests that, a one-standard-deviation increase in this variable, is associated with an average decrease of 1.6 (0.513×314.713 (S.D. of $EU^{j}_{s,t}$) $\times\ 0.0001 \times 100$ %) percent in wage.

The specification used in column (3) adds the one-year lagged value of uncertainty ($EU_{s,t-1}$) to the regression. The results in column (3) indicate that the coefficients of the concurrent and lagged values of the economic uncertainty index are negative and statistically significant at the 1% level. The results in columns (4) and (5) show that including additional variables included in the Autor and Handel (2013) model do not alter the total effect of EU on wage. The result in column (5), corresponding to expression (3.8), suggests that a one-standard-deviation increase in current and lagged economic uncertainty index leads to a 1.12 (0.357×314.713 (S.D. of $EU_{s,t}$) $\times\ 0.0001 \times 100$ %) percent and 1 (0.315×315.036 (S.D. of $EU_{s,t-1}$) $\times\ 0.0001 \times 100$ %) percent decrease in wage, respectively. Adding up the effects of concurrent and lagged values of the index then suggests a total 2.12 percent decline in wages. Moreover, the results confirm the expectations discussed in the section of introduction and the coefficients of all other variables are nearly equal to those in column (1).

Table 3.3: OLS regressions of log wages on EU.

	Dependent Variable: Yearly wage (log)				
	(1)	(2)	(3)	(4)	(5)
$EU_{s,t}$		-0.513***	-0.391***	-0.509***	-0.357***
		(0.129)	(0.164)	(0.081)	(0.092)
$EU_{s,t-1}$			-0.326***		-0.315***
			(0.135)		(0.089)
Less than high school	-0.212***			-0212***	-0.208***
	(0.006)			(0.006)	(0.006)
College	0.413***			0.413***	0.412***
	(0.006)			(0.006)	(0.006)
Post college	0.978***			0.978***	0.980***
	(0.014)			(0.014)	(0.014)
Experience	0.085***			0.085***	0.085***
	(0.001)			(0.001)	(0.001)
$Experiences^2$	-0.001***			-0.001***	-0.001***
	(0.000)			(0.000)	(0.000)
Male	0.349***			0.349***	0.349***
	(0.005)			(0.005)	(0.005)
White	0.023***			0.023**	0.022***
	(0.004)			(0.004)	(0.005)
Black	-0.136***			-0.136***	-0.139***
	(0.007)			(0.007)	(0.007)
Hispanic	-0.079***			-0.079***	-0.079***
	(0.008)			(0.008)	(0.008)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	8.833***	10.219***	10.230***	8.836***	8.843***
	(0.014)	(0.002)	(0.002)	(0.014)	(0.014)
Observations	19,199,574	19,199,574	18,700,181	19,199,574	18,700,181
R-squared	0.359	0.144	0.144	0.359	0.359

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) EU measures scaled by 0.0001
(4) The reference group for this regression is non-hispanic high school female with race other than white and black.
(5) Standard errors are robust to heteroskedasticity

3.6 Robustness Test

In order to see if industry and year explained most of the variation in the economic uncertainty index, I conducted a robustness test by first finding out the top 5 industries that have the highest standard errors from the regression of this index on all industries and years. The five industries include "Arts, Entertainment, and Recreation", "Manufacturing", "Finance and Insurance", "Wholesale Trade", and "Utilities" which are sorted by the standard errors in this regression from the highest to the lowest. I then removed them each at a time from the baseline regression in column (5) of Table 3.3. The results are reported in Table 3.4 and show that the industry "Arts, Entertainment, and Recreation" affects results shown in column (1) such that the economic uncertainty effects are still negative but not significant when removing that industry, while other industries wouldn't change the effects of economic uncertainty according to column (2) to (5). Moreover, $EU_{s,t-1}$ is still significant at 10% and negative in the baseline regression in column (6) when I removed all five outlier industries. Meanwhile, R-squared remains almost as same as it was in Table 3.3 column (5).

In order to avoid the potential collinearity between $EU_{s,t}$ and $EU_{s,t-1}$, I replicated the results in Table 3.3 but separated them into two regressions to see the effects of $EU_{s,t}$ and $EU_{s,t-1}$ individually. The results are reported in Table 3.5. Columns (1) and (2) only show the association between the concurrent economic uncertainty index and wages and the lagged index and wages, respectively. Columns (3) and (4) correspond to the baseline regression (3.7) by adding the concurrent or lagged values of the index. Column 5 replicates the result in column 5 of Table 3.3. Reported in this table, both $EU_{s,t}$ and $EU_{s,t-1}$ have significantly negative effects on wages in the U.S. labor market. In addition, I note that the AIC and

Table 3.4: Robustness test after removing outliers.

	Dependent Variable: Yearly wage (log)					
	(1)	(2)	(3)	(4)	(5)	(6)
$EU_{s,t}$	-0.240	-0.358***	0.368***	-0.348***	-0.343***	-0.274
	(0.256)	(0.093)	(0.084)	(0.096)	(0.095)	(0.495)
$EU_{s,t-1}$	-0.307	-0.375***	-0.321***	-0.310***	-0.306***	-1.146**
	(0.268)	(0.098)	(0.087)	(0.091)	(0.090)	(0.544)
Less than high school	-0.210***	-0.198***	-0.212***	-0.207***	-0.208***	-0.201***
	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)	(0.008)
College	0.410***	0.404***	0.412***	0.411***	0.413***	0.396***
	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)	(0.008)
Post college	0.984***	0.963***	0.982***	0.981***	0.982***	0.972***
	(0.014)	(0.016)	(0.015)	(0.015)	(0.014)	(0.018)
Experience	0.084***	0.087***	0.086***	0.085***	0.085***	0.086***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Experiences^2$	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.345***	0.346***	0.339***	0.346***	0.346***	0.337***
	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.007)
White	0.026***	0.016***	0.023***	0.020**	0.022**	0.018**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Black	-0.139***	-0.133***	-0.135***	-0.137***	-0.138***	-0.125***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Hispanic	-0.082***	-0.063***	-0.074***	-0.074***	-0.078***	-0.053***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)
Outlier industry removed	"Arts, Entertainment, and Recreation"	"Manufacturing"	"Finance and Insurance"	"Wholesale Trade"	"Utilities"	all five industries
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	8.861***	8.809***	8.817***	8.837***	8.837***	8.774***
	(0.015)	(0.015)	(0.015)	(0.014)	(0.014)	(0.017)
Observations	18,308,143	16,492,899	17,726,244	18,134,926	18,505,485	13,911,274
R-squared	0.357	0.357	0.354	0.360	0.357	0.348

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) EU measures scaled by 0.0001
(4) The reference group for this regression is non-Hispanic high school female with race other than white and black.
(5) Standard errors are robust to heteroskedasticity.

BIC criteria for model selection suggest that the specifications used in columns (4) and (5) are selected compared to the specifications used in other columns. Given the magnitude of the economic uncertainty effects, therefore, I should keep both $EU_{s,t}$ and $EU_{s,t-1}$ in the baseline regression. This is consistent with the assumption that the economic uncertainty index generated based on newspapers may take a year of time frame to fully affect contracts related to wages.

I have so far relied on U.S.-based media outlets to measure the economic uncertainty index. The results show that the index based on U.S. news has negative impacts on wages in the U.S. labor market. Assuming that U.S. economic uncertainties can also be discussed in foreign newspapers, I then constructed a U.S. economic uncertainty index based on newspapers issued by the other three countries when they mentioned about U.S. economy in their

Table 3.5: Robustness test by separating the effect of EU and its lag.

