Regional Variation in Trade Liberalization Outcomes: Evidence from Chinese Manufacturing Industry*

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Abstract

This paper studies the impact of import tariff reduction and its interaction with market-oriented policies on regional manufacturing output in China between 1998 and 2006. I address the concern of tariff endogeneity by exploiting the fact that tariffs of WTO members are bound by common exogenous WTO regulations. Using changes in Albania and Lithuania's tariffs as instruments for China's tariff concessions, I find that lower tariffs on final goods reduce real output while lower tariffs on intermediate inputs increase real output, and the effects are smaller in precfectures with policy zones. These results highlight the importance of local institutions and economic policies in determining the trade reform outcomes.

JEL codes: F13, F14, O14, O24
Keywords: trade liberalization, development, policy zones

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1 Introduction

Over the past few decades, many developing countries have liberalized their trade regime with the hope that globalization would lead to economic growth and welfare improvement. By removing trade barriers, countries have access to cheaper imported inputs and larger export markets, thereby, increase output. However, the empirical evidence is rather mixed. For instance, Zambia reduced its maximum tariff levels from 100% to 25% between 1985 and 1996. Yet real GDP per capita fell by 15% during the same period. Recent studies suggest that domestic institutions affect the outcomes of market liberalization (e.g. Aghion et al., 2008). Successful market reforms are often complemented with other supporting policies which facilitate the reallocation of resource towards more productive uses. On the contrary, market liberalization can be detrimental to growth with the presence of unfavorable institutions.

The aim of this paper is to examine the impact of trade liberalization on aggregate output, and in particular, how the effects vary across regions under different market regimes. I focus on China which reduced import tariffs significantly after its accession to the WTO in December 2001. Between 1998 and 2006, average tariff rates on agricultural and industrial products fell from 22% to 17.5% and 24.6% to 9.4% respectively. Also, import values grew at an average annual rate of 25%, from USD 140 billion in 1998 to USD 791 billion in 2006. I investigate importance of complementary policies on trade liberalization outcomes by exploiting the regional variation in local institutions in China due to its earlier reform policy. Since 1979, China has established more than a hundred policy zones of various types throughout the country. These policy zones adopted more market-oriented system and implemented a number of economic policies to encourage foreign investment and trade activities. With greater autonomy and integration with international markets, industries in policy zones lead the country in technology and productivity growth.

Tariff protection is endogenous due to the presence of unobservable time-varying industrial characteristics which are correlated with tariffs and regional economic performance (Trefler, 1993; 2004). China's WTO tariff concessions are also endogenous as they were negotiated between China and other WTO members such that special exemptions were granted to certain key industries.[1] I depart from the previous studies which use pre-reform tariff rates and initial

[1]Bound rates are maximum tariff rates allowed by the WTO to charge on imports from other WTO member states. They are negotiated between the new member and other WTO states before accession.

industry characteristics as instruments for future tariff changes (e.g. Trefler, 1994; 2004; Goldberg and Pavcnik, 2005; Amiti and Konings, 2007; Amiti and Davis, 2012). Instead, my instrumental variable strategy takes advantage of the fact that a country's bound tariff rates not only depend on its domestic industrial policies but also constrained by the WTO trade regulations which are exogenous. Tariff concessions of other WTO members are valid instruments for China's tariff cuts if two conditions are satisfied. First, China and these countries are bound by similar WTO rules. Second, these countries have different industrial characteristics from China. I use changes in Albania and Lithuania's tariffs as instruments for China's tariff concessions as these countries joined the WTO around the same time as China, and therefore have similar average bound rates. Also, they have different economic structure and very few trade links with China. The main advantage of my IV strategy over conventional approaches is the exogeneity assumption still holds even if domestic industry characteristics are serially correlated.

Using the Annual Surveys of Industrial Firms, I construct a balanced panel of prefecture-industries spanning the period from 1998 to 2006. The panel data includes 109 4-digit ISIC industries across 333 prefectures, among which 49 have established at least one policy zone by mid-1990s. The data is matched with 4-digit industry tariffs. The impact of tariff reduction is decomposed into two types: lower output tariffs (tariffs on imported final goods) increase the degree of import competition, and lower input tariffs (tariffs on imported intermediate inputs) reduce production costs and increase the variety of intermediate input available (Amiti and Konings, 2007). The IV results suggest that the reduction in output and input tariffs have have opposite effects on real output and the effects are smaller in prefectures with policy zones. A 0.1% fall in output tariff reduces real output by 0.29% in policy zones and 0.20% in non-policy zones, and a 0.1% decline in input tariff increases real output by 0.23% in non-policy zones but 0.12% in policy zones. The results are robust to controlling for other trade reforms and restricting the sample to coastal regions.

This paper is related to an empirical literature which examines the economic outcomes of tariff reduction. Trefler (2004) studies the impact of US-Canada Free Trade Agreement on Canadian manufacturing firms and finds that reduction in output tariffs leads to contraction of less productive firms, fall in aggregate employment and increase in industry labor productivity. At the micro-level, Amiti and Konings (2007) find that reductions in output and input tariffs increase firm's productivity and the size of effects vary with firm's trade orientation. A number of recent studies investigate the heterogeneous effects of market liberalization across regions. For example, Aghion et al. (2008) analyse how delicensing of manufacturing industry interacts with local labor market regulations in India. They find that the delicensing reform increased industrial output of states with pro-employer regulations but reduced output of states with pro-labor regulations.

The rest of the paper is organized as follows. In Section 2, I describe the background of this study. Section 3 explains the empirical strategy and Section 4 describes the data. Section 5 presents the empirical results and Section 6 concludes.

