Trade policy uncertainty

by

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Abstract

China has experienced tremendous growth in its exports to the world since the 1990's. Its exports to the world rose from just 2 percent of the world's share to close to 13 percent from 1990 to 2017. Its exports to the United States increased even more during the same period, from 3 percent to 33 percent. China's WTO accession, awarding China permanent most favored nation (MFN) status, led to this dramatically increase in exports through a reduction in the US trade policy uncertainty (TPU). This report first reviews the sources of gains from trade and the gravity equation to estimate trade flow between countries. Second, this report illustrates why optimal tariffs are not zero and the effects of tariffs on trade volumes and import prices. TPU arises when countries have the power to increase tariffs. This report reviews the recent literature on the effects of reducing TPU on export growth, export prices, and product varieties. Handley and Limão (2017a) find that over one third of the export growth from China to U.S. after China's accession to the WTO is accounted by the reduction in TPU between China and US.

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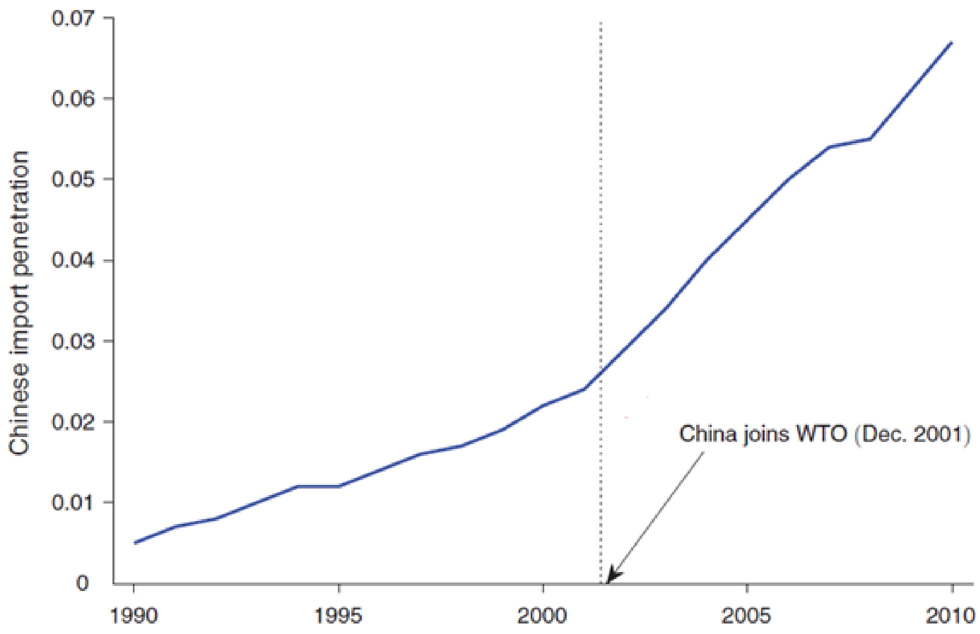
Chapter 1 Introduction

Over the past 30 years, members of the World Trade Organization (WTO) have increased global trade flows by a factor of five. Currently, there are 164 WTO memberships, representing more than 98% of international trade (WITS). After China acquired the permanent most favored nation (MFN) status from its WTO accession in 2001, its exports to the United States dramatically increased through a reduction in US trade policy uncertainty (TPU).

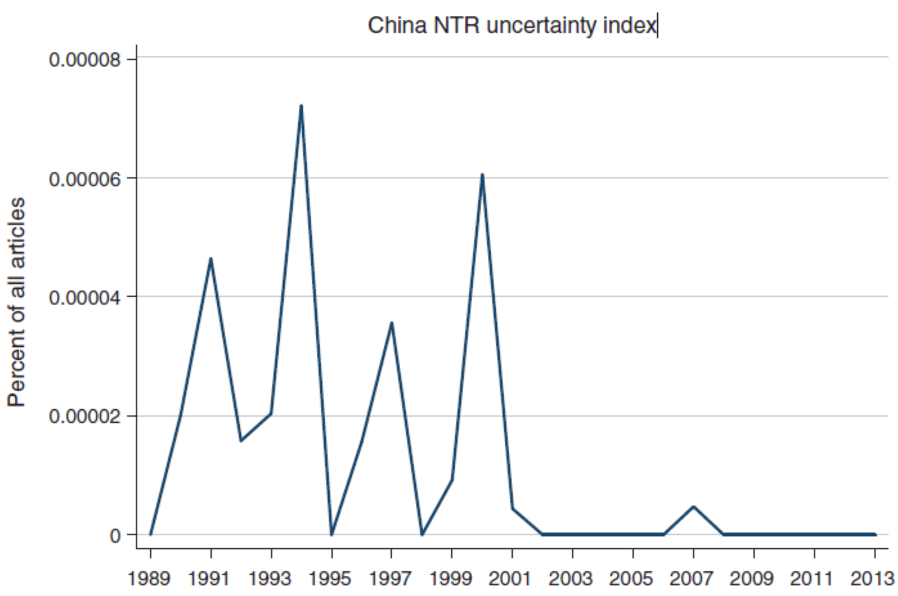
Figure 1.1, obtained from Handley and Limão (2017a), shows that the boom in exports from China to U.S. occurs after China's accession to the WTO. Some scholars argue that China's accession to WTO lowered Chinese exporters' trade costs but the actual US-applied tariffs toward China at the time remained unchanged. Although the applied tariffs remained at the MFN tariff level since China obtained temporary MFN status in 1980, in the 1990s, U.S. Congress had the right to revoke China's temporary MFN status every year. The annual U.S. threat to impose higher tariffs led to a great deal of uncertainties for Chinese exports to the U.S. in the 1990s. The U.S. threats to withdraw China's temporary MFN status, (or Normal Trade Relations, NTR), remained real during the 1990s. Pierce and Schott (2016) create a China NTR uncertainty index, as shown in Figure 1.2, that displays the percent of articles from New York Times, Wall Street Journal and Washington Post discussing the uncertainty of China's MFN status.

Figure 1.1. Chinese Import Penetration in the United States[1]



Source: Handley and Limão (2017a) Figure 1.

Figure 1.2 China MFN (or NTR) Uncertainty Index.



Source: Figure 1 in Pierce and Schott (2017).

[1] Import penetration ratios: are defined here as the ratio between the value of imports as a percentage of total consumption.

In October 2000, U.S. granted China Permanent Normal Trade Relations (PNTR) which became effective after China's accession to the WTO at the end of 2001. This eliminated Congress' right to revoke China's MFN status, and thus reduced TPU between U.S. and China.

However, in recent years, there are tremendous changes in U.S. trade policies after Donald Trump's election. President Trump already implemented higher tariffs on a diverse range of goods that are imported from China and is planning to increase tariffs on a broader range of Chinese goods unless an agreement is made between the U.S. and China. As a result, trade policy uncertainties between China and U.S. are beginning to rise. Nicita et al. (2018) claim that signs of a trade war start to appear. To understand what increasing TPU would mean to firms and workers in U.S. and China today, it is important to first assess the effects of reducing TPU that took place in 2000/2001.

The remainder of this report is organized as follows. First, in chapter two, this report reviews the sources of gains from trade and the structural gravity model to estimate trade flows between countries. Second, given there are gains from trade, chapter two of this report reviews a simple model that illustrates why optimal tariffs are not zero. The model suggests that the optimal tariffs are inversely related to the elasticity of the foreign export supply. The more inelastic the foreign export supply is, the higher is the tariff in the home country. Next, to understand the vital role of tariff as a trade policy instrument, this report assesses the effects of tariffs on various outcomes using a simple demand and supply model. Given that importing countries can change their tariffs, exporting countries face trade policy uncertainties. This report reviews the different measures of trade policy uncertainties and focuses on the tariff uncertainty used in Handley and Limão (2017a). In chapter 4, this report reviews the effects of reducing trade policy uncertainty (TPU) in the recent literature. In particular, this report first describes the structural model proposed by Handley and Limão (2017a) that leads to a TPU-augmented gravity equation to explain the effects of reducing the importing country's TPU on the foreign country's export growth. In the year 2000, U.S. granted China permanent normal trade relations tariff rates (PNTR) which reduced TPU for China's exports to US. This report reviews the empirical works that study the effects of reducing TPU on China's exports and the effects on various outcome variables in the U.S. Chapter five concludes.

Chapter 2 Gains from Trade and Trade Flows

In a neoclassical trade model with standard assumptions of perfect competition, constant returns to scale and no distortions, comparative advantage is the reason for trade. Chapter 2 reviews the neoclassical trade models including the Ricardian model that assumes technological differences as sources of comparative advantage, the Heckscher-Ohlin model that assumes factor endowment differences as sources of comparative advantages, and increasing returns to scale production technology. I review the theoretical foundation for the structural gravity model that will become useful when I discuss the structural model in Handley and Limão (2017a) to incorporate TPU in their TPU-augmented gravity model.