	Dependent Variable: Yearly wage (log)				
	(1)	(2)	(3)	(4)	(5)
$EU_{s,t}$	-0.513***		-0.509***		-0.357***
	(0.129)		(0.081)		(0.092)
$EU_{s,t-1}$		-0.455***		-0.433***	-0.315***
		(0.123)		(0.097)	(0.089)
Less than high school			-0.212***	-0208***	-0.208***
			(0.006)	(0.006)	(0.006)
College			0.413***	0.412***	0.412***
			(0.006)	(0.006)	(0.006)
Post college			0.978***	0.980***	0.980***
			(0.014)	(0.014)	(0.014)
Experience			0.085***	0.085***	0.085***
			(0.001)	(0.001)	(0.001)
$Experiences^2$			-0.001***	-0.001***	-0.001***
			(0.000)	(0.000)	(0.000)
Male			0.349***	0.346***	0.349***
			(0.005)	(0.005)	(0.005)
White			0.023***	0.023**	0.022***
			(0.004)	(0.004)	(0.005)
Black			-0.136***	-0.136***	-0.139***
			(0.007)	(0.007)	(0.007)
Hispanic			-0.079***	-0.079***	-0.079***
			(0.008)	(0.008)	(0.008)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	10.219***	10.228***	8.836***	8.842***	8.843***
	(0.002)	(0.002)	(0.014)	(0.014)	(0.014)
AIC	5.56×10^7	5.42×10^7	5.01×10^7	4.88×10^7	4.88×10^7
BIC	5.56×10^7	5.42×10^7	5.01×10^7	4.88×10^7	4.88×10^7
Observations	19,199,574	18,700,181	19,199,574	18,700,181	18,700,181
R-squared	0.144	0.144	0.359	0.359	0.359

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) EU measures scaled by 0.0001
(4) The reference group for this regression is non-Hispanic high school female with race other than white and black.
(5) Standard errors are robust to heteroskedasticity.

news articles. Among the select three countries, Canada and Mexico are physically close to the U.S. while China is far from U.S. It would be interesting to identify the effect of the economic uncertainty index which is constructed following steps 1-3 outlined in Section 3.1 and based on the newspapers mentioning about U.S. economy from these countries. In Mexico's case, I used information from the Yucatan Times which began operations on December 4 of 2010, the Banderas News which is Puerto Vallarta's liveliest website, and the Mexico News

Daily which was launched in June 2014 as a digital publication. For Canada, I relied on information from the Financial Post and the Maclean's. Notice that both outlets have been reliable information sources since the beginning of the 20th century. In China's case, I used information from China Daily which is an English-language daily newspaper established in 1981, the official English-language website of China's news service (www.ecns.cn), and the newspaper the Shine. Notice that the last source was established in 1999 and has become the largest English-language newspaper in East China.

The results can be found in Table 3.6 by using Canada's news, Table 3.7 by using Mexico's news, and Table 3.8 by using China's news. Following the same strategy used in Table 3.3 but excluding column (1) which is the benchmark reflecting Autor and Handel (2013) model. Columns (1) to (4) report the effects of concurrent economic uncertainty as well as the effects of both the concurrent and the lagged economic uncertainty on wages with and without controlling for other variables. The economic uncertainty index constructed by Canada's newspapers does not have a significant effect on U.S. wages in all columns. The indices constructed by Mexico's and China's newspapers are negative in all columns and largely significant. The coefficients of other variables in all three tables are in line with the literature.

Additionally, I also want to rule out the possibility of simultaneity between wages and economic uncertainty based on U.S. news or an omitted "confounder" that influences both wages and economic uncertainty and, therefore, affects the conclusion of this chapter. It is likely that the fluctuation in the labor market in the U.S. may affect the wages which will in turn influence the frequency of economic uncertainty mentioned in the U.S. news; or when unemployment rate increases or inflation rate decreases, both wages and the economic

Table 3.6: Robustness test by using news from Canada.

	Dependent Variable: Yearly wage (log)			
	(1)	(2)	(3)	(4)
$EU_{s,t}$	0.002	0.076	-0.017	0.047
	(0.166)	(0.165)	(0.125)	(0.114)
$EU_{s,t-1}$		-0.006		-0.025
		(0.137)		(0.096)
Less than high school			-0.212***	-0.208***
			(0.006)	(0.006)
College			0.413***	0.412***
			(0.006)	(0.006)
Post college			0.978***	0.980***
			(0.014)	(0.014)
Experience			0.085***	0.085***
			(0.001)	(0.001)
$Experiences^2$			-0.001***	-0.001***
			(0.000)	(0.000)
Male			0.349***	0.346***
			(0.005)	(0.005)
White			0.023***	0.022***
			(0.004)	(0.005)
Black			-0.136***	-0.139***
			(0.007)	(0.007)
Hispanic			-0.079***	-0.079***
			(0.008)	(0.008)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Constant	10.216***	10.225***	8.833***	8.839***
	(0.002)	(0.002)	(0.014)	(0.014)
Observations	19,199,574	18,700,181	19,199,574	18,700,181
R-squared	0.144	0.144	0.359	0.359

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) EU measures scaled by 0.0001
(4) The reference group is non-Hispanic high school female with race other than white and black.
(5) Standard errors are robust to heteroskedasticity.

uncertainty index generated from the U.S. news could be affected. To estimate the impact of U.S. economic uncertainty on wages in the U.S. labor market, I need instruments that have the exogenous variations in the economic uncertainty index. I find that the other countries' economic uncertainty index and its one-year lagged value generated based on

Table 3.7: Robustness test by using news from Mexico.

	Dependent Variable: Yearly wage (log)			
	(1)	(2)	(3)	(4)
$EU_{s,t}$	-0.088	-0.012	-0.078**	-0.024
	(0.056)	(0.047)	(0.040)	(0.035)
$EU_{s,t-1}$		-0.105***		-0.067**
		(0.038)		(0.028)
Less than high school			-0.212***	-0.208***
			(0.006)	(0.006)
College			0.413***	0.412***
			(0.006)	(0.006)
Post college			0.978***	0.980***
			(0.014)	(0.014)
Experience			0.085***	0.085***
			(0.001)	(0.001)
$Experiences^2$			-0.001***	-0.001***
			(0.000)	(0.000)
Male			0.349***	0.346***
			(0.005)	(0.005)
White			0.023***	0.022***
			(0.004)	(0.005)
Black			-0.136***	-0.139***
			(0.007)	(0.007)
Hispanic			-0.079***	-0.079***
			(0.008)	(0.008)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Constant	10.217***	10.226***	8.834***	8.840***
	(0.002)	(0.002)	(0.014)	(0.014)
Observations	19,199,574	18,700,181	19,199,574	18,700,181
R-squared	0.144	0.144	0.359	0.359

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) EU measures scaled by 0.0001
(4) The reference group is non-Hispanic high school female with race other than white and black.
(5) Standard errors are robust to heteroskedasticity.

their own newspapers about their own economy could be a good instrument, given that other countries' economic uncertainty indexes can be correlated with U.S. economic uncertainty index because of the globalization (i.e., free flow of goods), but they should not have a direct effect on U.S. wages due to immigration restrictions (i.e., limited flow of people). For

Table 3.8: Robustness test by using news from China.

	Dependent Variable: Yearly wage (log)			
	(1)	(2)	(3)	(4)
$EU_{s,t}$	-0.712***	-0.623	-0.599***	-0.254
	(0.249)	(0.655)	(0.168)	(0.386)
$EU_{s,t-1}$		-0.733***		-0.551***
		(0.244)		(0.147)
Less than high school			-0.212***	-0.208***
			(0.006)	(0.006)
College			0.413***	0.412***
			(0.006)	(0.006)
Post college			0.978***	0.980***
			(0.014)	(0.014)
Experience			0.085***	0.085***
			(0.001)	(0.001)
$Experiences^2$			-0.001***	-0.001***
			(0.000)	(0.000)
Male			0.349***	0.346***
			(0.005)	(0.005)
White			0.023***	0.022***
			(0.004)	(0.005)
Black			-0.136***	-0.139***
			(0.007)	(0.007)
Hispanic			-0.079***	-0.079***
			(0.008)	(0.008)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Constant	10.221***	10.234***	8.837***	8.844***
	(0.002)	(0.002)	(0.014)	(0.014)
Observations	19,199,574	18,700,181	19,199,574	18,700,181
R-squared	0.144	0.144	0.359	0.359

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) EU measures scaled by 0.0001
(4) The reference group is non-Hispanic high school female with race other than white and black.
(5) Standard errors are robust to heteroskedasticity.

constructing these instrument variables, I first collected economic-related news articles from three other countries: Canada, Mexico, and China. I then constructed the concurrent and one-year lagged values of the economic uncertainty index for each of the three countries based on their own news articles regarding their own economy. Next, I averaged the concurrent and one-year lagged values of such indices among the three countries at industry and year level. Lastly, I followed the specifications in Table 3.3 columns (2) to (5) to regress the effect of U.S. economic uncertainty index on wages of U.S. labor market via the instruments of the concurrent and the lagged values of other three countries' average economic uncertainty index, while clustering the standard errors of the economic uncertainty index at year - industry level and controlling for year fixed effects and industry fixed effects. In addition, the standard errors are robust to heteroskedasticity in all the specifications in this table.