2 Background

2.1 Import Tariffs and WTO Accession

When China joined the WTO in December 2001, it committed to reduce tariffs significantly. About 98% of the products have their final bound rates implemented within 3 years of accession.[2] The degree of trade liberalization varied significantly across industries. In general, industries with higher initial trade barriers were required to make larger concessions. Table 1 reports China's average import tariffs for 2-digit ISIC manufacturing industries.[3] It shows that China's pre-WTO tariffs were higher for industries with large state interests and lower for raw materials which are relatively abundant in the country. For instance, the average industry tariffs were more than 30% for tobacco, beverages and motor vehicles but less than 15% for petroleum, chemicals and basic materials. Using a more disaggregate level of industries, Brandt et al. (2012) find that tariffs were lower for intermediate inputs and higher for industries that are more concentrated or employ more unskilled labor. Between 1998 and 2006, average tariffs on tobacco products and motor vehicles fell by more than 20% while average tariff levels of petroleum and basic materials fell by 1-3% only. Although there is a clear sign of tariff convergence, the level of tariff protection still vary considerably across sectors after five years of accession.

[2]Bound rate is the maximum MFN tariff a WTO member can charge on the imports of other member states. When countries join the WTO, they negotiate and make agreements on the bound rates rather than the applied rates. According to China's WTO Schedule of Concessions, it is required to reduce tariffs across

Table 1: Changes in China's Average Import Tariffs for 2-digit ISIC Industries

Code	Industry	1998	2001	2002	2006	Total Change
15	Food & Beverages	30.86	29.25	21.81	17.01	-13.84
16	Tobacco	65.00	57.00	48.00	38.17	-26.83
17	Textiles	25.01	20.50	16.56	10.23	-14.78
18	Apparel	32.65	24.03	21.70	16.36	-16.29
19	Leather & fur	21.43	19.63	17.38	15.77	-5.67
20	Wood	12.12	11.46	7.37	5.24	-6.88
21	Paper	15.99	14.82	9.90	5.84	-10.16
22	Printing	10.82	9.71	6.64	4.15	-6.67
23	Petroleum	6.99	6.54	6.14	6.14	-0.85
24	Chemicals	11.27	10.28	7.72	6.54	-4.73
25	Rubber & plastic	16.31	15.49	11.90	9.87	-6.44
26	Other non-metallic products	17.07	16.49	13.78	12.19	-4.89
27	Basic metals	8.27	7.34	5.56	5.12	-3.15
28	Fabricated metal	13.71	12.87	11.36	10.99	-2.71
29	Machinery & equipment	15.32	14.75	10.96	9.49	-5.82
30	Office machinery	17.29	14.38	7.81	4.03	-13.26
31	Electical machinery	15.04	14.51	10.38	8.93	-6.12
32	Radio, tv, pc & comm equip	18.17	17.12	10.73	8.84	-9.32
33	Medical, prec equip & clocks	14.58	13.55	10.29	9.32	-5.27
34	Motor vehicles & trailers	36.98	33.16	23.55	14.62	-22.36
35	Other transport equip	12.47	11.47	9.68	8.43	-4.04
36	Furniture	21.93	20.60	16.99	13.75	-8.18

Note: Tariffs are simple average of 8-digit HS product tariffs. Industry concordance is from UN Statistics Division.

2.2 Policy Zones

One of the most notable and successful market reforms in China is the establishment of policy zones. The objectives of most policy zones are to attract foreign investment and promote exports, thereby stimulate regional economic growth. To create a favorable investment climate, a relatively free and market-oriented system is adopted in these policy zones Firms have more autonomy in management, operations, employment and engagement in trade activities. Business regulations are more flexible and administrative procedures are simplified. Also, preferential treatment is offered to foreign-invested and exporting firms. For instance, the statutory corporate income tax rate for foreign-invested manufacturing firms in policy zones is 15 or 24% while the national average is 33%, and tax holidays are granted to new

ten years but major tariff cuts occurred between 2002 and 2005.

[3] Industry tariffs is the simple average of 8-digit HS product tariffs. Concordance table for HS and ISIC Rev. 3 codes is obtained from UNSTAT.

foreign-invested manufacturing firms.[4] Besides, imported materials and machinery used to produce exported products are exempted from import duties.

China's first wave of policy zones can be traced back to 1979 when four special economic zones were set up in Guangdong and Fujian Province. In 1984, fourteen coastal cities were opened to foreign investment, and in 1988, the entire Hainan Province was designated as a special economic zone. Between 1984 and 1994, thirty four national economic and technological development zones and two coastal economic zones were established. From 2000 onwards, policy zones were expanded towards inland China to take advantage of the increased export opportunities after China's accession to the WTO. By 2010, almost every provincial capital has a policy zone. The size of policy zones varies from a district in a city to an entire province. I focus on the four main types of policy zones established between 1979 and 1994. They include special economic zones (SEZ), coastal economic zones (CEZ), national economic and technological development zones (NETDZ) and open coastal cities.[5] Other policy zones established at the local level or after 2000 are regarded as non-policy zones in this study for three reasons. First, only state-level policy zones are subject to regulations and tax policies that are formally institutionalized by the Chinese government. Second, these policy zones were established well before China's entry into the WTO and therefore had a longer history of marketization than the rest of the country. This ensures sufficient variation in local institutions to examine the heterogeneous effects of trade liberalization. Third, recent waves of policy zones are likely to be endogenous to China's WTO accession and tariff concessions in 2001. Figure 1 depicts the spatial distribution of prefectures which have established at least one type of policy zones in 1979-1994.