2.1 Comparative Advantage and Trade in a One-Factor World

The theory of comparative advantage is one essential part of explaining welfare gains from international trade. In *Wealth of Nations,* Adam Smith demonstrates that a country should specialize in its production and conduct trade exchange according to its comparative advantage and absolute advantage. During the process of this production, different countries can make full use of their different resources and maximize social welfare. That is, a country should trade for goods or services at lower opportunity costs from another country and make the products at lower opportunity cost at home.

It is best to illustrate the theory of comparative advantage in a one-factor economy using the following example. Suppose, there are two countries, called Home and Foreign respectively.

Each country only has 1000 hours of labor in producing two goods, wine and butter. Table 2.1 indicates that Home country can produce a unit of wine with 4 hours of labor and one unit of butter with 8 hours of labor; Foreign country produces one unit of wine requiring 15 hours of labor, and one unit of butter requires 10 hours of labor.

Table 2.1 Unit Labor Requirements for Home country and Foreign country

	Wine	Butter
Home country	4	8
Foreign country	15	10

In the absence of international trade, if each country produces both goods, relative prices must adjust as follows:

$$P_W^H/P_B^H = a_W^H/a_B^H \quad (2.11)$$

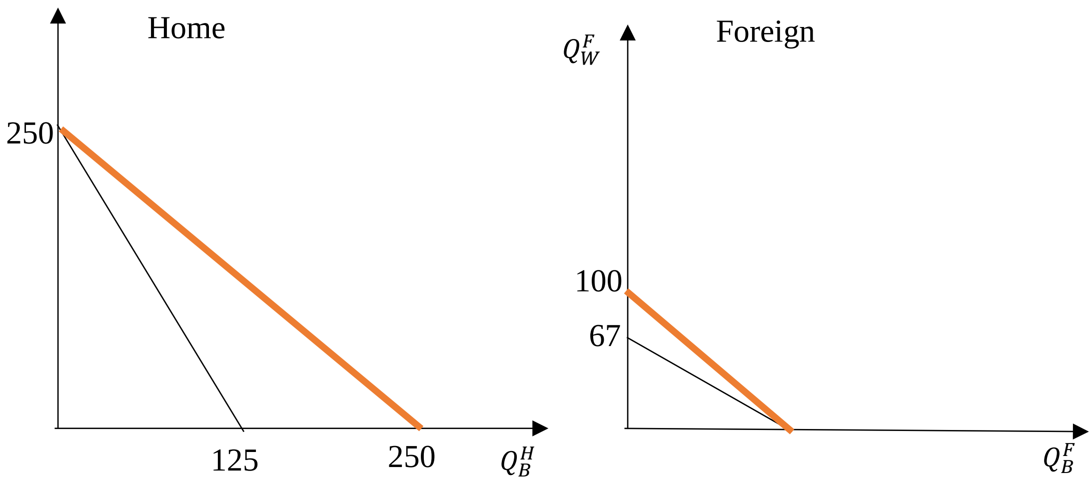
$$P_W^F/P_B^F = a_W^F/a_B^F$$

where a_W^H is labor requirements of producing a unit of wine, a_B^H is labor requirements of producing a unit of butter, P_W^H/P_B^H is the relative price in Home country. a_W^F, a_B^F are labor requirements of producing wine and butter in Foreign country. Thus, we have relative price $P_W^H/P_B^H = 1/2$, $P_W^F/P_B^F = 1.5$. The opportunity cost of wine in the Home country is much smaller than the Foreign country. Production for both goods in both countries shown in Figure 2.1.

In international trade, although the Home country has an absolute advantage in both productions, the Foreign country still has a comparative advantage in producing butter, the Home country has a comparative advantage in producing wine. We can value the relative price between relative prices in these countries, say 1.

Then the Home country can trade its 250 units maximum production of wine for 250 units

Figure 2.1 Production Probabilities Frontier



Source: Krugman et al. 2015, p34
Notes: Thick lines are production probabilities with a trade.
Thin lines are production probabilities without trade.

of butter, instead of the 125 units it could produce itself. Similarly, the Foreign country only produces butter with a trade. Figure 2.1 indicates the expansions of production probabilities due to the trade. Therefore, each country is better off in trade.

2.2 Heckscher-Ohlin Factor Endowment Theory

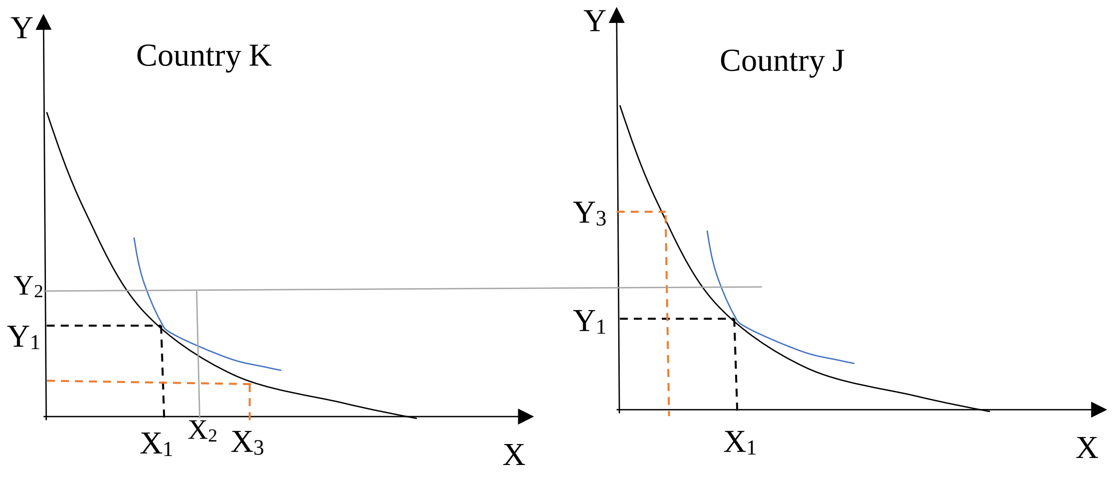
Factor Endowment Theory is another important theory. The reason we choose to import cobalt from the Democratic Republic of the Congo rather than from other countries is that Congo's factor endowment in cobalt is abundant, and therefore the price of cobalt is relatively cheap. Factor Endowment Theory suggests that a country exports products of its abundant resources and imports products of scarce resources. Trade between China and the US is a sound example to demonstrate the theory. Due to the high cost of labor in the U.S., U.S. has to import a large number of labor-intensive products from China. This is because compared to China's labor endowment, U.S. labor endowment is quite limited and scarce. However, the U.S. has sufficient capital to produce capital-intensive products. Therefore, China exports labor-intensive products to the US and imports capital-intensive products from the US.

2.3 Economies of Scale

Relaxing the assumption on the constant returns to scale production technology allows us to study the implications of economies of scale. When one firm has an increasing returns to scale production technology, average cost is decreasing with as the firm expands its production when it exports to the foreign market.

We can use the following example to illustrate why the economy of scale provides an incentive for international trade. Suppose, consumer preferences, production technology, factors and any other relevant conditions for production are exactly same in country K and J. We use the same production probability frontier and indifference curve for product X and Y in both countries. Because both J and K have economies of scale, producing X and Y has a decreasing cost implies for one additional unit of X, the amount of Y you must give up reduces. Without trade, both countries can produce X_1 units of X and Y_1 units of Y at maximized utility as Figure 2.2 shown. At this time, the relative domestic prices for X and Y are the same for the both countries. However, if country K expands X production to X_3 and country J expands Y production to Y_3, and then they trade with each other, countries get more cost advantages. Country K exports $X_3 - X_2$ units of X and imports $Y_3 - Y_2$ units of Y. Meanwhile, country J trade the same amount of these two products. Therefore, we can get (X_2, Y_2) for both countries which is more beneficial than (X_1, Y_1). This example follows that international trade based on international division of labor will make more benefits through rising productivity, reducing cost if there are economies of scale.

Figure 2.2 Production Probability Frontier for Country K and Countrv J



2.4 Trade in N Countries

Next, consider extending the two-country two-goods case into N countries, G goods and F factors. Samuelson (1939) explains gains from trade in the following model. Consider a world economy with $n = 1, \cdots, N$ countries, each country has $h = 1, \cdots, H_n$ individuals. There are $g = 1, \cdots, G$ goods, in country *n*. $p \equiv (p_1^n, \cdots, p_G^n)$ is goods price in country *n*, $y \equiv (y_1^n, \cdots, y_G^n)$ is output quantity for good in country *n*. y^n maximizes revenue under perfect competition:

$$r^n(p^n, v^n) = p^n y^n \tag{2.12}$$

In addition, there are $f = 1, \cdots, F$ factors in country *n*. $v^n \equiv (v_1^n, \cdots, v_F^n)$ denotes different kinds of factors and $w^n \equiv (w_1^n, \cdots, w_F^n)$ denotes the price for factors in country *n*. c^{nh} minimizes expenditure for the household:

$$e^{nh}(p^n, u^{nh}) = p^n c^{nh} \tag{2.13}$$

where $c^{nh} \equiv \left(c_1^{nh}, \cdots, c_G^{nh}\right)$ denotes household consumption and u^{nh} denotes utility level of the household in equilibrium in country *n*.