Tables 3.9 and 3.10 report the two-stage least squares regression results with instruments. The results from the first stage regression indicate a positive association between the concurrent and the lagged values of U.S. economic uncertainty and the instruments. In addition, the results from the second stage regression show that both the coefficients of the concurrent and the lagged index are negative. Particularly, the concurrent value of the economic uncertainty index in all specifications has statistically significant impact on wages in the U.S. labor market at 5% or 1% level. It is worth noting that the total effects of both concurrent economic uncertainty and its lag on wages via instruments in column (4) of Table 3.10 is close to the total effects of both concurrent index and its lag in column (5) of Table 3.3. The coefficients of all other variables are consistent with expectations. The instruments of other countries' economic uncertainty and its lag confirm the expectation of the negative economic uncertainty impact on wages.

From figure 3.3, I found that the economic uncertainty index at year level in 2002 is zero. This seems like a red flag to us, which means that there were no uncertainty-related words found in the selected newspapers. It may be true that the economy was going very smoothly that year, or it was caused by insufficient data collected that year. In order to

Table 3.9: Robustness test with instruments - first stage.

	(1)	(2)		(3)	(4)	
Dependent Variable	(a) $EU_{s,t}$	(a)$EU_{s,t}$	(b) $EU_{s,t-1}$	(a) $EU_{s,t}$	(a)$EU_{s,t}$	(b)$EU_{s,t-1}$
$EUIV_{s,t}$	0.023	0.023	0.466***	0.023	0.023	0.466***
	(0.131)	(0.131)	(0.178)	(0.131)	(0.131)	(0.178)
$EUIV_{s,t-1}$	0.453***	0.453***	0.034	0.453***	0.453***	0.034
	(0.156)	(0.156)	(0.140)	(0.156)	(0.156)	(0.140)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.010***	0.010***	0.014***	0.011***	0.011***	0.014***
	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)
Observations	18,700,181	18,700,181	18,700,181	18,700,181		
R-squared	0.143	0.934	0.928	0.934	0.934	0.928

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) EU measures scaled by 0.0001
(4) $EUIV_{s,t}$ and $EUIV_{s,t-1}$ are the concurrent and the lagged values of average economic uncertainty indexes. of Canada, Mexico, and China.

avoid the index outliers generated in year 2002, I conducted a robustness test by selecting all the data after 2002 and run the same specifications in Table 3.3. Reported in Table 3.11, results shows that both the concurrent economic uncertainty index and its one-year lag are still negative and statistically significant after removing data in years 2001 and 2002. Meanwhile, the effects of all other variables are consistent with the results in Table 3.3.

3.7 Conclusion

This paper provides a novel way to study the effects of economic uncertainty on wage. The baseline results rely on constructing an economic uncertainty index based on news articles published by four major U.S. newspapers. This index controls for the presence of a wide set of economic events over the years, such as the financial crisis, the fiscal cliff and government shutdown, and the international trade war, etc. The baseline specification shows that an increase in economic uncertainty tends to reduce wages in the U.S. labor market. Moreover, these results are economically meaningful. I find that a one-standard-deviation increase

Table 3.10: Robustness test with instruments - second stage.

	Dependent Variable: Yearly wage (log)			
	(1)	(2)	(3)	(4)
$EU_{s,t}$	-0.613**	-0.578**	-0.484***	-0.438***
	(0.241)	(0.229)	(0.161)	(0.139)
$EU_{s,t-1}$		-0.074		-0.095
		(0.901)		(0.645)
Less than high school		-0208***	-0.208***	
			(0.006)	(0.006)
College			0.412***	0.412***
			(0.006)	(0.006)
Post college			0.980***	0.980***
			(0.014)	(0.014)
Experience			0.085***	0.085***
			(0.001)	(0.001)
$Experiences^2$			-0.001***	-0.001***
			(0.000)	(0.000)
Male			0.346***	0.346***
			(0.005)	(0.005)
White			0.022**	0.022***
			(0.005)	(0.005)
Black			-0.139***	-0.139***
			(0.007)	(0.007)
Hispanic			-0.079***	-0.079***
			(0.008)	(0.008)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Constant	9.988***	9.989***	8.754***	8.755***
	(0.023)	(0.024)	(0.023)	(0.024)
Observations	18,700,181	18,700,181	18,700,181	18,700,181
R-squared	0.144	0.144	0.359	0.359

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) EU measures scaled by 0.0001
(4) The reference group for this regression is non-Hispanic high school female with race other than white and black.
(5) Standard errors are robust to heteroskedasticity.

in U.S. economic uncertainty index leads to a combined decline of 2.12 percent in U.S. wages. In addition, the results are robust to the specifications when I remove the industry outliers from the baseline regression, when I remove year 2001 and year 2002 to avoid zero

Table 3.11: Robustness test by using data after 2002.

	Dependent Variable: Yearly wage (log)				
	(1)	(2)	(3)	(4)	(5)
$EU_{s,t}$		-0.419**	-0.231	-0.448***	-0.299***
		(0.171)	(0.190)	(0.111)	(0.110)
$EU_{s,t-1}$			-0.365***		-0.290***
			(0.141)		(0.087)
Less than high school	-0.206***			-0.206***	-0.206***
	(0.006)			(0.006)	(0.006)
College	0.411***			0.411***	0.411***
	(0.006)			(0.006)	(0.006)
Post college	0.983***			0.983***	0.983***
	(0.015)			(0.015)	(0.015)
Experience	0.085***			0.085***	0.085***
	(0.001)			(0.001)	(0.001)
$Experiences^2$	-0.001***			-0.001***	-0.001***
	(0.000)			(0.000)	(0.000)
Male	0.343***			0.343***	0.343***
	(0.005)			(0.005)	(0.005)
White	0.022***			0.022***	0.022***
	(0.005)			(0.005)	(0.005)
Black	-0.141***			-0.141***	-0.141***
	(0.007)			(0.007)	(0.007)
Hispanic	-0.079***			-0.079***	-0.079***
	(0.008)			(0.008)	(0.008)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	8.846***	10.237***	10.238***	8.849***	8.849***
	(0.014)	(0.002)	(0.002)	(0.014)	(0.014)
Observations	18,254,752	18,254,752	18,254,752	18,254,752	18,254,752
R-squared	0.358	0.144	0.144	0.358	0.358

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) EU measures scaled by 0.0001
(4) The reference group for this regression is non-Hispanic high school female with race other than white and black.
(5) Standard errors are robust to heteroskedasticity.

index, and when I use the average of other countries' own economic uncertainty indices as an instrument. The results are also supported by constructing U.S. economic uncertainty index using newspapers issued by other countries. Above all, it is reasonable to say that the baseline economic uncertainty index has a significant effect on wages and that controlling such uncertainty will maintain a stable labor market in the U.S.

This paper has profound impacts on policy makers and political leaders for both local and national economic development. It utilizes text mining skills to extract key information from numerous pieces of online news articles that efficiently and effectively predict wages in the U.S. labor market. It implies that economic uncertainty reduces wages and therefore hampers efforts to develop the economy. Reducing economic uncertainty when making policies and regulations could be a crucial component to sustain the labor market as well as the whole economy in the country.

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Appendix A

Chapter 1 Appendix

In this Appendix, we first offer the details about the steps taken to aggregate our measure of TPU at the industry, trade partner, and year levels. Next, we display several of the Tables referenced in the main body of the paper.