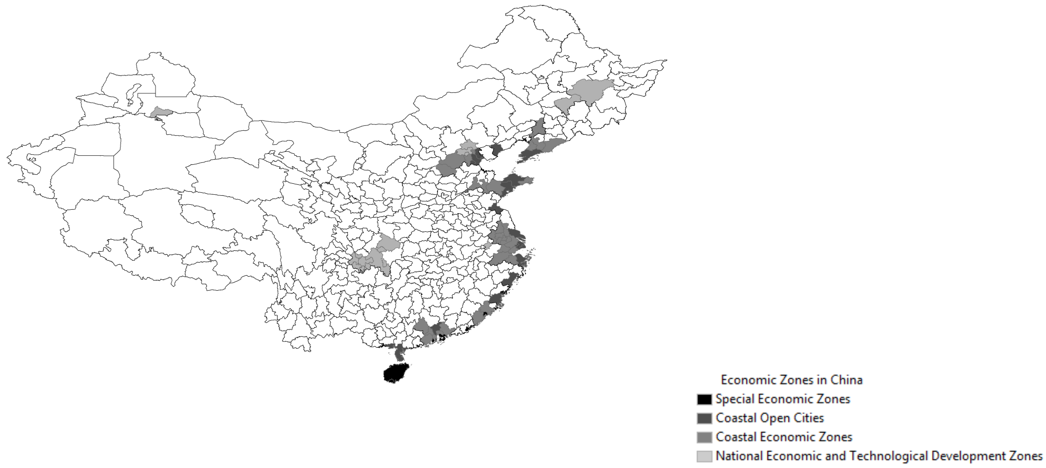
2.3 Mechanism

While previous studies find that lower output and input tariffs both increase firm productivity, they are likely to have opposite effects on aggregate output (e.g. Amiti and Konings, 2007; Yu, 2011). Suppose that domestic and imported goods are substitutes. A fall in output tariff

[4] Before 2007, domestic and foreign firms were subject to separate enterprise income tax regulations. Various tax incentives and tax holidays are granted to foreign enterprises and export-oriented firms in China. However, only foreign-invested firms in special economic zones, coastal development zones and economic and technological development zones were entitled to a lower statutory enterprise income tax rate of 15% or 24%.

[5] Other types of policy zones include high-tech development zones (HTDZ) and export processing zones (EPZ). Most HTDZ and EPZ locate in the same prefecture as the four main types of policy zones.

Figure 1: Spatial Distribution of Prefectures with Policy Zones in 1994



reduces the price of imported goods and hence the demand for domestic products. Aggregate output would decrease as loss-making firms exit the market and surviving firms reduce output. Lower input tariff reduces price and increases the variety of intermediate inputs available for firms. Then aggregate output would increase as higher industry profits attract new entrants and incumbents expand production.

The effects of tariff reduction are likely to vary across regions for two reasons. First, domestic institutions affect the extent of resource reallocation in a region following a trade shock. Regions with stronger local protectionism may impose other trade barriers to offset the negative impact of import competition. Labor markets rigidities such as trade unions or unemployment benefits increase the cost of employment adjustment and encourage labor hoarding, which lead to smaller employment effects of tariff reduction. Credit market imperfections reduce firms' ability to offset negative shocks through lending and borrowing, hence amplify the effects of tariff reduction.

Second, local institutions and economic policies affect regional firm composition and hence the effect magnitude. In China, foreign enterprises are more concentrated in policy zones to take advantage of the business-friendly environment and preferential policies. Previous studies find that foreign enterprises are more productive, larger in size more likely to engage in international trade activities than domestic firms (Ma et al., 2014; Manova and Zhang, 2009). Therefore, foreign enterprises may be less affected by the increase in import competition as they target at overseas market. Also, they may benefit more from lower inputs tariffs since they use imported inputs more intensively. However, the impact of input tariff reduction may be smaller in policy zones where foreign exporting firms have exemptions in import duties. The net impact of an input tariff cut depends on the relative magnitude of these opposing effects.

3 Empirical Strategy

3.1 Baseline Specification

The impact of tariff reduction on regional output growth is estimated by the following equation:

$$\Delta Y_{ijt} = \gamma_1 \Delta\tau^O_{it} + \gamma_2 \Delta\tau^I_{it} + \omega_{it} + \xi_{jt} + \Delta\epsilon_{ijt} \tag{3.1}$$

where Y_{ijt} is the log of real output of industry i in prefecture j in year t, τ^O_{it} and τ^I_{it} are the industry output and input tariff rates, ω_{it} is a vector of industry-specific trade shocks, ξ_{jt} is the prefecture-year fixed effect controlling for time-varying regional characteristics such as improvement in infrastructure, changes in access to markets and migration trends, and υ_{ijt} is the stochastic error term. Standard errors are clustered by industry and year. Equation (3.1) is estimated in five-year differences to allow for long-run adjustments and to eliminate time-invariant prefecture-industry characteristics that may affect real output. [6]

The differential impact of tariff reduction across regions is captured by the interactions between tariff changes and a policy zone dummy:

$$\Delta Y_{ijt} = \beta_1 \Delta\tau^O_{it} + \beta_2 \Delta\tau^I_{it} + \beta_3 \Delta\tau^O_{jt} \times PZ_j + \beta_4 \Delta\tau^I_{it} \times PZ_j + \omega_{it} + \xi_{jt} + \Delta\upsilon_{ijt} \tag{3.2}$$

where PZ_j is a dummy indicating prefecture j established one of the four types of policy zone in 1979-1994. While the unit of analysis is a prefecture-industry, most policy zones are at more disaggregated district level. Therefore, the interaction terms in equation (3.2) would provide the lower bound of the actual effects of market-oriented policies. For simplicity,

[6] Long-differences model has several advantages over fixed-effects model. First, estimating in long differences allows outcome variables to have longer time to adjust. Second, attenuation bias is less severe in long-differences model. Also, coefficient estimates are consistent even when there are serial correlations in the outcome variables. Third, it is relatively easier to find instruments for future changes in tariffs (Trefler, 2004; Goldberg and Pavcnik, 2005; Amiti and Konings, 2007; Amiti and Davis, 2012).

'policy zones' and 'prefectures with policy zones' are used interchangeably in the rest of this paper.