Holding expressions 2.12 and 2.13, we are in a neoclassical trade model, we assume there is just one household per country to simplify our analysis. By the definition of expenditure, we have:

$$e(p, u^a) \leq pc^a \tag{2.14}$$

By the definition of revenue, we have:

$$e(p, u^a) \leq r(p, v) \tag{2.15}$$

By the market clearing under autarky[2], we have:

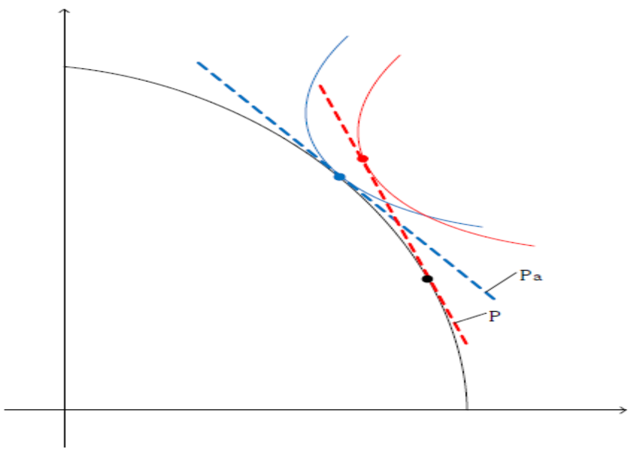
$$e(p, u^a) = py^a \tag{2.16}$$

By equations 2.12, 2.13, and trade balance, we have:

$$e(p, u^a) = e(p, u) \tag{2.17}$$

Where (y^a, c^a, p^a) denote output, consumption, and good prices under autarky, (y, c, p) denote output, consumption, and good prices under free trade. Since $e(p,\cdot)$ is increasing, we can get $u \geq u^a$. Inequalities 2.14 and 2.15 correspond to consumption and production gains from trade, see Figure 2.3. Even facing a new price vector, households cannot be worse by reoptimizing consumption and production. Therefore, the proposition that free trade makes all households (slightly) better off in a neoclassical trade model with one household per country is confirmed.

Figure 2.3 Gains from trade



Source: Costinot and Donaldson 2013

[2] Autarky: a system or policy of economic self-sufficiency aimed at removing the need for imports.

2.5 The Gravity Model in Trade Flows

2.51 Introduction to the Gravity Model

Since there are gains from trade, it is important to learn what affects trade flows. The gravity model is a successful in predicting trade flows.

The gravity model is used to explain bilateral trade flows as the following (Bergstrand 1985):

$$X_{ij} = \beta_0 (Y_i)^{\beta_1} (Y_j)^{\beta_2} (D_{ij})^{\beta_3} (A_{ij})^{\beta_4} u_{ij} \tag{2.18}$$

where X_{ij} is exports from country *i* to country j, Y_i and Y_j are gross domestic production(GDP) in country *i* and j, D_{ij} is the distance between country *i* and j, A_{ij} is any other factor(s) between *i* and j, and u_{ij} is a log-normally distributed error term with $E(ln\, u_{ij}) = 0$. In this expression, Y_i and Y_j influence potential trade scale for countries *i* and j, and the distance becomes a trade barrier due to its impacting the transport cost.

For the sake of regression, when we transform equation 2.18 into the log-linear version, we can get the following:

$$ln\, X_{ij} = \beta_0 + \beta_1\, ln\, Y_i + \beta_2\, ln\, Y_j + \beta_3\, ln\, D_{ij} + \beta_4\, ln\, A_{ij} + u_{ij} \tag{2.19}$$

where β_1, β_2, and β_3 are correlation coefficients and indicate effects on the bilateral trade of GDP and distances.

2.52 Explanatory Variables Adjustment

Early research using gravity model did not rely on theoretical foundations (Tinbergen

1962, Bergstrand 1985, McCallum 1995). The majority of their regression equations are log linear, and the regression results can explain the correlation between the explanatory variables and trade flows. Isard and Peck (1954) find that flow of trade is greater between countries that are located close to one another. Tinbergen (1962) and Poyhonen (1963) find that bilateral trade flows are positively associated with economic aggregates but negatively associated with distance. The specific expression is:

$$T_{ij} = A\left(Y_i Y_j / D_{ij}\right) \tag{2.20}$$

where T_{ij} is the total value of bilateral trade, and A is a proportional constant.

Without a theoretical foundation, scholars added explanatory variables in the gravity equation to better explain trade flows. For example, Linnemann (1966) introduces population as an additional explanatory variable into the equation. Bergstrand (1989) introduces per capita income, exchange rates, and other dummy variables into the gravity equation. Since then, the gravity model has commonly included dummy variables, such as whether country *i* and *j* have the same language, the same border, the same currency, and so on.

2.53 Border Effect

McCallum (1995) uses a modified gravity model (2.19) to regress bilateral flows between Canada and 30 states in the US in 1988. He finds that trade volume among provinces in Canada is 22 times the volume between one Canadian province and one US state while controlling for GDP and distance. This is known as the border effect. Border has an adverse impact on trade. Grossman (1998) thinks it to be a surprising discovery. A number of studies (McCallum 1995; Head and Ries 2001) confirm the existing border effect. However, the border effect is on a declining trend and has different effects for different countries or regions.

Anderson and Wincoop (2003) derive a structural gravity model based on a theoretical foundation of consumers and firms. They argue that the model established by McCallum (1995) lacks important explanatory variables: the multilateral resistance variables[3]. Omitting the multilateral resistance terms would lead to the overestimation of border effect. Moreover, the border effect is highly related to economy size. It is lager for small countries. Evans (2003) finds that numerous factors cause border effect, for example, tariffs, costs of information or trade, substitutions and so on.

The gravity model derived by Anderson and Wincoop (2003) laid the foundation for the TPU-augmented gravity model in Handley and Limão (2017a), for which this report will discuss in details in Chapter 4.

Chapter 3 Tariffs and Trade Policy Uncertainty

As explained in the last chapter, there are gains from trade. It follows that countries should have little incentive to restrict international trade. However, we do not observe free trade in the world. Every country uses trade policies to place restrictions on international trade.

Therefore, this chapter offers some theoretical foundation on why some countries are protectionists. The most common trade policy instrument is the manipulation of tariffs. As tariffs change, trade policy uncertainty arises. There are different measures of TPU used in the

[3] Multilateral resistance terms: can be one of the most crucial factors to be accounted for to avoid the omitted variable bias in the gravity model. Anderson and Wincoop (2003) refer to relative price effect as multilateral resistance variables.

literature. I will focus my discussion on two measures of TPU. I will discuss the effects of trade policy uncertainty in the next chapter.

3.1 Optimal Tariffs

In reality, even when free trade is optimal, we cannot find a country that trades without any restrictions. Most countries have incentives to impose import tariffs and export subsidies or taxes to meet their preferences in terms of trade. There are theories explaining why countries want to place positive tariffs.

Assuming welfare is governments' one concern, the only motive for trade protection is price manipulation. Suppose, there are two countries, $c = A, B$ in a world economy and two goods, $v = 1{,}2$, both of which are produced under perfect competition. We use good 2 as the numeraire, $p_2^w = 1$. Country A is a natural importer of good 1, and country B is a natural importer of good 2. The number of imports in both countries can be written as follows:

$$m_1^A(p^A, p^w) \equiv d_1^A(p^A, p^w) - y_1^A(p^A) \tag{3.11}$$

$$m_2^B(p^B, p^w) \equiv d_2^B(p^B, p^w) - y_2^B(p^B) \tag{3.12}$$

where $p^c \equiv p_1^c / p_2^c$ is the relative price in country c, $p^w \equiv p_1^w / p_2^w$ is world relative price, $d_v^c(p^c, p^w)$ is demand for good *v* in country *c*, $y_v^c(p^c)$ is the supply of good *v* in country *c*.

The exports in country c also can be written as:

$$x_2^A(p^A, p^w) \equiv y_2^A(p^A) - d_2^A(p^A, p^w) \tag{3.13}$$

$$x_1^B(p^B, p^w) \equiv y_1^B(p^B) - d_1^B(p^B, p^w) \tag{3.14}$$

Because of the premise of natural imports and exports, it is reasonable that good 1 imports of country A are equal to the demand for good 1 less supply, which leads to a shortage without trade, and equation 3.11 is positive. In terms of exports, the amount of exports of good 2 in country A, is supply for the good 2 minus the demand. There will be a surplus if the country does not trade, so equation 3.13 is positive. Since country B has symmetric conditions, equations 3.12 and 3.14 are positive as well.