A.1 Aggregation of the TPU index

Generating the TPU index at other levels of aggregation follow the same steps 1-3 described in Section 1.1. We use equations (A.1)-(A.3) to construct the TPU index at the industry and year levels, in which case we do not control for information about specific trade partners.

$$U_{i,s,t} = \sum_q U_{q,i,t} F_{q,i,s,t} \tag{A.1}$$

$$z_{s,t} = \frac{1}{N} \sum_{i=1}^{N} \left[\frac{\frac{U_{i,s,t}}{T_{i,t}}}{std\left(\frac{U_{i,s,t}}{T_{i,t}}\right)} \right] \tag{A.2}$$

$$TPU_{s,t} = \frac{z_{s,t}}{\frac{1}{K}\sum_{k=1}^{K} z_{s,t}} \tag{A.3}$$

Instead, we use equations (A.4)-(A.6) to calculate the trade partner-specific U.S. TPU index that varies by year.

$$U_{i,t}^{j} = \sum_{q} U_{q,i,t} F_{q,i,t}^{j} \tag{A.4}$$

$$z_{t}^{j} = \frac{1}{N} \sum_{i=1}^{N} \left[\frac{\frac{U_{i,t}^{j}}{T_{i,t}}}{std\left(\frac{U_{i,t}^{j}}{T_{i,t}}\right)} \right] \tag{A.5}$$

$$TPU_{t}^{j} = \frac{100 z_{t}^{j}}{\frac{1}{K}\sum_{k=1}^{K} z_{t}^{j}} \tag{A.6}$$

Last, we employ equations (A.7)-(A.9) to measure TPU at the year level.

$$U_{i,t} = \sum_{q} U_{q,i,t} \tag{A.7}$$

$$z_{t} = \frac{1}{N} \sum_{i=1}^{N} \left[\frac{\frac{U_{i,t}}{T_{i,t}}}{std\left(\frac{U_{i,t}}{T_{i,t}}\right)} \right] \tag{A.8}$$

$$TPU_{t} = \frac{100 z_{t}}{\frac{1}{K}\sum_{k=1}^{K} z_{t}} \tag{A.9}$$

A.2 Additional Figures and Tables

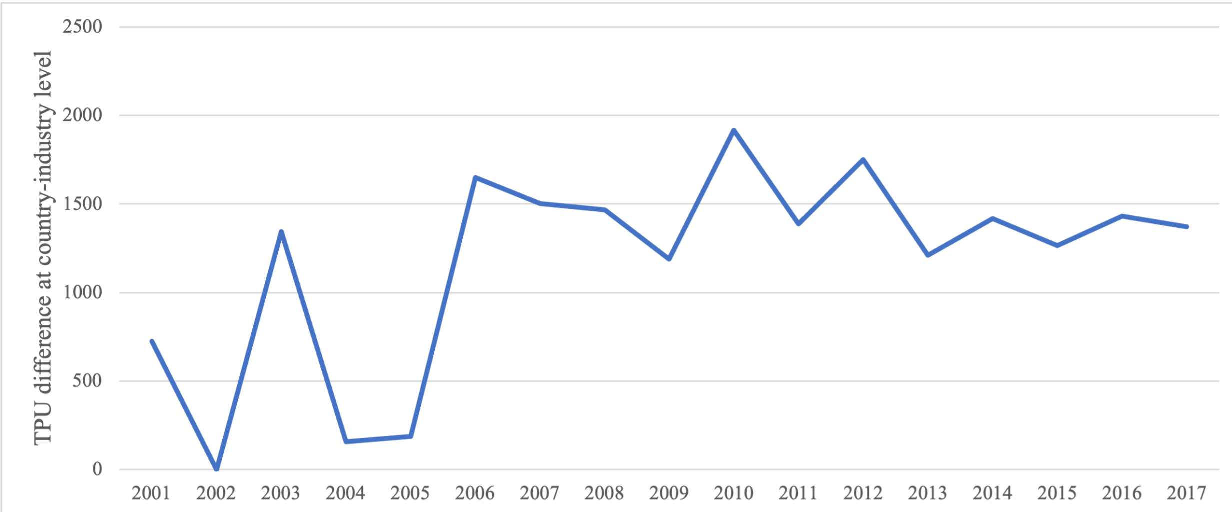

Figure A.1: TPU difference at country-year level between China and the EU

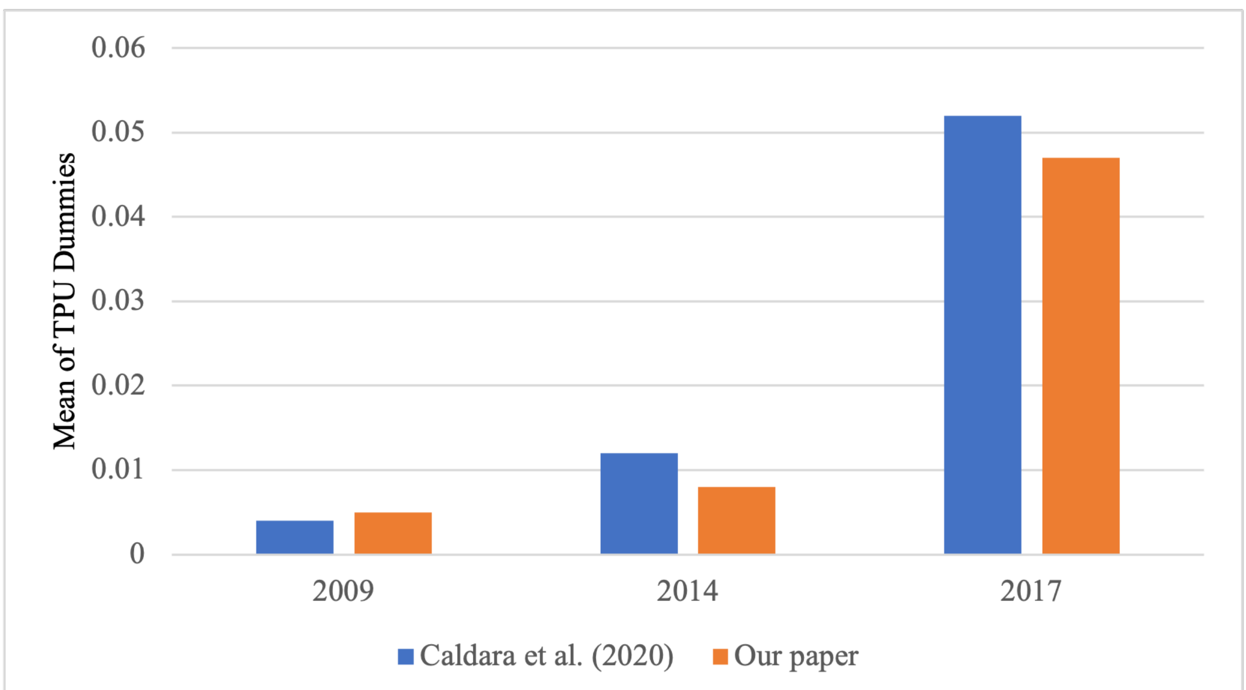

Figure A.2: TPU comprison between Caldara et al. (2020) and ours for manufacturing industry

Table A.1: Structural model estimation with alternative tariffs (Import).

	Dependent Variable: US Export Value (log)				
	(1)	(2)	(3)	(4)	(5)
$TPU^{j}_{s,t}$	-0.016*	-0.016*	-0.016*	-0.016*	-0.016*
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
$TPU^{j}_{s,t-1}$		-0.014*	-0.014*	-0.014*	-0.017**
		(0.008)	(0.008)	(0.008)	(0.007)
$ln\tau^{us,j}_{s,t}$			-1.144***	-1.146***	-0.889***
			(0.103)	(0.103)	(0.097)
$ln\tau^{j}_{s,t}$				0.019	0.008
				(0.013)	(0.012)
$ln\left(\sum_{k\neq us} Y^{k,j}_{s,t}\right)$					0.609***
					(0.006)
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry-country fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	15.198***	15.199***	15.232***	15.229***	4.098***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.104)
Observations	105,777	105,777	105,777	105,777	105,777
R-squared	0.934	0.934	0.934	0.934	0.941

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(3) Tariffs are changed into the minimum between MFN and Preferential tariffs

Table A.2: Structural model estimation with alternative tariffs (Export).