3.2 Tariff Endogeneity

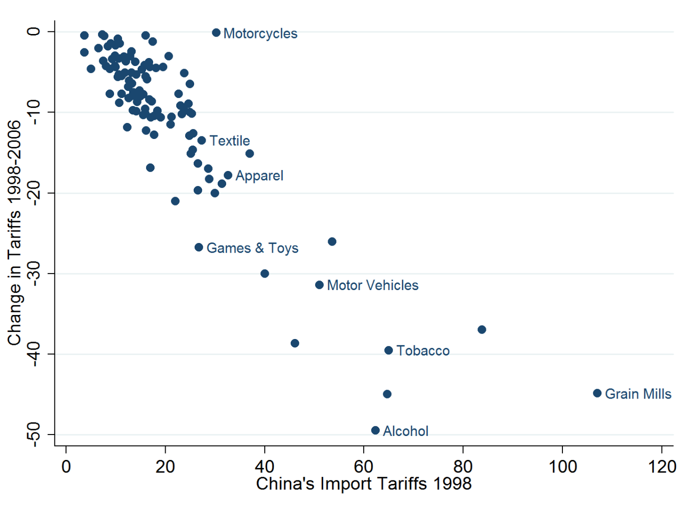
The endogeneity of trade protection is well documented in the literature. Trefler (1993) argues that trade protection is determined by two broad factors: the cost of coordinating lobbying and the interests of politicians. Industries with lower opportunity cost of lobbying and larger gains from protection tend to have greater trade protection. In China, industries are more protected if they are important sources of government revenue or crucial to national interest. Since tariffs are often correlated with political and economic factors, a number of studies use initial industry characteristics such as market concentration ratio and share of unskilled workers as instruments for trade barriers (e.g. Trefler, 2004; Amiti and Konings, 2007). Another commonly used instrument is pre-reform tariff rates. For instance, Goldberg and Pavcnik (2005) study the impact of tariff reduction on industry wage premium in Colombia. They argue that initial tariffs are strong instruments for future tariff changes since industries with higher pre-WTO tariffs face larger tariff cuts and post-WTO tariffs are exogenous.

I adopt an alternative approach to address the issue of tariff endogeneity for two reasons. First, initial industry characteristics and pre-reform tariffs are endogenous and therefore, do not satisfy the exogeneity assumption. Fast growing industries may have lower tariffs because they can compete with foreign competition. Industries may also experience higher growth rate because they are more protected. The former would lead to an upward bias of the OLS estimates while the latter would cause a downward bias of the OLS estimates. [7] Second, unlike Columbia which reduced its tariffs to a uniform rate of 13%, China's post-WTO tariff rates vary significantly across sectors. This suggests that China's WTO tariff concessions are likely to be endogeneous. Figure 2 plots the percentage change in China's import tariffs in 1998-2006 against the initial tariff levels for 4-digit ISIC. It shows that the extent of tariff reduction is unequal across sectors with similar initial tariffs. For instance, average tariffs on games and toys and motorcycles were about 35% in 1998. Yet tariffs on games and toys fell

[7] Pre-reform tariffs strongly correlated with industry characteristics. Suppose θ_{jt} are unobservable time-varying political-economic factors that are correlated with tariffs and we use initial tariffs τ_{j0} as instruments for future tariff changes. Then τ_{j0} is a good instrument if the relevance and exogeneity assumptions are satisfied i.e. $Cov(\tau_{j0}, \Delta\tau_{jt}) \neq 0$ and $Cov(\tau_{j0}, \Delta\theta_{jt}) = 0$. It can be immediately shown that two conditions cannot be satisfied simultaneously if $\tau_{jt} = f(\theta_{jt})$.

by 20% in 2006 while tariffs on motorcycles reduced by 0.5% only.

Figure 2: Changes in China's Import Tariffs Relative to Initial Levels



My instrumental variable strategy exploits the WTO principles of trading system which state that tariffs of WTO members should be reduced and bound against future increase. Suppose a country's tariff policy can be expressed by a simple econometric model:

$$\Delta\tau_{ikt} = \pi_k' \Delta\theta_{ikt} + \delta_k' (\Delta D_{kt} * \Delta WTO_{ikt}) + u_{ikt} \tag{3.3}$$

where τ_{ikt} is the tariff rate of industry i in country k at time t, θ_{ikt} is the industry-time effect, D_{kt} is a dummy indicating country k is a member of the WTO, and WTO_{ikt} is the unobservable constraint on country ks's tariffs arising from its WTO commitments. Equation (3.3) implies that tariffs of WTO member states not only depend on domestic industry characteristics but also constrained by exogenous WTO regulations. Note that equation (3.3) does not rule out the possibility that a country's WTO bound rates are endogenous. In fact, agreements on tariff commitments are reached through multilateral negotiations among WTO member states. While countries are obliged to maintain tariffs below their bound rates, special exemptions and longer transition periods are granted to developing countries taking into account their level of economic development and specific trade needs. Although WTO bound rates may be endogenous, other WTO members' tariff concessions are potential instruments for China's tariff changes if two conditions are satisfied: $Cov(\Delta WTO_{it}, \Delta WTO_{kit}) \neq 0$ and $Cov(\Delta\theta_{it}, \Delta\theta_{kit}) = 0$. The first condition requires China and country k to be subject to common exogenous WTO rules, and the second condition suggests that country k and China's industries should be uncorrelated.