If these countries trade and the market clearing for good 2 requires imports of good 2 in country B must be the same as the exports of good 2 in country A:

$$x_2^A(p^A, p^w) = m_2^B(p^B, p^w) \tag{3.15}$$

Imposing an ad-valorem tariff τ^c creates a wedge between the world and local prices:

$$p^A = (1 + \tau^A)p^w \tag{3.16}$$

$$p^B = p^w/(1 + \tau^B) \tag{3.17}$$

Equations 3.15-3.17 define relative prices of country *c* are determined by world relative prices and tariffs in country *c*, while world relative prices are related to the tariffs in both countries. Since both governments only care about welfare, they simultaneously set τ^c to maximize utility:

$$\max_{\tau^c} U^c(p^c, y^c) \equiv U^c[p^c, R^c(p^c) + T^c(p^c, p^w)] \tag{3.18}$$

where $R^c(p^c) = \max_y\{p_1^c y_1 + p_2^c y_2 | y\ feasible\}$ is revenue for sum of two goods in country c, $T^c(p^c, p^w) = (p^A - p^w)m_1^A(p^A, p^w)$ if $c = A$; $T^c(p^c, p^w) = (p^w/p^B - 1)m_1^B(p^B, p^w)$ if $c = B$. Solving the maximum utility function, we obtain optimal tariffs should be inverse of the elasticity of foreign export supply:

$$\tau^A = 1/\sigma^B \tag{3.19}$$

$$\tau^B = 1/\sigma^A \tag{3.20}$$

where σ^c is the elasticity of export supply of country c. It is true that import tariffs are intimately related to countries' market power[4]. If countries have enough market power to be able to improve their terms-of-trade, there is an incentive to impose strictly positive tariffs.

Therefore, we conclude that countries with market power are willing to impose import tariffs. Optimal tariffs are inversely associated with the elasticity of foreign export supply. In other words, if the elasticity of foreign export supply is small, then governments will have higher incentive to set high tariffs. If the elasticity of foreign export supply is large, then governments will have lower incentive to set high tariffs.

3.2 Effects of Tariffs

The goal of trade policies for a country is to manipulate prices and protect its trade. A country uses import tariffs to protect domestic industries from competition from imports through raising the imported goods' price, thus reducing the demand for imported goods. A

[4] Market power: ability for the importing country to knock down the world price after applying a tariff.

country may also impose export subsidies to encourage export industries. The potential for tariffs to change is the primary source of trade policy uncertainty. But first, we need to understand the effect of changes in applied tariffs.

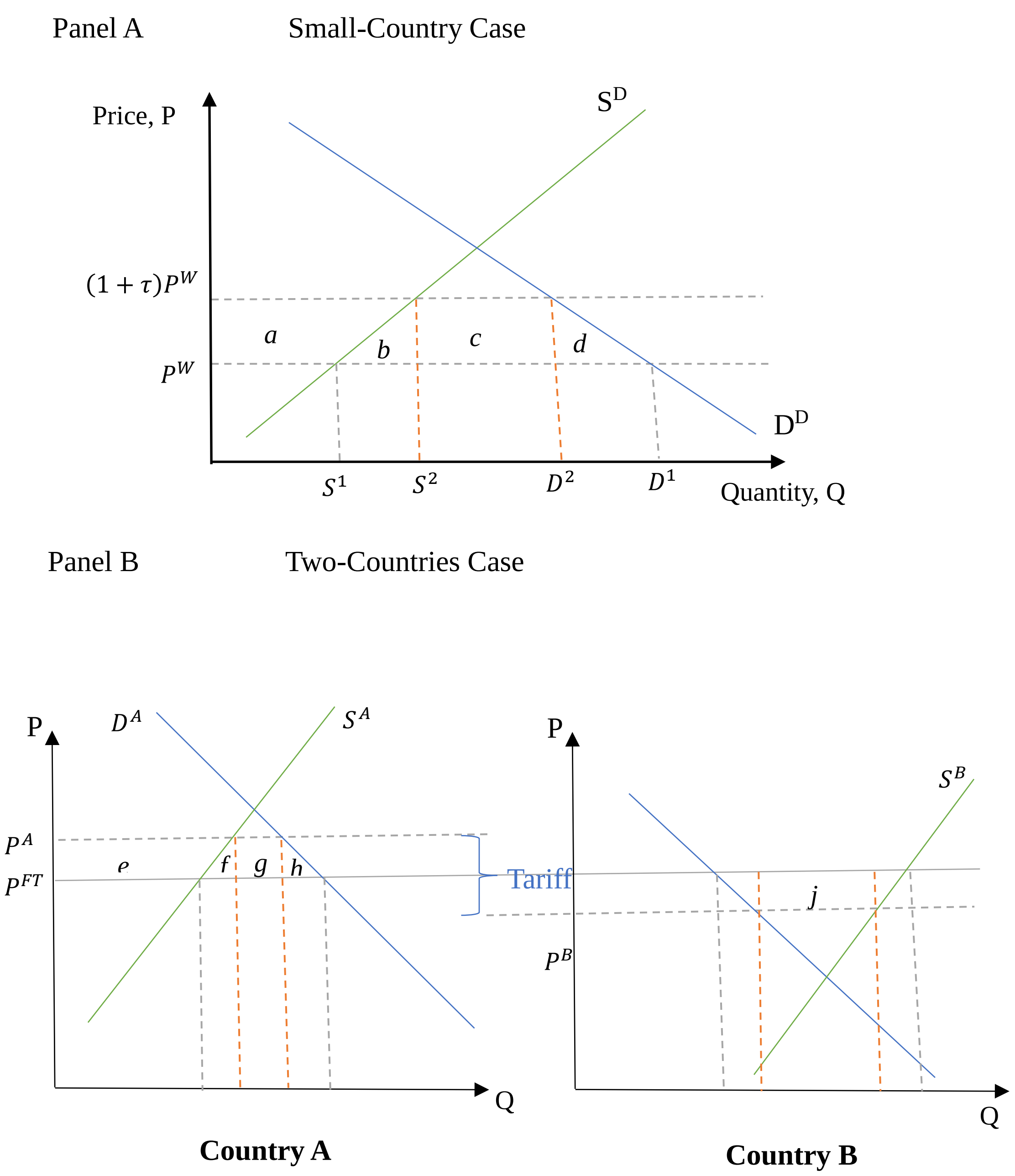
Tariffs are taxes levied when a good is imported. They have been used as the most important trade policy instrument by many governments for the following reasons. First, governments impose tariffs to raise government revenue. Second, tariffs are often used to protect domestic industries, especially infant or uncompetitive domestic firms, by discouraging imports. Nonetheless, tariffs have different effects on different countries.

When a small country imposes a tariff, it cannot affect world prices and bring down the foreign price of the imported good. As Panel A of Figure 3.1 shows, before trade, the small country has a shortage amount of $D^1 - S^1$ units for the good so the country has a desire to import the shortage amount of the good. If it imports in free trade, $D^1 - S^1$ amount of the good needs to be imported. If the country imposes a tariff, because it is too small to affect the world price P^W, the price of the imports will increase by the percentage of tariff rates τ, to $(1+\tau)P^W$.

The country will have new quantities for demand and supply because of the increased price, and the shortage of good lowers to the amount of $D^2 - S^2$. An increase in price leads to a loss of consumer surplus, exhibited by $a + b + c + d$ area. Meanwhile, producer surplus increases by area a, and the government gets the $(D^2 - S^2) \times \tau$ amount of revenue exhibited by the c area. Therefore, an increased price causes deadweight loss in the country, given by the area $b + d$. We can see from a small-country case that surplus is transferred from consumers to producers and the government if a tariff is levied on the good. Moreover, consumers lose more than producers and the government, so that brings out deadweight loss.

Nonetheless, the small-country case is not the whole story when it comes to studying the effects of a tariff. We must also analyze what happens to large countries. The following is an example. Suppose there are two large countries A and B, country A imports from country B within a single market. If these two countries are in free trade equilibrium, the world price is such that country B is willing to export the same quantity that country A is willing to import. However, if the price in country B would remain the same after imposing a tariff, country B would be willing to export more than country A would be willing to import. Thus, country B must decrease the price to reach the equilibrium. As Panel B of Figure 3.1 shows, in country A, loss of consumer surplus is the area of $e+f+g+h$; the increase of producer surplus is e; government revenue is $g+j$. Thus, we can compute gains for country A that is $j-f-h$. Furtherly, country A would gain from the imposition of the tariff if j is bigger than the deadweight loss, the sum of f and h. Other trade policy instruments include non-tariff trade barriers such as quota and the rule of origin. This report, however, focuses on the effects of tariffs and TPU in tariffs. The next subsection of this report discusses the evolution of trade policy uncertainty in the literature.