	Dependent Variable: US Export Value (log)				
	(1)	(2)	(3)	(4)	(5)
$TPU^{j}_{s,t}$	0.002	0.003	0.005	0.012	0.013
	(0.005)	(0.007)	(0.007)	(0.010)	(0.009)
$TPU^{j}_{s,t-1}$	0.006	0.010	0.010	0.014	0.012
	(0.005)	(0.007)	(0.007)	(0.009)	(0.008)
$TPU^{j}_{s,t} \times PWR67^{j}_{s}$		-0.003		-0.028**	
		(0.010)		(0.013)	
$TPU^{j}_{s,t-1} \times PWR67^{j}_{s}$		-0.008		-0.034***	
		(0.010)		(0.012)	
$TPU^{j}_{s,t} \times PWR75^{j}_{s}$			-0.005		-0.030**
			(0.010)		(0.013)
$TPU^{j}_{s,t-1} \times PWR75^{j}_{s}$			-0.009		-0.033***
			(0.010)		(0.012)
$ln\tau^{j,us}_{s,t}$	-0.811***	-0.855***	-0.856***	-0.963***	-0.963***
	(0.063)	(0.065)	(0.065)	(0.087)	(0.087)
$ln\tau^{j}_{s,t}$	0.025**	0.016*	0.016*	0.019	0.019
	(0.010)	(0.010)	(0.010)	(0.013)	(0.013)
$ln\left(\sum_{k\neq us} Y^{j,k}_{s,t}\right)$	0.208***	0.265***	0.265***	0.246***	0.246***
	(0.006)	(0.007)	(0.007)	(0.009))	(0.009)
Sample selected in the sample	Full sample	Full sample	Full sample	After year 2007	After year 2007
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry-country fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	11.228***	10.456***	10.455***	10.946***	10.947***
	(0.110)	(0.132)	(0.132)	(0.186)	(0.186)
Observations	115,665	93,405	93,405	57,108	57,108
R-squared	0.943	0.948	0.948	0.962	0.962

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(3) Tariffs are changed into the minimum between MFN and Preferential tariffs

Table A.3: Structural model estimation with TPU dummy (Import).

	Dependent Variable: US Import Value (log)				
	(1)	(2)	(3)	(4)	(5)
$TPUdummy^{j}_{s,t}$	-0.069	-0.072	-0.073	-0.073	-0.079
	(0.052)	(0.052)	(0.052)	(0.052)	(0.050)
$TPUdummy^{j}_{s,t-1}$		-0.095*	-0.097*	-0.097*	-0.091*
		(0.057)	(0.057)	(0.057)	(0.054)
$ln\tau^{us,j}_{s,t}$			-1.165***	-1.168***	-0.944***
			(0.113)	(0.113)	(0.107)
$ln\tau^{j}_{s,t}$				0.012**	0.010*
				(0.006)	(0.006)
$ln\left(\sum_{k\neq us} Y^{k,j}_{s,t}\right)$					0.613***
					(0.006)
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry-country fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	15.335***	15.336***	15.375***	15.369***	4.055***
	(0.003)	(0.003)	(0.005)	(0.005)	(0.116)
Observations	98,963	98,963	98,963	98,963	98,963
R-squared	0.935	0.935	0.936	0.936	0.942

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPUdummy is 1 if $TPU > 0$ and 0 otherwise

Table A.4: Structural model estimation with TPU dummy (Export).

	Dependent Variable: US Export Value (log)				
	(1)	(2)	(3)	(4)	(5)
$TPUdummy^j_{s,t}$	0.068	0.064	0.066	0.052	0.048
	(0.045)	(0.047)	(0.046)	(0.045)	(0.044)
$TPUdummy^j_{s,t-1}$	0.063	0.059	0.059	0.058	0.048
	(0.049)	(0.051)	(0.050)	(0.049)	(0.048)
$TPUdummy^j_{s,t} \times PWR67^j_s$		-0.003		-0.020**	
		(0.007)		(0.010)	
$TPUdummy^j_{s,t-1} \times PWR67^j_s$		-0.003		-0.026***	
		(0.007)		(0.009)	
$TPUdummy^j_{s,t} \times PWR75^j_s$			-0.005		-0.022**
			(0.007)		(0.009)
$TPUdummy^j_{s,t-1} \times PWR75^j_s$			-0.003		-0.025***
			(0.007)		(0.009)
$ln\tau^{j,us}_{s,t}$	-1.024***	-1.136***	-1.136***	-1.264***	-1.265***
	(0.072))	(0.076)	(0.076)	(0.103)	(0.103)
$ln\tau^j_{s,t}$	0.099***	0.104***	0.104***	0.132***	0.132***
	(0.013)	(0.013)	(0.013)	(0.019)	(0.019)
$ln\left(\sum_{k\neq us} Y^{j,k}_{s,t}\right)$	0.208***	0.264***	0.264***	0.246***	0.246***
	(0.006)	(0.007)	(0.007)	(0.009)	(0.009)
Sample selected in the sample	Full sample	Full sample	Full sample	After year 2007	After year 2007
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry-country fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	11.217***	10.454***	10.454***	10.915***	10.915***
	(0.111)	(0.132)	(0.132)	(0.186)	(0.186)
Observations	114,742	92,497	92,497	56,608	56,608
R-squared	0.943	0.948	0.948	0.962	0.962

Notes:
(1) Standard errors in parentheses
(2) *** p<0.01, ** p<0.05, * p<0.1
(3) TPUdummy is 1 if TPU>0 and 0 otherwise
(4) $PWR67^j_s$ is 1 if the market power of an industry in a country is above 67 percentile of such variations and 0 otherwise
(5) $PWR75^j_s$ is 1 if the market power of an industry in a country is above 75 percentile of such variations and 0 otherwise
(6) Five countries including EU, JP, CHN, CA, MEX have largest market power (Nicita, Olarreaga, and Silva, 2018)

Table A.5: Country list

Country Code	Country Name	Country Code	Country Name	Country Code	Country Name	Country Code	Country Name
4	Afghanistan	208	Denmark	410	Rep. Of Korea	604	Peru
8	Albania	214	Dominican Rep.	414	Kuwait	608	Philippines
12	Algeria	218	Ecuador	418	Lao People'S Dem. Rep.	616	Poland
24	Angola	222	El Salvador	422	Lebanon	620	Portugal
31	Azerbaijan	226	Equatorial Guinea	426	Lesotho	634	Qatar
32	Argentina	231	Ethiopia	428	Latvia	642	Romania
36	Australia	233	Estonia	430	Liberia	643	Russian Federation
40	Austria	242	Fiji	434	Libya	646	Rwanda
44	Bahamas	246	Finland	440	Lithuania	682	Saudi Arabia
48	Bahrain	251	France	442	Luxembourg	702	Singapore
50	Bangladesh	266	Gabon	446	China, Macao Sar	703	Slovakia
51	Armenia	268	Georgia	450	Madagascar	704	Viet Nam
52	Barbados	276	Germany	454	Malawi	705	Slovenia
56	Belgium	288	Ghana	458	Malaysia	710	South Africa
60	Bermuda	300	Greece	462	Maldives	716	Zimbabwe
68	Bolivia (Plurinational State Of)	320	Guatemala	470	Malta	724	Spain
72	Botswana	324	Guinea	478	Mauritania	748	Swaziland
76	Brazil	328	Guyana	480	Mauritius	752	Sweden
84	Belize	332	Haiti	484	Mexico	756	Switzerland
100	Bulgaria	340	Honduras	498	Rep. Of Moldova	764	Thailand
104	Myanmar	344	China, Hong Kong Sar	504	Morocco	780	Trinidad And Tobago
112	Belarus	348	Hungary	508	Mozambique	784	United Arab Emirates
116	Cambodia	352	Iceland	512	Oman	788	Tunisia
120	Cameroon	356	India	516	Namibia	792	Turkey
124	Canada	360	Indonesia	524	Nepal	800	Uganda
144	Sri Lanka	368	Iraq	528	Netherlands	804	Ukraine
148	Chad	372	Ireland	540	New Caledonia	807	Tfyr Of Macedonia
152	Chile	376	Israel	554	New Zealand	818	Egypt
156	China	381	Italy	558	Nicaragua	826	United Kingdom
170	Colombia	384	Cã´Te D'Ivoire	566	Nigeria	834	United Rep. Of Tanzania
178	Congo	388	Jamaica	578	Norway	858	Uruguay
180	Dem. Rep. Of The Congo	392	Japan	586	Pakistan	862	Venezuela
188	Costa Rica	398	Kazakhstan	591	Panama	887	Yemen
191	Croatia	400	Jordan	598	Papua New Guinea	890	Serbia
196	Cyprus	404	Kenya	600	Paraguay	894	Zambia