Table 2: Comparison of WTO Bound Rates

Country	Date of Accession	Trade to GDP Ratio in 2010	Average Final Bound Rates		
			All	Agriculture	Non-Agriculture
China	Dec 2001	55.2	10	15.7	9.2
Group 1					
Argentina	Jan 1995	41.3	31.9	32.4	31.8
Brazil	Jan 1995	23.8	31.4	35.4	30.7
Chile	Jan 1995	74.8	25.1	26.0	25.0
India	Jan 1995	47.7	48.7	113.1	34.6
Indonesia	Jan 1995	49.5	37.1	47.1	35.5
Mexico	Jan 1995	59.2	36.1	44.2	34.9
Philippines	Jan 1995	68.2	25.7	35.0	23.4
Colombia	Apr 1995	33.2	42.8	91.4	35.4
Group 2					
Albania	Sep 2000	84.3	7.0	9.5	6.6
Armenia	Feb 2003	59.3	8.5	14.7	7.6
Croatia	Nov 2000	75.8	6.1	10.4	5.5
Georgia	Jun 2000	83.3	7.4	13.0	6.5
Jordan	Apr 2000	116.6	16.3	23.6	15.2
Lithuania	May 2001	126.5	5.0	12.3	3.9
Macedonia	Apr 2003	112.9	7.1	12.9	6.3
Moldova	Jul 2001	120.5	7.0	14.0	5.9
Oman	Nov 2000	109.0	13.7	27.6	11.6

Source: WTO Trade Profile. Bound rate is the maximum MFN tariff a WTO member can charge on the imports of other member states.

Table 2 presents the average final bound rates of China and another 17 countries with their date of accession. The first group of countries joined the WTO in the 1995 and the second group joined the WTO around the same time as China. In general, tariff bound rates tend to lower for late joiners as the WTO regulations become more stringent over time. Although the first group of countries are more comparable to China in terms of economic size or level of economic development, their average bound rates are much higher than China's (above 25%). This suggests that the 1995 WTO regulations were obsolete during China's accession negotiations. In contrast, the average bound rates of the second group are similar to China's.

Among the second group of countries, I use the changes in Albania and Lithuania's tariffs as my instruments for China's tariff concessions as they have the strongest first stage results. This is partly due to the large differences between their initial tariffs and WTO bound rates, which help to ensure sufficient instrument variation. Moreover, Albania and Lithuania's tariff concessions are likely to satisfy the exclusion restriction. First, they have very little trade linkages with China. In 2014, China accounts for less than 10% of Albania's total trade value and less than 3% of Lithuania's imports. Second, their economic structures are different from China. For instance, the employment shares of industrial sector in China, Albania and Lithuania are 28.7%, 12.8% and 19.6% respectively. As these countries have little trade connections and distinct economic structures, their tariffs are unlikely to be correlated with the China's industry characteristics.

4 Data

This paper uses data from the 1998-2006 Annual Surveys of Industrial Firms. The firm surveys include all state-owned enterprises and non-state owned enterprises with sales over 5 million RMB. Firms report their zip codes, 4-digit CIC codes, ownership, export status and more than 60 financial variables from their balance sheets and profit statements.[8] I exclude non-manufacturing firms and industries that report no tariff or import data (e.g. finishing of textiles).[9] The CIC codes are matched with 4-digit ISIC codes using the official Chinese concordance. The firm data is aggregated to create a 9-year panel of prefecture-industries at 4-digit ISIC-level. Firm output is deflated using the 4-digit CIC output price deflator constructed by Brandt et al. (2012) before aggregating to 4-digit ISIC level.

Tariff and import data are from the World Integrated Trade Solution (WITS) and UN Comtrade, and the breakdown of industry input cost shares is from the 2002 Chinese Input-Output Table. China's industry output and input tariffs are constructed according to the standard approach in the literature (e.g. Amiti and Konings, 2007; Goldberg et al., 2010). Output tariffs are the average HS6 tariffs weighted by the product import shares in 1998, and input tariffs are the average output tariffs of non-consumption goods weighted by their industry cost shares.[10] Output tariffs are measured at 4-digit ISIC (108 industries) and input

[8]Firms report 4-digit industry code based on the 1996 and 2002 Chinese Industrial Classification (410 industries). I use the concordance table developed by Brandt et al. (2012) to match firm's CIC code across time.

[9]The Annual Surveys of Industrial Firms include non-manufacturing firms in mining, construction and public utilities.

[10]According to the Broad Economic Classification (BEDC), HS6 products are classified as intermediate goods, capital goods and consumption good. Non-consumption goods include intermediate goods and capital goods which may be used as intermediate inputs in production.

tariffs are computed at 3 to 4-digit ISIC (69 industries) due to the higher level of aggregation in China's Input-Output Table. Details of the computation of output and input tariffs are summarized in Appendix A.1. Albania and Lithuania's industry output tariffs are the simple average of HS6 tariffs, and input tariffs are the average output tariffs of non-consumption goods weighted by China's industry cost shares. As Albania and Lithuania only report one year of pre-WTO tariffs, I assume that their tariffs remained at the same level until they joined the WTO. The two countries' post-WTO tariffs are the WTO bound rates reported in their schedule of concessions.[11] The computed output and input tariffs are then matched and aligned with China's tariffs such that countries begin to implement tariff concessions in the same year.

Table 3: Descriptive Statistics

	1998		2006	
	Mean	Std. Dev.	Mean	Std. Dev.
Prefectures without Policy Zones				
Log Real Output	11.23	1.63	12.69	1.88
Export-Sale Ratio	0.09	0.27	0.09	0.19
Foreign Share of Output	0.08	0.31	0.14	0.26
Output Tariff	0.21	0.15	0.11	0.10
Input Tariff	0.16	0.12	0.07	0.04
Prefectures with Policy Zones				
Log Real Output	12.24	1.72	13.80	1.87
Export-Sale Ratio	0.20	0.20	0.20	0.26
Foreign Share of Output	0.21	0.21	0.31	0.32
Output Tariff	0.20	0.18	0.10	0.09
Input Tariff	0.15	0.13	0.07	0.04
Observations	13,218		13,218	

Notes: Each observation is a four-digit ISIC industry-prefecture pair. Log real output, export-sale ratio and foreign share of output are from 1998-2006 ASIF. Output tariff and input tariff are at 3 to 4-digit ISIC. Policy zones refer to SEZ, CEZ, NETDZ and open coastal cities established between 1979 and 1994.