Figure 3.1 Effects of a Tariff



Source: Krugman et al. 2015, p211-215

3.3 Evolution of Trade Policy Uncertainty

In practice, the profitability of exporting enterprises is easily affected by changes in the international trade policy environment, which is mainly reflected by the frequent adjustment of tariffs on imported products by foreign governments. To understand why and how export is affected by trade policy, it is better to understand the history of TPU and the measurement of TPU.

Bernanke (1983) divides uncertainty in investment information into two types, known and unknown until investment. The latter is usually a source of risk, and we cannot avoid it. Knight (1921) argues that there is a third type of information, that firms have to wait and see to obtain. It is also the source of uncertainty and firms avoid it through delaying investment. Furthermore, Dixit (1989) proposes that firms must pay entry costs to enter the market. Roberts and Tybout (1997) show the existence of entry costs and the irreversibility of these costs. The uncertainty in the environment leads to uncertain firm profits. Firms only choose to invest if the expected profit is more than the sunk cost.

At the beginning of the uncertainty analysis, the literature was mostly concerned with analyzing the effects of economic policy uncertainty. For example, Baldwin and Krugman (1989) analyze the impact of exchange rate uncertainty on firms' entry and exit. Handley (2014) is one of the first to discuss the effect of trade policy uncertainty (TPU) on firms' export decisions. Since then, there has been an emerging literature on the effects of TPU. Similar to economic policy uncertainty, TPU delays firms' investment and affects firms' exports (Limão and Maggi, 2015). In addition, Carballo et al. (2018) combine economic policy uncertainty

(EPU) and trade policy uncertainty to study their effects on economic recovery. They find that both EPU and TPU restricted world export growth after the 2008 crisis but a reduction of TPU because of a preferential trade agreement reduced the adverse effects of EPU.

3.4 Measures of Trade Policy Uncertainty

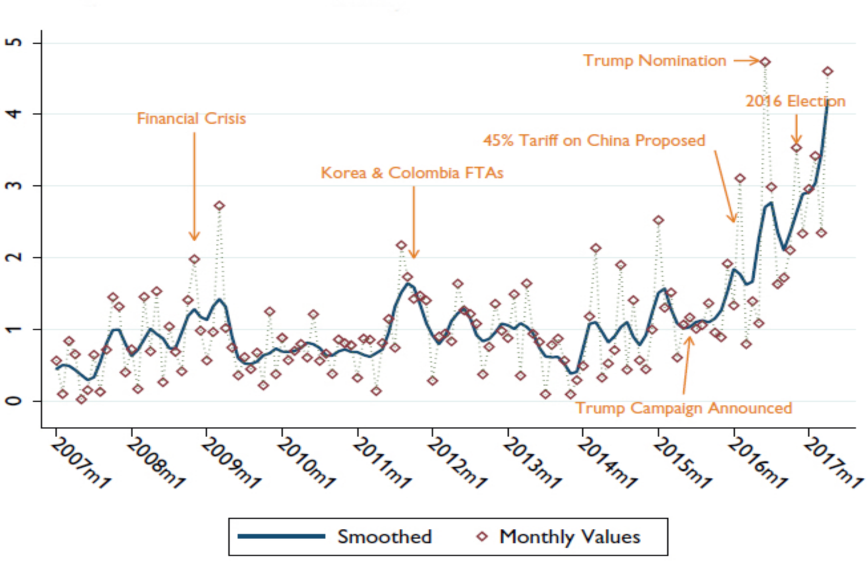
In order to study the effects of TPU, a sound measure of TPU must be developed. Sudsawasd and Moore (2006) use five trade policy indicators to measure the overall trade policy because of the absence of a consensus on which method is the best. The five indicators are average import tariffs, trade shares, average duties, tax ratios, and the Dollar Index. However, more economists now measure TPU using uncertainty in tariffs after Handley (2014).

3.41 Index of Trade Policy Uncertainty

Baker et al. (2016) conduct an economic policy uncertainty index according to the frequency of appearance of related news. Handley and Limão (2017b) apply this methodology to get an index of trade policy uncertainty. X_{it} denotes the number of news stories that mention 'trade,' 'policy' or 'uncertainty' for newspaper *i* in month *t*, T_1 denotes the time intervals used in the standardization calculations, σ_i^2 denotes time-series variance. Remove the abnormal data and standardize X_{it} through standard deviation σ_i in T_1 time intervals, to get standardized TPU frequency $Y_{it} = X_{it}/\sigma_i^2$ and average Y_{it} in time t $Z_t = \bar{Y}_{it}$. Furthermore, use T_2 to calculate the normalized time intervals in order to get average Z_t in T_2 time intervals $M = \bar{Z}_t$. The objective of this step is to restrict the frequency to a certain range to avoid the results in different levels. Lastly, we can get trade policy uncertainty based on news, $TPU = Z_t \cdot \frac{100}{M}$. This measurement provides extensive coverage for TPU because it can measure other aspects of policy uncertainty by changing the keywords, for example, economic policy uncertainty. Moreover, the uncertainty index is highly compatible with macro fluctuations (Baker et al. 2016). Additionally, Handley and Limão (2017b) use this approach to measure the variation tendency of TPU of the United States and find that the TPU index rises dramatically after Trump' nomination (Figure 3.2).

Despite the fact that the index of TPU can be used for many other fields, there still are drawbacks. First, subjective options for keywords may lead to slant. Second, we have to check many times, which causes a heavy workload. Third, it is normal that newspapers and news websites publish an article many times. If we do not delete duplicate samples, the index would be overestimated. Four, it is one-sided because of the absence of tariffs. It is usually applied when researching the changes in TPU due to the shocks in economics and politics.

Figure 3.2 US Trade Policy Uncertainty News Index 2007-



Source: Handley and Limão (2017b) Figure 1.

3.42 Tariff Measurement

Compared to the TPU index based on news stories, the measure based on tariff uncertainty is easier to obtain. Usually, research papers focus on changes in one country's TPU from its accesses to multilateral trade organizations or changes in two countries' TPU from signing a bilateral free trade agreements. Handley and Limão (2017a) derive a measuring method by theoretical models.

Handley and Limão (2017a) explain that even though China obtained temporary most favored nation status in 1980 with the U.S., China had always faced the threat of losing MFN status with the U.S. until its WTO accession. China's accession to WTO ended the threat of U.S. reverting to Smoot-Hawley Tariffs, and the TPU for Chinese export firms reduced gradually. Handley and Limão (2017a) use tariff rates of column 2[5] in 2000 and MFN tariffs to obtain $TPU = 1 - \left(\frac{\tau_2}{\tau_1}\right)^{-\sigma}$, where σ is the constant elasticity of substitution, τ_1 is applied (MFN) tariff, τ_2 is the worst-case (column 2) tariff.

Pierce and Schott and Feng et al. (2017) use a reduced-form equation to measure TPU. They directly calculate the reduction in uncertainty using the gap between the worst-case tariff and the applied tariff. That is, $TPU = \tau_2 - \tau_1$. A positive TPU value implies that a large amount of uncertainty is reduced after China's WTO accession.

Limão (2016) explain that there are three primary sources of TPU. The first is tariff volatility. The volatility of trade policy is still important even after signing bilateral or multilateral trade agreements. The second source is shocks from the international environment.

[5] Tariff rates of column 2 are the rates for countries that are denied NTR (MFN) treatment.

For example, Present Trump's policies cause an increase in uncertainty in the world. The third source is domestic policies. For example, Brexit in 2016 led to rising in policy uncertainty in England, including trade policy. The next chapter discusses the model developed by Handley and Limão (2017a) that incorporates TPU and generates predictions about export growth in details.

Chapter 4 Theoretical and Empirical Analysis

In this chapter, I review the TPU-augmented gravity model proposed by Handley and Limao (2017a). Moreover, I provide empirical evidence from China's WTO accession to study the effects of reducing the TPU in US on the China's export growth.

4.1 Theoretical Analysis

4.11 Consumer Preference and Firms

Handley and Limão (2017a) develop a theoretical model that allows firms to take trade policy uncertainty into account when making decisions to export. Handley and Limão (2017a) build on Melitz's (2003) model to allow heterogeneous firms with different costs (productivities). Consumer preferences for differentiated goods v follow a CES utility function:

$$U = \left[\int q_i(\varphi)^{\frac{\sigma-1}{\sigma}} d\varphi\right]^{\frac{\sigma}{\sigma-1}} \qquad (4.11)$$

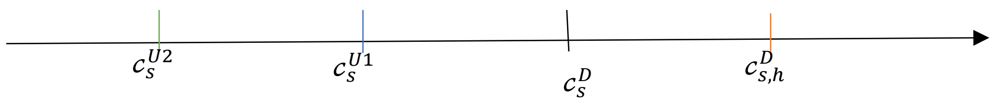
where U is the utility level, $\sigma > 1$ is the constant elasticity of substitution (CES), $q_i(\varphi)$ is the quantity demanded for product v.