Table A.6: Industry list

HS 2-digit	Industry descriptions
1	Live animals
2	Meat and edible meat offal
3	Fish and crustaceans, molluscs and other aquatic invertebrates
4	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included
5	Products of animal origin, not elsewhere specified or included
6	Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage
7	Edible vegetables and certain roots and tubers
8	Edible fruit and nuts; peel of citrus fruit or melons
9	Coffee, tea, mate and spices
10	Cereals
11	Products of the milling industry; malt; starches; inulin; wheat gluten
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal plants ; straw and fodder
13	Lac; gums, resins and other vegetable saps and extracts
14	Vegetable plaiting materials; vegetable products not elsewhere specified or included
15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes
16	Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates
17	Sugars and sugar confectionery
18	Cocoa and cocoa preparations
19	Preparations of cereals, flour, starch or milk; pastrycooks' products
20	Preparations of vegetables, fruit, nuts or other parts of plants
21	Miscellaneous edible preparations
22	Beverages, spirits and vinegar
23	Residues and waste from the food industries; prepared animal fodder
24	Tobacco and manufactured tobacco substitutes
25	Salt; sulphur; earths and stone; plastering materials, lime and cement
26	Ores, slag and ash
27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes
29	Organic chemicals
30	Pharmaceutical products
31	Fertilisers
32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints and varnishes; putty and other mastics; inks
33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations
34	Soap, organic surface-active agents, washing preparations, lubricating preparations, artificial waxes, prepared waxes, polishing or scouring preparations, candles and similar articles, modelling pastes, "dental waxes" and dental preparations with a basis of plaster
35	Albuminoidal substances; modified starches; glues; enzymes
36	Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations
37	Photographic or cinematographic goods
38	Miscellaneous chemical products
39	Plastics and articles thereof
40	Rubber and articles thereof
41	Raw hides and skins (other than furskins) and leather
42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut)
43	Furskins and artificial fur; manufactures thereof
44	Wood and articles of wood; wood charcoal
45	Cork and articles of cork
46	Manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork
47	Pulp of wood or of other fibrous cellulosic material; waste and scrap of paper or paperboard
48	Paper and paperboard; articles of paper pulp, of paper or of paperboard
49	Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans
50	Silk

Table A.7: Industry list (Continued)

HS 2-digit	Industry descriptions
51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric
52	Cotton
53	Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn
54	Sewing thread of man-made filaments, whether or not put up for retail sale
55	Man-made staple fibres
56	Wadding, felt and nonwovens; special yarns; twine, cordage, ropes and cables and articles thereof
57	Carpets and other textile floor coverings
58	Special woven fabrics; tufted textile fabrics; lace; tapestries; trimmings; embroidery
59	Impregnated, coated, covered or laminated textile fabrics; textile articles of a kind suitable for industrial use
60	Knitted or crocheted fabrics
61	Articles of apparel and clothing accessories, knitted or crocheted
62	Articles of apparel and clothing accessories, not knitted or crocheted
63	Other made up textile articles; sets; worn clothing and worn textile articles; rags
64	Footwear, gaiters and the like; parts of such articles
65	Headgear and parts thereof
66	Umbrellas, sun umbrellas, walking-sticks, seat-sticks, whips, riding-crops and parts thereof
67	Prepared feathers and down and articles made of feathers or of down; artificial flowers; articles of human hair
68	Articles of stone, plaster, cement, asbestos, mica or similar materials
69	Ceramic products
70	Glass and glassware
71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal, and articles thereof; imitation jewellery; coin
72	Iron and steel
73	Articles of iron or steel
74	Copper and articles thereof
75	Nickel and articles thereof
76	Aluminium and articles thereof
78	Lead and articles thereof
79	Zinc and articles thereof
80	Tin and articles thereof
81	Other base metals; cermets; articles thereof
82	Tools, implements, cutlery, spoons and forks, of base metal; parts thereof of base metal
83	Miscellaneous articles of base metal
84	Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof
85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles
86	Railway or tramway locomotives, rolling-stock and parts thereof; railway or tramway track fixtures and fittings and parts thereof; mechanical (including electro-mechanical) traffic signalling equipment of all kinds
87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof
88	Aircraft, spacecraft, and parts thereof
89	Ships, boats and floating structures
90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; parts and accessories thereof
91	Clocks and watches and parts thereof
92	Musical instruments; parts and accessories of such articles
93	Arms and ammunition; parts and accessories thereof
94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated name-plates and the like; prefabricated buildings
95	Toys, games and sports requisites; parts and accessories thereof
96	Miscellaneous manufactured articles
97	Works of art, collectors' pieces, and antiques

Appendix B

Chapter 2 Appendix

In this Appendix, we first offer the details about the steps taken to aggregate our measure of TPU at the industry, trade partner, and year levels. Next, we display several of the Tables referenced in the main body of the paper.

B.1 Aggregation of the TPU index

Generating the TPU index at other levels of aggregation follow the same steps 1-3 described in Section 2.1. We use equations (B.1)-(B.3) to construct the TPU index at the industry and year levels for importer m, in which case we do not control for information about specific trade partners.

$$U^m_{i,s,t} = \sum_q U^m_{q,i,t} F^m_{q,i,s,t} \tag{B.1}$$

$$z^m_{s,t} = \frac{1}{N}^m \sum_{i=1}^{N^m} \left[\frac{\frac{U^m_{i,s,t}}{T^m_{i,t}}}{std\left(\frac{U^m_{i,s,t}}{T^m_{i,t}}\right)} \right] \tag{B.2}$$

$$TPU_{s,t}^{m} = \frac{z_{s,t}^{m}}{\frac{1}{K^m}\sum_{k^m=1}^{K^m} z_{s,t}^{m}} \tag{B.3}$$

Instead, we use equations (B.4)-(B.6) to calculate the trade partner-specific m's TPU index that varies by year.

$$U_{i,t}^{m,j} = \sum_{q} U_{q,i,t}^{m} F_{q,i,t}^{m,j} \tag{B.4}$$

$$z_{t}^{m,j} = \frac{1}{N}^{m} \sum_{i=1}^{N^m} \left[\frac{\frac{U_{i,t}^{m,j}}{T_{i,t}^{m}}}{std\left(\frac{U_{i,t}^{m,j}}{T_{it}^{m}}\right)} \right] \tag{B.5}$$

$$TPU_{t}^{m,j} = \frac{100 z_{t}^{m,j}}{\frac{1}{K^m}\sum_{k^m=1}^{K^m} z_{t}^{m,j}} \tag{B.6}$$

Last, we employ equations (B.7)-(B.9) to measure TPU at the year level.

$$U_{i,t}^{m} = \sum_{q} U_{q,i,t}^{m} \tag{B.7}$$

$$z_{t}^{m} = \frac{1}{N}^{m} \sum_{i=1}^{N^m} \left[\frac{\frac{U_{i,t}^{m}}{T_{i,t}^{m}}}{std\left(\frac{U_{i,t}^{m}}{T_{i,t}^{m}}\right)} \right] \tag{B.8}$$

$$TPU_{t}^{m} = \frac{100 z_{t}^{m}}{\frac{1}{K^m}\sum_{k^m=1}^{K^m} z_{t}^{m}} \tag{B.9}$$