The final sample is a balanced panel of 4-digit ISIC industries in 333 prefectures, 49 of them have established at least one policy zone in 1979-1994. The full list of policy zones is from Wang (2013). The number of prefectures per industry-year ranges from 15 to 333. Table 3 summaries the data. It shows that prefectures with policy zones have higher real

[11] Using tariffs of countries other than Albania and Lithuania do not improve the performance of my instruments as pre-WTO tariffs are available for only one year for most countries. Pre-WTO tariff data can be downloaded from WITS for the following country-year pairs: Albania 1997; Armenia 2001; Georgia 1999; Lithuania 1997; Macedonia 2001; Moldova 1996, 2000; Taiwan 1996, 1999-2001.

output, export-sales ratio and foreign share of output. Average output and input tariffs are similar across both types of prefectures and decrease over time.

5 Empirical Results

5.1 Baseline Results

Table 4 presents the estimation results of equations (3.1) and (3.2) without controlling for other industry-level trade shocks. The OLS estimates in column 1 show that tariff reduction has large and significant impact on real output. A 0.1% decline in output tariff reduces real output by 0.14% and a 0.1% fall in input tariff increases real output by 0.15% on average. Column 2 shows that the effects of tariff reduction vary significantly across regions. A 0.1% decline in output tariff reduces real output by 0.15% in non-policy zones but only 0.04% in policy zones. The estimated coefficients for input tariffs have similar magnitude but opposite signs. This suggests that tariff reduction has a much smaller impact on prefectures with more market-oriented economy.

Table 4: Tariffs and Real Output, 1998-2006

	Dependent Variable: Δ Log Real Output			
	OLS		2SLS	
	(1)	(2)	(3)	(4)
Δ Output Tariff	0.141***	0.150***	0.274***	0.287***
	(0.0475)	(0.0655)	(0.0757)	(0.0675)
Δ Input Tariff	-0.146***	-0.155**	-0.206***	-0.227***
	(0.0566)	(0.0771)	(0.0704)	(0.0627)
Δ Output Tariff × Policy Zone		-0.092***		-0.067*
		(0.0136)		(0.040)
Δ Input Tariff × Policy Zone		0.117***		0.105**
		(0.0149)		(0.0509)
Prefecture × Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	52,872	52,872	52,872	52,872
F-statistic			18.32	14.59
p-value			0.61	0.59

Notes: All variables are in five-year differences. Constant not reported. F-statistic is the Kleibergen-Paap rk Wald F statistic for non i.i.d. errors. Hansen J statistic p-value tests for overidentifying restrictions. Robust standard errors in parentheses are clustered by industry and year. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Columns 3 and 4 report the second-stage results where China's tariff concessions are instrumented by Albania and Lithuanias tariff changes. The F-statistics are well above 10

Table 5: First Stage: Correlations Between China, Albania and Lithuania's Industry Tariffs

	(1) Δ Output Tariff	(2) Δ Input Tariff	(3) Δ Output Tariff × Policy Zone	(4) Δ Input Tariff × Policy Zone
Δ ALB Output Tariff	0.279**	0.0955	0.0524*	0.0166
	(0.129)	(0.174)	(0.0311)	(0.0373)
Δ ALB Input Tariff	0.517	0.143*	0.0462	0.0307*
	(0.610)	(0.0808)	(0.131)	(0.0183)
Δ LTN Output Tariff	0.538***	0.298***	0.00456**	0.00138
	(0.0431)	(0.0477)	(0.00218)	(0.00314)
Δ LTN Input Tariff	0.257***	0.466***	0.00141	0.00294**
	(0.0543)	(0.0346)	(0.0193)	(0.0112)
Δ LTN Output Tariff × Policy Zone			0.539***	0.317***
			(0.0361)	(0.0399)
Δ LTN Input Tariff × Policy Zone			0.120**	0.209***
			(0.0507)	(0.0601)
Prefecture × Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	52,809	52,809	52,809	52,809
R-squared	0.256	0.215	0.234	0.181

Notes: All variables are in five-year differences. ALB and LTN denote Albania and Lithuania respectively. Constant not reported. Robust standard errors in parentheses are clustered by industry and year. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

and the p-values of Hansen J-statistic are around 0.6, which suggest that the instruments strong and are orthogonal to China's real output. The first-stage results in Table 5 also show that Albania and Lithuania's tariffs are strongly correlated with China's tariffs. Interactions between Lithuania's tariff concessions and a policy zone dummy are included as additional instruments for the interaction terms in equation (3.2).[12] The IV results in Table 4 suggest a larger impact of tariff reduction than the OLS estimates. In column 3, a 0.1% decrease in output tariff reduces real output by 0.27% and a 0.1% decline in input tariff increases real output by 0.21%. The estimates are significant at 1% level. The results in columns 1 and 3 show that the OLS estimates are biased downwards for output tariffs and biased upwards for input tariffs. This suggests that fast-growing industries face larger output tariff cuts and smaller input tariffs reduction. As with the OLS results, the IV estimates also show that impact of tariff reduction is smaller in policy zones. In column 4, a 0.1% decline in output tariff reduces real output by 0.29% in non-policy zones and 0.20% in policy zones, and a 0.1% reduction in input tariffs increases real output by 0.23% in non-policy zones and 0.12% in policy zones.

[12]Interactions between changes in Albania's tariffs and a policy zone dummy are excluded in columns 3 and 4 of Table 5 as they reduce the F-statistics in Table 4.