On the production side, firms are heterogeneous in their costs. For a single-product enterprise, firm's entry and exit are reflected in the product's entry and exit. Handley and Limão assume that the firm observes the economic conditions state s, denoted by a_s, and decides to export or not depending on its expected profits and the sunk cost of exporting, denoted by K. If the expected profit is larger than the sunk cost, the firm will enter the foreign markets and continues to export with probability $0 \leq \beta \leq 1$ in the following period. For every firm, profit is determined by the market conditions, a_s and its cost c. Therefore, based on the CES utility function and the price index, the expected value of any firm from exporting is

$$\prod_e(a_s, c) = a_s\, c^{1-\sigma} + \mathbb{E}_s \sum_{t=1}^{\infty} \beta^t\, a_s'\, c^{1-\sigma} \tag{4.12}$$

where c is the heterogeneous firm cost, $\mathbb{E}_s$ is the expectation for future state conditions based on the current conditions, and β is the probability of staying in the market.

Figure 4.1 A Firm's Preferences



The conditions in the domestic market are assumed to be deterministic because firms do not face tariffs in their home market. As a result, firms will serve the domestic market if their costs are below the deterministic cutoff, $c_{s,h}^{D}$. If a firm is certain about future conditions and does not expect the tariff to change in the foreign market, the firm will enter the export market when its cost is lower than threshold for exporting under the deterministic environment, c_s^{D}. If the firm is uncertain about the tariff it will face, it must make a decision about whether to enter now and incur the sunk cost of entry or wait for a lower tariff in the future to enter. Figure 4.1 indicates a firm's preferences under different scenarios. Depending on what the current applied tariff is, denoted by τ_1, and the maximum level the tariff could increase to, denoted by τ_2, the cost cutoff under uncertainty is shifted to the left. The greater the uncertainty, the further the cutoff for exporting will move to the left. c_s^{U1} is exporting cutoff under the case with uncertainty when the applied tariff is τ_1. As shown in Figure 4.1, $c_s^{U1} < c_s^D$, therefore firms with costs between c_s^{U1} and c_s^D are no longer able to export under the uncertainty case. By reducing uncertainty, these firms will begin to export. Uncertainty is larger when the probability of shifting to τ_2 is larger. When uncertainty is larger, the cost cutoff for exporting is further shifted to the left. Based on the model, it follows then that only in industries with large sunk costs we would expect trade uncertainty to affect trade flows and the number of variety of goods produced. In low sunk costs industries, we would expect that reducing uncertainty has no effect.

4.12 Trade Policy

In order to estimate the effect of trade policy uncertainty, Handley and Limão (2017a) classify states into three different trade policies, denoted by $m = 0,1,2$, corresponding to the three types of tariffs, $\tau_0 \leq \tau_1 \leq \tau_2$, where τ_0 is the low protection tariff, τ_2 is the high protection tariff, and τ_1 denotes a temporary tariff in the intermediate state, which changes with probability γ. For example, we can consider China's pre -WTO period as the intermediate state because the United States could change China's MFN status every year with probability γ. While China enjoys permanent MFN after WTO accession, the state is in the low protection state.

4.13 Partial Equilibrium

Handley and Limão (2017a) first look at a small country, so its change in exports has no effect on the importer's aggregate variables. The relationship between the cost cutoff in the intermediate state and any deterministic baseline state with tariff τ_b satisfies:

$$c_1^U / c_b^D \;=\; U(\omega, \gamma) \;\times\; (\tau_1/\tau_b)^{\frac{-\sigma}{1-\sigma}} \tag{4.13}$$

where ω is the ratio of operating profits under the τ_2 relative to τ_1, c_1^U / c_b^D reflects the influences of trade policy changes on costs of exporting firm's entry, $(\tau_1/\tau_b)^{\frac{-\sigma}{1-\sigma}}$ reflects the effects of tariff changes, $U(\omega, \gamma)$ reflects the impact of trade policy uncertainty, entry is decreased if U is smaller than 1. One thing needs to be noted, an increase in γ is interpreted as the probability of a change in trade policy is higher, but we cannot distinguish if the change is to the low protection state with probability λ_1 or to the high protection state with probability λ_2.

4.2 The TPU-Augmented Gravity Equation

China's WTO accession brings not only more exporters thanks to the reduced trade policy uncertainty but also more investment from incumbent exporters. For instance, existing exporters are willing to pay more to upgrade technology conditions under less uncertainty. Because export growth reflects both extensive and intensive margin effects, Handley and Limão (2017a) derive a TPU-augmented gravity equation to estimate the effects of changes in trade policy uncertainty on export growth. In order to set the model as time-invariant, they use the Markov process and define the set of firms in industry V, with a similar productivity distribution G_V.

As mentioned before, the gravity model is an important model for studying factors that influence international trade; it is widely used due to its solid theoretical basis. According to Anderson and Wincoop (2003), the gravity model should add multilateral-resistance factors. Otherwise, there would be bias. Following Anderson and Wincoop (2003), Handley and Limão (2017a) add two items, policy uncertainty, and technology upgrade condition, into the gravity equation to estimate these two factors' impact. Thus, the TPU-augmented gravity equation stands thus:

$$ln\, R_{sV} = (k - \sigma + 1)\ ln\, U_{sV} - \frac{\sigma}{\sigma-1} k\, ln\, \tau_{sV} - k\, ln\, d_V + k\, ln\, P + \frac{k}{\sigma-1} ln\, E + ln\, \zeta_V + ln\, \tilde{\alpha}_V \quad (4.14)$$

where R_{sV} is export revenue of industry V, U_{sV} denotes policy uncertainty, τ_{sV} denotes the tariff level of industry V in state s, d_V denotes distance, P denotes price index, E denotes aggregate expenditure, ζ_V denotes upgrade conditions. From 4.14 expression, $U_{sV} = 1$ implies there is no policy uncertainty, analogous to a technology upgrade, $\zeta_{V=} = 1$ implies there is no upgrading so that 4.14 expression is reduced to the standard industry-level gravity equation on tariffs, distance, price index, and aggregate expenditure. To estimate the difference between pre-WTO and post-WTO, they also derive a time-difference equation,

$$\Delta\, ln\, R_V = f(\frac{\tau_{2V}}{\tau_{1V}}, \gamma) + b_\tau \Delta\, ln\, \tau_v + b_d \Delta\, ln\, D_v + b + e_V \quad (4.15)$$

where $b_\tau < 0$ is the coefficient of applied tariffs, b_d is the distance coefficient, b is any changes in expenditure or price index. Ceteris paribus, the equation predicts that if there was a probability of increase in tariffs or distance costs, the export growth rate would be lower. The standard gravity model yields a restricted version of (4.15) with $f = 0$. The authors use nonparametric and semiparametric specifications to estimate (4.15) and show the results are similar to when they used OLS with the structural measure of $\frac{\tau_{2V}}{\tau_{1V}}$.

4.3 Empirical Analysis

4.31 Effects on China

Handley and Limão (2017a) use China-US trade data between 2000 and 2005, to estimate the effect of τ_{2V}/τ_{1V} on China's export growth to the US using a nonparametric approach. Table 4.1 shows the summary statistics on the changes in export across HS-6 industries between 2000 and 2005. As Table 4.1 shows, Chinese export value averaged 1.28 log points, which implies that growth in export is more than two times during the period. At the same time, the Chinese export price index decreased by more than 10 percent. The Chinese export variety growth averaged .32 log points, that is, variety rose by 37 percentage. Moreover, there is a significant difference between high and low sunk-cost industries. The industries' high uncertainty subsample has a much greater growth rate on export value and variety and is lower on the price index. The reduction of trade policy uncertainty has a more remarkable impact on the high initial uncertainty subsample than low. Additionally, Handley et al. (2014) find that the reduction of TPU in intermediate-term production boosts Chinese total productivity growth. However, the reduction of TPU for the final product restrains Chinese total productivity growth.

Although the nonparametric method is theoretically possible with an infinitely large sample, it is difficult to use in practice because the data needs to be sliced into several dimensions. As a result, econometricians have focused on semiparametric methods. Semiparametric methods combine a parametric component with a nonparametric component, avoiding the curse of dimensionality. It is helpful to control for other determinants of dependent variables and estimate for specific terms.

The model in Handley and Limão (2017a) suggest that the parametric measure of uncertainty is $1-(\tau_2/\tau_1)^{-\sigma}$ and the tariffs coefficients b_τ and transport cost coefficients b_d satisfy $b_\tau = b_d\left(\frac{\sigma}{\sigma-1}\right)$. As explained before, σ is the constant elasticity of substitution, and it is estimated to be between 3 and 8 in the literature. Handley and Limão (2017a) use $\sigma = 3$. The coefficients estimated by OLS in Handley and Limão (2017a) using the parametric measure of uncertainty are reported in Table 4.2 below. In addition, given that $b_\tau = -4.25$, $b_d = -2.833$, this confirms that $\sigma = 3$.