B.2 Additional Tables

Table B.1: Structural model estimation for each group (2008-2017 Imports)

	Dependent Variable: Import Value (Log)			
	Canada	Mexico	China	EU
	(1)	(2)	(3)	(4)
$TPU_{s,t}^{m,j}$	-0.035	-0.144**	-0.011	-0.016
	(0.065)	(0.064)	(0.091)	(0.038)
$ln\tau_{s,t}^{m,j}$	0.344***	-0.615***	-2.898***	-1.576***
	(0.092)	(0.179)	(0.234)	(0.272)
$ln\tau_{s,t}^{j}$	-0.001	0.023*	-0.002	-0.009
	(0.009)	(0.012)	(0.012)	(0.007)
$ln\left(\sum_{k\neq m} Y_{s,t}^{k,j}\right)$	0.141***	0.175***	0.208***	0.100***
	(0.010)	(0.014)	(0.013)	(0.005)
Industry-year FE	Yes	Yes	Yes	Yes
Country-year FE	Yes	Yes	Yes	Yes
Industry-country FE	Yes	Yes	Yes	Yes
Constant	11.261***	10.724***	11.245***	13.825***
	(0.182)	(0.271)	(0.240)	(0.087)
Observations	50,277	39,924	38,662	67,282
R-squared	0.943	0.929	0.936	0.953

Notes:
(1) Standard errors in parentheses
(2) ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) The superscripts "m,j" means one of the four select importers imports from country j and "k,j" means non-select importer country k imports from j

Table B.2: Structural model estimation for each group (2008-2017 Exports)

	Dependent Variable: Export Value (Log)			
	Canada	Mexico	China	EU
	(1)	(2)	(3)	(4)
$TPU_{s,t}^{j,x}$	-0.057	-0.142**	-0.029	-0.021
	(0.065)	(0.075)	(0.032)	(0.022)
$ln\tau_{s,t}^{j,x}$	-0.896***	-0.357**	-0.613***	-1.202***
	(0.144)	(0.156)	(0.098)	(0.083)
$ln\tau_{s,t}^{j}$	0.056*	0.001	0.066***	0.076***
	(0.032)	(0.040)	(0.018)	(0.014)
$ln\left(\sum_{k\neq m} Y_{s,t}^{j,k}\right)$	0.105***	0.282***	0.082***	0.095***
	(0.015)	(0.021)	(0.007)	(0.005)
Industry-year FE	Yes	Yes	Yes	Yes
Country-year FE	Yes	Yes	Yes	Yes
Industry-country FE	Yes	Yes	Yes	Yes
Constant	11.487***	8.222***	14.106***	14.201***
	(0.283)	(0.425)	(0.123)	(0.093)
Observations	53,343	36,505	86,169	71,561
R-squared	0.908	0.901	0.958	0.968

Notes:
(1) Standard errors in parentheses
(2) ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) The superscripts "j,x" means one of the four select importers imports from country j and "j,k" means non-select importer country k imports from j

Table B.3: Structural model estimation with alternative tariffs (2008-2017 Imports)

	Dependent Variable: Export Value (Log)			
	(1)	(2)	(3)	(4)
$TPU_{s,t}^{m,j}$	-0.052*	-0.052*	-0.052*	-0.052*
	(0.028)	(0.028)	(0.028)	(0.028)
$ln\tau_{s,t}^{m,j}$		-0.325***	-0.325***	-0.325***
		(0.057)	(0.057)	(0.057)
$ln\tau_{s,t}^{j}$			-0.004	0.000
			(0.008)	(0.008)
$ln\left(\sum_{k\neq m} Y_{s,t}^{k,j}\right)$				0.127***
				(0.004)
Importer-exporter-year FE	Yes	Yes	Yes	Yes
Importer-exporter-industry FE	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
Constant	14.713***	14.729***	14.729***	12.369***
	(0.002)	(0.003)	(0.004)	(0.077)
Observations	196,170	196,170	196,170	196,170
R-squared	0.943	0.943	0.943	0.943

Notes:
(1) Standard errors in parentheses
(2) ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) The superscript "m, j" means one of our selected four importers' imports from country j and "k, j" means non-selected importer country k imports from j
(5) Tariffs are changed into the minimum between MFN and Preferential tariffs

Table B.4: Structural model estimation with alternative tariffs (2008-2017 Exports)

	Dependent Variable: Export Value (Log)			
	(1)	(2)	(3)	(4)
$TPU_{s,t}^{j,x}$	-0.040**	-0.039**	-0.039**	-0.036*
	(0.020)	(0.020)	(0.020)	(0.020)
$ln\tau_{s,t}^{j,x}$		-0.737***	-0.777***	-0.778***
		(0.051)	(0.053)	(0.053)
$ln\tau_{s,t}^{j}$			0.022***	0.027***
			(0.007)	(0.007)
$ln\left(\sum_{k\neq x} Y_{s,t}^{j,k}\right)$				0.100***
				(0.005)
Importer-exporter-year FE	Yes	Yes	Yes	Yes
Importer-exporter-industry FE	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
Constant	14.937***	14.989***	14.985***	13.129***
	(0.001)	(0.004)	(0.004)	(0.085)
Observations	247,795	247,795	247,795	247,795
R-squared	0.949	0.949	0.949	0.949

Notes:
(1) Standard errors in parentheses
(2) ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) The superscript "j, x" means one of our selected four exporters' exports to country j and "j, k" means non-selected exporter country k exports to j
(5) Tariffs are changed into the minimum between MFN and Preferential tariffs

Table B.5: First differencing of structural model estimation for four groups (2008-2017 Imports)

	Dependent Variable: Import Value (Log)			
	(1)	(2)	(3)	(4)
$TPU_{s,t}^{m,j}$	-0.003	-0.002	-0.002	-0.003
	(0.020)	(0.020)	(0.020)	(0.020)
$ln\tau_{s,t}^{m,j}$		-0.269***	-0.268***	-0.263***
		(0.067)	(0.067)	(0.067)
$ln\tau_{s,t}^{j}$			-0.002	-0.002
			(0.004)	(0.004)
$ln\left(\sum_{k\neq m} Y_{s,t}^{k,j}\right)$				0.083***
				(0.004)
IYear FE	Yes	Yes	Yes	Yes
Constant	0.042***	0.041***	0.041***	0.038***
	(0.002)	(0.002)	(0.002)	(0.002)
Observations	175,483	175,483	175,483	175,483
R-squared	0.016	0.016	0.016	0.018

Notes:
(1) Standard errors in parentheses
(2) ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) The superscript "m, j" means one of our selected four importers' imports from country j and "k, j" means non-selected importer country k imports from j

Table B.6: First differencing of structural model estimation for four groups (2008-2017 Exports)

	Dependent Variable: Export Value (Log)			
	(1)	(2)	(3)	(4)
$TPU_{s,t}^{j,x}$	-0.016	-0.016	-0.016	-0.014
	(0.015)	(0.015)	(0.015)	(0.015)
$ln\tau_{s,t}^{j,x}$		-0.699***	-0.798***	-0.806***
		(0.052)	(0.055)	(0.055)
$ln\tau_{s,t}^{j}$			0.059***	0.067***
			(0.012)	(0.012)
$ln\left(\sum_{k\neq x} Y_{s,t}^{j,k}\right)$				0.127***
				(0.004)
Year FE	Yes	Yes	Yes	Yes
Constant	0.055***	0.055***	0.055***	0.050***
	(0.002)	(0.002)	(0.002)	(0.002)
Observations	216,783	216,783	216,783	216,783
R-squared	0.022	0.023	0.023	0.026

Notes:
(1) Standard errors in parentheses
(2) ** p<0.05, * p<0.1
(3) TPU measures scaled by 0.0001
(4) The superscript "j, x" means one of our selected four exporters' exports to country j and "j, k" means non-selected exporter country k exports to j