5.2 Robustness Checks

China's WTO accession package involved a wide range of trade reforms, therefore one may suspect that the results in Table 5 are driven by other trade liberalization policies. Apart from tariff concessions, China was required to remove most quotas, licensing and other quantitative restrictions on its import within two years of accession. Yet China may substitute non-tariff barriers for tariffs as instruments to reduce import penetration and this would bias the tariff estimates downwards. To control for non-tariff barriers, I include an industry dummy which equals to one if any HS8 product is subject to non-tariff barriers. Another concern is changes in tariffs imposed on Chinese exports. Chinas MFN status was made permanent after its accession which guarantees that other WTO members cannot raise their tariffs on Chinese exports above the MFN rates on non-Chinese exports. Lower export tariffs may increase real output by reducing export prices and hence increase demand for Chinese products in international markets. I control for Chinas export tariff changes by including a variable which measures the average changes of HS6 applied rate of 149 countries at 4-digit ISIC. Details of the computation of industry export tariffs are explained in Appendix A.2. Table 7 shows that the tariff estimates are robust after controlling for non-tariff barriers and export tariffs. Reductions in output and input tariffs have opposite effects on real output, and the impact is smaller in policy zones. The IV estimates in columns 3 and 4 suggest that removal of non-tariff barriers reduce real output by 0.1%, and a 0.1% decrease in export tariff increases real output by 0.6%.

An important global trade development occurred in the last decade is the expiration of Agreement on Textiles and Clothing (ATC) in January 2005 which removed quotas imposed on developing country exports of textiles and clothing. This resulted in a huge surge in textiles and clothing exports from China to the West from 2005 onwards (Brambilla et al., 2010). As China's initial tariffs on textiles and clothing imports are lower than other products, the end of ATC may lead to an upward bias in the effects of tariff reduction. For the sake of brevity, columns 1 and 2 of Table 7 only present IV results after dropping all textile and clothing industries at 4-digit ISIC. The IV estimates in columns 3 and 4 are smaller than the full sample results, which is consistent with the fact that real output growth for textiles and clothing increased significantly after 2005. Although the IV estimates are smaller, they are still strong and significant.

Table 6: Tariffs and Real Output: With Trade Policy Controls

	Dependent Variable: Δ Log Real Output			
	OLS		2SLS	
	(1)	(2)	(3)	(4)
Δ Output Tariff	0.176***	0.184***	0.307***	0.320***
	(0.0583)	(0.0662)	(0.0772)	(0.0787)
Δ Input Tariff	0.113**	-0.125*	-0.218***	-0.241***
	(0.0575)	(0.0777)	(0.0713)	(0.0735)
Δ Output Tariff × Policy Zone		-0.092***		-0.075*
		(0.0356)		(0.0400)
Δ Input Tariff × Policy Zone		0.126***		0.121**
		(0.0450)		(0.0506)
Δ Export Tariff	-0.106	-0.101	-0.604***	-0.591***
	(0.0856)	(0.0859)	(0.217)	(0.216)
Non-Tariff Barrier	-0.0365***	-0.0358***	-0.104*	-0.102*
	(0.0117)	(0.0126)	(0.0591)	(0.0592)
Prefecture × Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	52,872	52,872	52,872	52,872
F-statistic			18.16	15.10
p-value			0.412	0.416

Notes: All variables are in five-year differences. Constant not reported. F-statistic is the Kleibergen-Paap rk Wald F statistic for non i.i.d. errors. Hansen J-statistic p-value tests for overidentifying restrictions. Robust standard errors in parentheses are clustered by industry and year. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

As mentioned in section 3, the first three waves of policy zones are concentrated in the coastal regions which have proximity to foreign markets and port terminals. With larger market size and lower transport costs, industries in coastal regions may have higher profit margins than their inland counterparts. This allows them maintain more internal capital to smooth production in response to demand shocks. To examine the role of geographical factors, I re-estimate equations (3.1) and (3.2) for prefectures in eastern provinces only. The subsample consists of 100 prefectures in in Beijing, Tianjin, Liaoning, Shanghai, Hebei, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan. If the heterogeneous effects in tariff reduction are driven by geographical factors, the estimated coefficients for non-policy zones should be significantly different from the baseline results in Table 6. The IV results are presented in columns 3 and 4 of table 7. Tariff reduction has larger effects in the eastern provinces but the estimates are not significantly different from the full sample results. This suggests that geographical location amplifies the effects of trade liberalization but their role is rather limited.

Table 7: Robustness Checks: 2SLS Estimates

	Dependent Variable: Δ Log Real Output			
	Excluding Textiles and Clothing		Eastern Provinces	
	(1)	(2)	(3)	(4)
Δ Output Tariff	0.249***	0.255***	0.339***	0.427***
	(0.0855)	(0.0869)	(0.0967)	(0.135)
Δ Input Tariff	-0.123***	-0.136***	-0.207**	-0.305***
	(0.0472)	(0.0491)	(0.0827)	(0.103)
Δ Output Tariff × Policy Zone		-0.0379*		-0.209**
		(0.0224)		(0.092)
Δ Input Tariff × Policy Zone		0.0675**		0.233***
		(0.0367)		(0.0830)
Δ Export Tariff	0.119*	0.118*	0.146**	0.142*
	(0.0701)	(0.0601)	(0.0642)	(0.0742)
Non-Tariff Barrier	-0.485**	-0.477**	-0.716**	-0.887**
	(0.238)	(0.206)	(0.310)	(0.410)
Prefecture × Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	36,588	36,588	18,844	18,844
F-statistic	18.06	14.43	16.24	13.76
p-value	0.501	0.495	0.253	0.274

Notes: All variables are in five-year differences. Constant not reported. F-statistic is the Kleibergen-Paap rk Wald F statistic for non i.i.d. errors. Hansen J-statistic p-value tests for overidentifying restrictions. Robust standard errors in parentheses are clustered by industry and year. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

5.3 Firm Composition

A notable feature of China's policy zones is the high concentration of foreign enterprises. Manova and Zhang (2009) find that foreign enterprises in China trade more and have significantly higher survival rate than domestic firms. As foreign enterprises are more likely to export their products and receive preferential treatment to import intermediate inputs, the impact of tariff reduction tend to be smaller in policy zones. One may suspect that the heterogeneous effects of tariff reduction are simply due to regional differences in firm composition. To examine the relative importance of institutions and firm composition in explaining the results, I include the interactions between tariff concessions and the initial share of real output produced by foreign enterprises in a prefecture in the regressions. Foreign firms include foreign-owned enterprises, Sino-foreign joint ventures and hybrid firms with more than 50% foreign share in equity. The new interactions terms are instrumented with the interactions between Lithuania's tariff concessions and the initial foreign share of real output in a prefecture. If the heterogeneous effects are driven by the spatial distribution of foreign enterprises, one would expect the interactions of policy zone to be insignificant. Table 8 shows that the main results on policy zone remain intact.