The coefficient of interest is uncertainty in Table 4.2. The positive coefficient suggests that reducing uncertainty leads to an increase in Chinese export growth to the U.S. In addition, one standard deviation reduction in uncertainty (0.20) is associated with 14.7 percentage increase in Chinese export growth to the US. As predicted, the coefficients on tariffs and transport costs are negative and significant.

Table 4.1 Summary Statistics by Pre-WTO Uncertainty

	Low	High	Total
Chinese export value growth	1.16***	1.35***	1.28***
Chinese export price index growth	-.77***	-.14***	-.11***
Chinese export variety growth	.27***	.35***	0.32***
Observations	1124	2087	3211

Source: Handley and Limão (2017a) Table 1.

Notes: low uncertainty refers to bottom tercile of pre -WTO uncertainty; high uncertainty refers to high TPU industries.

Table 4.2 Dependent Variable: Chinese Export Growth 2000-2005

Uncertainty	.734***
	(.154)
Change in tariff	-4.25***
	(.677)
Change in transport cost	-2.833***
	(.451)
Sector FE	YES

Source: Handley and Limão (2017a) Table 2.

Notes: correlation effects are reported. *** indicates significance at the 1 percent level.

Table 4.3 US Imports and Chinese Exports Growth, 2000-2005

US imports from:	China		Taiwan	
Sunk cost sample:	Low	High	Low	High
Panel A: US imports growth Δln				
Uncertainty pre-WTO (US)	-.611 [.393]	1.105*** [.280]	-.593 [.414]	.0486 [.297]
Chinese exports to:	US		EU	
Sunk cost sample:	Low	High	Low	High
Panel B: China exports growth Δln				
Uncertainty pre-WTO (US)	.0363 [.313]	.816*** [.263]	.492 [.302]	-.336 [.241]

Source: Handley and Limão (2017a) Table 3.
Note: For panel A: The United States imports from China and Taiwan in 2000 and 2005 in the subset of HS-6 products. For panel B: China exports to the United States and European Union in 2000 and 2005 in the subset of HS-6 products

Panel A in Table 4.3 provides evidence for the Chinese export growth resulted from a reduction in TPU in industries with high sunk costs. There is no significant effect of reducing trade policy uncertainty on Chinese export to the US in low-sunk cost industries. However, TPU has a significant and positive effect on high-sunk cost industries, as the model predicts. As a placebo test, there is no significant effect of reducing TPU on Taiwanese export growth in either low- and high-sunk-cost industries (Columns 3 and 4). This is because, unlike China, Taiwan did not face temporary MFN status with the U.S. in the 1990s but enjoyed permanent normal trade relation with the U.S. (PNTR). Moreover, in panel B of Table 4.3, there is significant growth of Chinese exports to the United States in high-sunk cost industries and no significant effect in low-sunk cost industries. Reducing TPU between China and the U.S. also has no effect on Chinese exports to the European Union (EU).

Feng et al. (2017) estimate uncertainty and price data of China-US trade in 2000 -2006 to capture accordant conclusions to Handley and Limão (2017a): more reduction in TPU, lower Chinese export price. The most contributions of them was on export dynamic process. They are the first to point out the simultaneity of entry and exit and confirm that reduction in TPU influences resource allocation by encouraging more firms to enter, while fewer incumbents exit. They divided firms into three types: incumbents, new entrants, and exiters. They find that after the reduction in TPU, firms who exited the export market decreased by 76% while the number of new exporters increased by 67%. That because TPU reductions induce more competitive firms with higher productivity entry export market, while firms with lower productivity may not able to compare with the new export market entrants. Furthermore, TPU reductions simulate market competition because reductions encourage new exporters who charge relatively lower prices (Feng et al. 2017). They believe new exporters are more productive to produce higher quality goods and charge lower prices than exiting exporters.

Therefore, Feng et al. (2017) confirm a dramatic relocation in fine-product level due to China's WTO accession through TPU reduction. More importantly, they demonstrate lower prices and higher quality for the goods produced by new exporters. Largest effects on products experienced larger TPU reduction.

4.32 Effects on the US

Trade policy uncertainty also impacts the macroeconomic index, such as productivity, the employment rate, and public welfare. Specifically, reductions in trade policy uncertainty affects not only Chinese export but also US employment. I confirm that the elimination of the probability of sudden tariff hikes encourages Chinese producers to invest in entering or upgrading to the US markets. This phenomenon aggravates the competition between Chinese exporters and US producers in the US market. Moreover, US producers have the incentive to invest more in the China market through building factories in China or establishing relationships with Chinese producers. All the phenomena above imply that US producers are not willing to pay the same amount of money for less labor in the US than they are in China.

Pierce and Schott (2016) note that Permanent Normal Trade Relations (PNTR) in China-US trade in 2000 reduced not only TPU but also employment rate. Figure 4.2 compares annual manufacturing unemployment according to the US Bureau of Labor Statistics to Real Value Added as measured by the Bureau of Economic Analysis from 1948 to 2010. US manufacturing employment drops dramatically after 2000 while the real value added in US manufacturing gradually grows during this period, despite a slower rate in 2008. Pierce and Schott (2016) think the decline in US manufacturing employment is caused by willingness of US labor-intensive industries to hire workers that are cheaper in labor-abundant China.

Difference-in-differences (DID) is typically used to predict the effect of a particular treatment by comparing the changes in outcomes over time between the treatment group and the control group. Here, this approach removes biases in post-PNTR between the indicator and time-varying variables, NTR tariff rates and other controls from permanent differences between these groups. Thus, to test the relationship between the enactment of Permanent Normal Trade Relations (PNTR) between the United States and China, and US manufacturing employment, they apply a generalized OLS DID approach. Table 4.4 reports the results of DID regressions.

The dependent variable is the log of employment, and the independent variable is an indicator of the interaction of the NTR gap and a post-PNTR.

As indicated in Table 4.4, the results of the first row are negative and significant in all three columns, implying that the enactment of PNTR is consistent with the decrease in US manufacturing employment. The absolute numbers of these results decrease as more covariates are added. The result in the last row of column 3 represents the applied impact of PNTR as being associated with -0.151 log points of manufacturing employment. Further, the negative and statistically significant coefficient of China import tariffs indicates that a decline of Chinese import tariffs coincides with higher US manufacturing employment vice versa for positive and statistically significant coefficients.

To confirm that the lower US manufacturing employment is not because of shocks of global manufacturing employment, Pierce and Schott (2016) also compare employment in the United States to the European Union (EU) using data from 1998 to 2005. The first row of Table 4.5 indicates that PNTR is related to lower manufacturing employment in the US versus the EU. The second and third columns display DID regressions. Results in these two columns show that PNTR is related to statistically significant lower employment in the US but not in the EU. Further, they confirmed that lower US manufacturing employment after PNTR is not because of global shocks in manufacturing employment.

Table 4.4 Baseline Results (LBD)

	$\ln(Emp_{it})$	$\ln(Emp_{it})$	$\ln(Emp_{it})$
Post × NTR Gap_i	-0.714*** (0.193)	-0.601*** (0.191)	-0.469*** (0.147)
Post × $\ln(K/Emp_{i,1990})$		0.037 (0.031)	-0.016 (0.025)
Post × $\ln(NP/Emp_{i,1990})$		0.081 (0.054)	0.132*** (0.053)
Post × Contract Intensity_i			-0.181 (0.112)
Post × Δ China Import Tariffs_i			-0.244 (0.140)
Post × Δ China Subsidies_i			0.063 (0.088)
MFA Exposure_{it}			-0.342*** (0.060)
Observations	5700	5700	5700
R^2	0.98	0.98	0.99
Fixed effects	*i*, *t*	*i*, *t*	*i*, *t*
Employment weighted	Yes	Yes	Yes
Implied impact of PNTR	-0.229	-0.193	-0.151

Source: Pierce and Schott (2016) Table 1.