Table B.7: Country list

Country Code	Country Name	Country Code	Country Name	Country Code	Country Name	Country Code	Country Name	Country Code	Country Name
4	Afghanistan	208	Denmark	410	Rep. Of Korea	604	Peru	894	Zambia
8	Albania	214	Dominican Rep.	414	Kuwait	608	Philippines		
12	Algeria	218	Ecuador	418	Lao People'S Dem. Rep.	616	Poland		
24	Angola	222	El Salvador	422	Lebanon	620	Portugal		
31	Azerbaijan	226	Equatorial Guinea	426	Lesotho	634	Qatar		
32	Argentina	231	Ethiopia	428	Latvia	642	Romania		
36	Australia	233	Estonia	430	Liberia	643	Russian Federation		
40	Austria	242	Fiji	434	Libya	646	Rwanda		
44	Bahamas	246	Finland	440	Lithuania	682	Saudi Arabia		
48	Bahrain	251	France	442	Luxembourg	702	Singapore		
50	Bangladesh	266	Gabon	446	China, Macao Sar	703	Slovakia		
51	Armenia	268	Georgia	450	Madagascar	704	Viet Nam		
52	Barbados	276	Germany	454	Malawi	705	Slovenia		
56	Belgium	288	Ghana	458	Malaysia	710	South Africa		
60	Bermuda	300	Greece	462	Maldives	716	Zimbabwe		
68	Bolivia (Plurinational State Of)	320	Guatemala	470	Malta	724	Spain		
72	Botswana	324	Guinea	478	Mauritania	748	Swaziland		
76	Brazil	328	Guyana	480	Mauritius	752	Sweden		
84	Belize	332	Haiti	484	Mexico	756	Switzerland		
100	Bulgaria	340	Honduras	498	Rep. Of Moldova	764	Thailand		
104	Myanmar	344	China, Hong Kong Sar	504	Morocco	780	Trinidad And Tobago		
112	Belarus	348	Hungary	508	Mozambique	784	United Arab Emirates		
116	Cambodia	352	Iceland	512	Oman	788	Tunisia		
120	Cameroon	356	India	516	Namibia	792	Turkey		
124	Canada	360	Indonesia	524	Nepal	800	Uganda		
144	Sri Lanka	368	Iraq	528	Netherlands	804	Ukraine		
148	Chad	372	Ireland	540	New Caledonia	807	Tfyr Of Macedonia		
152	Chile	376	Israel	554	New Zealand	818	Egypt		
156	China	381	Italy	558	Nicaragua	826	United Kingdom		
170	Colombia	384	Cã´Te D'Ivoire	566	Nigeria	842	United States		
178	Congo	388	Jamaica	578	Norway	834	United Rep. Of Tanzania		
180	Dem. Rep. Of The Congo	392	Japan	586	Pakistan	858	Uruguay		
188	Costa Rica	398	Kazakhstan	591	Panama	862	Venezuela		
191	Croatia	400	Jordan	598	Papua New Guinea	887	Yemen		
196	Cyprus	404	Kenya	600	Paraguay	890	Serbia		

Table B.8: Industry list

HS 2-digit	Industry descriptions
1	Live animals
2	Meat and edible meat offal
3	Fish and crustaceans, molluscs and other aquatic invertebrates
4	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included
5	Products of animal origin, not elsewhere specified or included
6	Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage
7	Edible vegetables and certain roots and tubers
8	Edible fruit and nuts; peel of citrus fruit or melons
9	Coffee, tea, mate and spices
10	Cereals
11	Products of the milling industry; malt; starches; inulin; wheat gluten
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal plants ; straw and fodder
13	Lac; gums, resins and other vegetable saps and extracts
14	Vegetable plaiting materials; vegetable products not elsewhere specified or included
15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes
16	Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates
17	Sugars and sugar confectionery
18	Cocoa and cocoa preparations
19	Preparations of cereals, flour, starch or milk; pastrycooks' products
20	Preparations of vegetables, fruit, nuts or other parts of plants
21	Miscellaneous edible preparations
22	Beverages, spirits and vinegar
23	Residues and waste from the food industries; prepared animal fodder
24	Tobacco and manufactured tobacco substitutes
25	Salt; sulphur; earths and stone; plastering materials, lime and cement
26	Ores, slag and ash
27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes
29	Organic chemicals
30	Pharmaceutical products
31	Fertilisers
32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints and varnishes; putty and other mastics; inks
33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations
34	Soap, organic surface-active agents, washing preparations, lubricating preparations, artificial waxes, prepared waxes, polishing or scouring preparations, candles and similar articles, modelling pastes, "dental waxes" and dental preparations with a basis of plaster
35	Albuminoidal substances; modified starches; glues; enzymes
36	Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations
37	Photographic or cinematographic goods
38	Miscellaneous chemical products
39	Plastics and articles thereof
40	Rubber and articles thereof
41	Raw hides and skins (other than furskins) and leather
42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut)
43	Furskins and artificial fur; manufactures thereof
44	Wood and articles of wood; wood charcoal
45	Cork and articles of cork
46	Manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork
47	Pulp of wood or of other fibrous cellulosic material; waste and scrap of paper or paperboard
48	Paper and paperboard; articles of paper pulp, of paper or of paperboard
49	Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans
50	Silk

Table B.9: Industry list (Continued)

HS 2-digit	Industry descriptions
51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric
52	Cotton
53	Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn
54	Sewing thread of man-made filaments, whether or not put up for retail sale
55	Man-made staple fibres
56	Wadding, felt and nonwovens; special yarns; twine, cordage, ropes and cables and articles thereof
57	Carpets and other textile floor coverings
58	Special woven fabrics; tufted textile fabrics; lace; tapestries; trimmings; embroidery
59	Impregnated, coated, covered or laminated textile fabrics; textile articles of a kind suitable for industrial use
60	Knitted or crocheted fabrics
61	Articles of apparel and clothing accessories, knitted or crocheted
62	Articles of apparel and clothing accessories, not knitted or crocheted
63	Other made up textile articles; sets; worn clothing and worn textile articles; rags
64	Footwear, gaiters and the like; parts of such articles
65	Headgear and parts thereof
66	Umbrellas, sun umbrellas, walking-sticks, seat-sticks, whips, riding-crops and parts thereof
67	Prepared feathers and down and articles made of feathers or of down; artificial flowers; articles of human hair
68	Articles of stone, plaster, cement, asbestos, mica or similar materials
69	Ceramic products
70	Glass and glassware
71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal, and articles thereof; imitation jewellery; coin
72	Iron and steel
73	Articles of iron or steel
74	Copper and articles thereof
75	Nickel and articles thereof
76	Aluminium and articles thereof
78	Lead and articles thereof
79	Zinc and articles thereof
80	Tin and articles thereof
81	Other base metals; cermets; articles thereof
82	Tools, implements, cutlery, spoons and forks, of base metal; parts thereof of base metal
83	Miscellaneous articles of base metal
84	Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof
85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles
86	Railway or tramway locomotives, rolling-stock and parts thereof; railway or tramway track fixtures and fittings and parts thereof; mechanical (including electro-mechanical) traffic signalling equipment of all kinds
87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof
88	Aircraft, spacecraft, and parts thereof
89	Ships, boats and floating structures
90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; parts and accessories thereof
91	Clocks and watches and parts thereof
92	Musical instruments; parts and accessories of such articles
93	Arms and ammunition; parts and accessories thereof
94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated name-plates and the like; prefabricated buildings
95	Toys, games and sports requisites; parts and accessories thereof
96	Miscellaneous manufactured articles
97	Works of art, collectors' pieces, and antiques

Appendix C

Chapter 3 Appendix

Table C.1: Industry list

Industry descriptions (IPUMS 4-digit)
Agriculture, Forestry, Fishing, and Hunting
Mining, Quarrying, and Oil and Gas Extraction
Construction
Manufacturing
Wholesale Trade
Retail Trade
Transportation and Warehousing
Utilities
Information
Finance and Insurance
Real Estate and Rental and Leasing
Professional, Scientific, and Technical Services
Management of companies and enterprises
Administrative and support and waste management services
Educational Services
Health Care and Social Assistance
Arts, Entertainment, and Recreation
Accommodation and Food Services
Public Administration