Table 8: Tariffs and Real Output: Control for Foreign Share of Output

	Dependent Variable: Δ Log Real Output	
	OLS	2SLS
	(1)	(2)
Δ Output Tariff	0.145***	0.303***
	(0.0641)	(0.0714)
Δ Input Tariff	-0.126*	-0.236***
	(0.0767)	(0.0965)
Δ Output Tariff × Policy Zone	-0.0831***	-0.106*
	(0.015)	(0.0592)
Δ Input Tariff × Policy Zone	0.098***	0.123**
	-0.0164	(0.0544)
Δ Output Tariff × Share of Foreign Output	0.255	0.218
	(0.186)	(0.140)
Δ Input Tariff × Share of Foreign Output	-0.192	-0.221
	(0.127)	(0.135)
Δ Export Tariff	-0.0986	-0.583***
	(0.0716)	(0.213)
Non-Tariff Barrier	-0.0355	-0.102*
	(0.0246)	(0.0589)
Prefecture × Year Fixed Effects	Yes	Yes
Observations	52,872	52,872
F-statistic		12.65
p-value		0.194

Notes: All variables are in five-year differences. Constant not reported. F-statistic is the Kleibergen-Paap rk Wald F statistic for non i.i.d. errors. Hansen J-statistic p-value tests for overidentifying restrictions. Robust standard errors in parentheses are clustered by industry and year. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

6 Conclusion

This paper studies the impact of trade liberalization on regional manufacturing in China and how this impact varies across regions with different economic policies. After joining the WTO in December 2001, China was required to reduce tariffs significantly. While industries benefit from cheaper imported inputs, some face tougher import competition. I argue that the conventional instrument variable strategies are likely to fail the exogeneity assumption as the instruments are often correlated with industry characteristics which are serially correlated. I address this concern by exploiting the exogeneity of WTO regulations applied to the WTO member states. I use Albania and Lithuanias WTO tariff concessions as instruments for

China's tariff reduction. The IV estimates show that the lower and input tariffs have opposite effects on real output, and the impact is smaller in policy zones. The results are robust controlling for other trade policies, regions and foreign ownership. This suggest that local institutions and economic policies affect the outcomes of trade liberalization. Countries which experienced economic loss due to increased foreign competition might lack policies to protect domestic firms during the initial period of opening or have insufficient incentives to encourage the development of new capacity. How specific policies affect other regional outcomes of trade reform is left for future research.

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A Appendix

A.1 Import Tariffs

China's tariff and import data can be downloaded from World Integrated Trade Solution (WITS) and UN Comtrade at 8-digit and 6-digit HS product level respectively. The revision of HS classification in 2002 imposes difficulties in computing a consistent measure of industry-level tariffs. Using 6-digit HS concordance table published by the United Nations Statistics Division, only 76% of 8-digit HS product codes can be matched one-to-one between the 1996 and 2002. Some of the remaining 24% products are divided into multiple products under the 2002 HS classification. Therefore, we will incorrectly attribute more weights to those products after 2002 if we take simple averages of the 2002 8-digit HS to 6-digit HS. I tackle this problem by exploiting the fact that China's WTO bound rates were set before China's accession to the WTO; hence, they are reported in 1996 8-digit HS codes. Since China's applied rates follow its bound rates very closely, I replace its post-2001 tariff rates with the WTO bound rates for products that cannot be matched 1 to 1. The correlation between China's WTO bound rates and applied rates for products that are matched one-to-one is 0.998, which implies that China's WTO bound rates is a good proxy for its applied rates after 2001.

A.2 Export Tariffs

The World Integrated Trade Solution (WITS) has tariff data on 149 China's trading partners. Each country's tariffs are obtained at 6-digit HS level and converted to HS 1996 6-digit classification using the concordance table provided by the United Nations Statistics Division (UNSD). While complete data is available for China's major trading partners such as EU, US, Japan and South Korea, less than 10% of the remaining countries report tariffs every year between 1998 and 2006. I replace missing observations based on the following assumptions: First, tariffs are assumed to be the same between 1998 and the first year of reporting if the first year of data available is after 1998. Second, tariffs are also assumed to be the same between the last year of reporting and 2006 if the last year of data available is before 2006. Third, tariffs missing between any two years are assumed to change in equal installments. After replacing the missing values, I aggregate the imputed tariff rates to 4-digit ISIC using China's country-export shares as weights. One may worry that this measure tends to smooth tariff changes across years and won't capture any sharp decline in China's export tariffs in 2002. Figure 3 plots the average tariff rates on Chinese imports and exports for manufacturing products in 1998-2006. It shows that import tariffs fell by an average of 8% while export tariffs reduced by less than 3%. This is due to the fact that China was granted preferential tariff treatment well before its accession to the WTO. US granted normal trade relations status to China on an annually-renewable basis since 1980. Other major trading partners such as Canada, EU and Japan also imposed lower tariffs on Chinese exports through the Generalized System of Preferences (GSP) in the 1980s. The GSP was designed to give developing countries which were non-GATT/WTO members better access to markets of developed countries. The GSP exempts WTO members from the MFN for the purpose of lowering tariffs for developing countries. The preferential rates under GSP are even lower than the MFN rates for some products. Since the total changes in tariff rates between 1998 and 2006 are quite small, my measure of export tariffs should not introduce large bias in my estimation.

Figure 3: China's Average Import and Export Tariffs for Manufacturing Goods