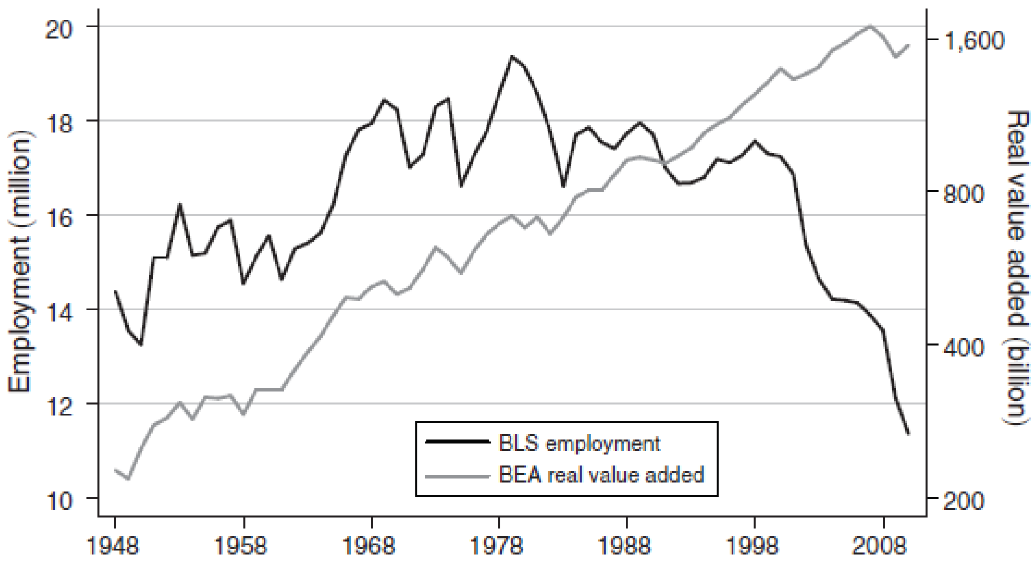
Notes: Dada from 19990 to 2007. The first column only includes the DID term and the necessarily fixed effects. The second column includes the terms of the 1st column and the initial factor intensities of industries. The third column includes the terms above, China import tariffs, China subsidies, and other covariates.

Table 4.5 Employment in the United States versus European Union (EU)

	$\ln(Emp_{it})$	$\ln(Emp_{it})$-EU	$\ln(Emp_{it}) - \text{US}$
Post × NTR Gap$_{i,1999}$ × 1	-0.641*** (-0.247)		
Post × NTR Gap$_{i,1999}$		0.016 (-0.112)	-0.649*** (-0.270)
Observations	1664	999	832
R^2	0.997	0.994	0.982
Fixed Effects	*ct, ci, it*	*i, t*	*i, t*
Employment weighted	Yes	Yes	Yes

Source: Pierce and Schott (2016)

Figure 4.2 US Manufacturing Employment versus Valued Added



Pierce and Schott (2016) Figure 3.

Chapter 5 Conclusion

A growing amount of theoretical and empirical research claims that the significance of trade policy uncertainty cannot be neglected. Early literatures suggest that one motive for signing agreements is to offer a stable trade policy environment for firms (Limão, 2016). However, this motive had not been presented until the economists, represented by Handley and Limão, bring this motive under theoretical analysis within the heterogenous firms' framework (Melitz, 2003) and confirm that TPU is an essential mechanism of the preferential trade agreement. A reduction in TPU between two countries accelerates more firm entries into export markets and more expenditure on intermediate goods from the foreign country. More importantly, the entry and exit of the firms show heterogenous characteristics: a reduction in TPU not only causes competitive firms to enter the export market but also leads to exits of uncompetitive firms. The reduction in TPU has more effects on high-sunk cost industries. This finding has contributed to formulating industrial and trade policies. Furthermore, the reduction in TPU also affects the prices and quality of products and promotes production innovation. Although academia has formed systematic theoretical research on the reduction in TPU, there are still deficiencies that need to be explored.

First, we need to make an improvement in the insufficient comprehensive measurements of TPU. In an increasingly complex international environment, the interaction among tariffs, fluctuations in the global economy and domestic policies are also becoming increasingly complex. Measuring TPU due to these three factors is crucial. Second, for now, there is little literature on an increase in TPU. Several pieces of literatures research a TPU hike just according to counterfactual introduction (Handley and Limão 2017a). We realize that understanding the effects of an increase in TPU will be more beneficial and important to face the current increasing TPU in the US.

Bibliography

Anderson, James E. and Eric van Wincoop. 2003. "Gravity with Gravitas: A Solution to the Border Puzzle." *American Economic Review* 93 (1): 170-192.

Baldwin, Richard. & Krugman, Paul R. 1989. "Persistent Trade Effects of Large Exchange Rate Shocks." *The Quarterly Journal of Economics* 104 (4): 635–654

Bergstrand, Jeffrey H. 1985. "The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence." *Review of Economics and Statistics* 67 (3): 474-481.

Bergstrand, Jeffrey H. 1989. "The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade." *Review of Economics and Statistics* 71 (1): 143-153.

Baker, Scott R., Bloom, Nicholas. & Davis, Steven J. 2016. "Measuring Economic Policy Uncertainty." *The Quarterly Journal of Economics* 131 (4): 1593–1636.

Bernanke, Ben S. 1983. "Irreversibility, Uncertainty, and Cyclical Investment." *Quarterly Journal of Economics,* Vol. 97, No. 1: 85-106.

Carballo, Jerónimo., Handley, Kyle. & Limão Nuno. (2018, March 16). *Trade cold wars and the value of agreements during crises.* Retrieved from https://voxeu.org/

Costinot, A. & Donaldson, D. 2013 *Gains from Trade and the Law of Comparative Advantage.* Retrieved from https://ocw.mit.edu/index.htm

Crowley, M., Meng, N., & Song, H. 2018. "Tariff scares: Trade policy uncertainty and foreign market entry by Chinese firms." *Journal of International Economics* 114: 96-115.

Dixit, Avinash. 1989. "Entry and Exit Decisions under Uncertainty." *Journal of Political Economy* 97 (3): 620-38

Evans, Carolyn, L. 2003. "The Economic Significance of National Border Effects." *American Economic Review* 93 (4): 1291-1312.

Feng, L., Z. Li, & D. Swenson. 2017. "Trade policy uncertainty and exports: Evidence from China's WTO accession." *Journal of International Economics* 106, (C): 20-36.

Grossman, Randi Priluck. 1998. "Developing and managing effective consumer relationships." *Journal of Product & Brand Management*, Vol. 7 Issue: 27-40.

Handley, Kyle. 2014. "Exporting under trade policy uncertainty: Theory and evidence," *Journal of International Economics*, *Elsevier*, 94 (1): 50-66.

Handley, Kyle. & Limão, Nuno. 2015. "Trade and Investment under Policy Uncertainty: Theory and Firm Evidence." *American Economic Journal: Economic Policy* 7 (4): 189-222.

Handley, Kyle. & Limão, Nuno. 2017a. "Policy Uncertainty, Trade, and Welfare: Theory and Evidence for China and the United States." *American Economic Review* 107 (9): 2731-83.

Handley, Kyle. & Limão, Nuno. 2017b. "Trade under T.R.U.M.P. policies. " *Economics and Policy in the Age of Trump*, CEPR, ed. Chad Bown, 141-152.

Head, Keith, and Ries, John. 2001. "Increasing Returns versus National Product Differentiation as an Explanation for the Pattern of U.S.-Canada Trade." *American Economic Review* 91 (4): 858-876.

Isard, Walter & Peck, Merton J. 1954. "Location Theory and International and Interregional Trade Theory." *The Quarterly Journal of Economics* 68 (1), 97–114.

Knight, Frank H. 1921. "Risk, Uncertainty and Profit." University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship.

Krugman, Paul, Maurice Obstfeld, & Marc Melitz. (2015). *International Economics: Theory and Policy*. 10^{th}.

Limão, Nuno. 2016. "Preferential Trade Agreements." NBER Working Paper No. 22138

Limão, Nuno. & Maggi, Giovanni. 2015. "Uncertainty and Trade Agreements." *American Economic Journal*: Microeconomics, 7 (4): 1-42.

Linnemann, Hans. 1966. *An Econometric Study of International Trade Flows*. Amsterdam: North-Holland.

McCallum, John. 1995. "National Borders Matter: Canada-U.S. Regional Trade Patterns." *American Economic Review* 85 (3): 615-623.

Nicita, A., Olarreaga, M. & Silva, P. (2018, April 5). *A trade war will increase average tariffs by 32 percentage points.* Retrieved from https://voxeu.org/

Pierce, Justin R., & Peter K. Schott. 2016. "The Surprisingly Swift Decline of US Manufacturing Employment." *American Economic Review* 106 (7): 1632-62.

Poyhonen, Peniti. 1963. "A Tentative Model for the Volume of Trade between Countries." *Welltwirtschaftliches Archive 90*, 93-100.

Roberts, Mark. & Tybout, James. 1997. "The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs." *American Economic Review* 87 (4): 545-64.

Samuelson, Paul A. 1939. "The Gains from International Trade. " *The Canadian Journal of Economics and Political Science / Revue Canadienne D'Economique Et De Science Politique* 5 (2): 195–205.

Sudsawasd, Sasatra & Moore, Robert Elijah. 2006. "Investment Under Trade Policy Uncertainty: An Empirical Investigation." *Review of International Economics* 14 (2): 316-329

Tinbergen, Jan. 1962. *Shaping the World Economy: Suggestions for an International Economics Policy*. New York: The Twentieth Century Fund.