

The Impact of the World Trade Organization: Evidence From China

May 7, 2018

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Abstract

Since David Ricardo developed his theory of comparative advantage, it is a staple of elementary Economics that free trade between countries leads to all parties benefiting. General support for international trade has over time developed into the creation of organizations such as the General Agreement on Tariffs and Trade (GATT) and its successor World Trade Organization (WTO), which were created to encourage trade between partner countries. While there have been a multitude of economic studies about the value of such organizations, there is limited research about how they impact developing economies. As China joined the WTO in 2001, looking at how various industries and firms were differentially impacted by the WTO allows us to identify the winners of increased integration into the global economy. This paper will analyze the relevance of capital-intensiveness in how Chinese firms responded to the WTO. Using an immense database of firm level data in China, I determine that capital-intensive companies benefitted more from the WTO than their peers that depended on labor. More importantly, I call into question the prevailing belief in Western economic literature that labor intensive firms in China benefitted the most from greater global trade.

Keywords: China, WTO, Capital

Acknowledgements: I would like to thank my advisor, Pete Klenow, for his invaluable guidance and expertise. I came to him with a blank canvas and together we developed a beautiful work of art. I would also like to thank Marcelo Clerici-Arias for his unwavering support throughout this project. His confidence in me made writing a thesis turn from an abstract idea to a goal within reach. Lastly, I owe my family and friends for their unconditional love. Your adoration means more to me than you'll ever know.

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1. Introduction

Before the reforms of Deng Xiaoping in the 1980s, China was an untapped market. A nation with immense cultural and historical acclaim, China looked inwards for development. In the 1980s Deng Xiaoping began opening up China to the rest of the world. He described his policy as “crossing the river by feeling the stones” – progressively opening up to capitalism and free trade, but one step at a time.

Joining the global economy was not an easy task for the Middle Kingdom. A host of sociopolitical problems including foreign exchange deficits, SOE inefficiency, and even threats to the Chinese Communist Party were barriers along China’s road to joining the global economic order. However, overtime China stayed on a path to becoming increasingly open to the outside economy.

In 1986, China began lobbying to be in the World Trade Organization (WTO). It clearly was a key component in their effort to reach the forefront of global economics. In December 2001, China became the 143rd member of the organization. On the eve of being admitted, President Hu Jintao said, “China’s accession to the WTO is a milestone in China’s reform and opening up, bringing us into a new era to further open up”. After joining the WTO, China’s GDP grew exponentially from around \$1 Trillion to almost \$4.25 Trillion in 2010 (China). This was a massive step for an economy like China’s, which was subject to a multitude of anti-trade laws and still needed to liberalize much of their economy. China’s dependence on State-Owned Enterprises (SOEs), tariffs, and manipulation of their currency all prevented it from truly being an economy free from trade restrictions. Joining the WTO was an explicit agreement by China to take a step towards joining the greater market economy.

My analysis takes a macro approach to identifying how China was impacted by the WTO, and I hope it will show how openness to globalization can impact developing countries and highlight which markets within emerging economies are most affected by an increase in international trade. Moreover, it can illustrate the relevance of the WTO and if it is an essential organization for economic growth.

My hypothesis is that labor intensive firms in China benefitted more from the WTO than capital-intensive companies, due to cheap labor being a competitive advantage for China in 2001. With access to greater exporting coupled with the lack of foreign competition, I believe that labor intensive firms had more to gain. In addition to looking at the relevance of labor against capital, I will also analyze how heterogeneity in geography, policy, and other factors influenced how the WTO impacted firms.

While I am trying to identify the WTO's influence on the growth of specific firms, there are some confounding arguments that can be made. One could argue that China was already on a path of growth before 2001, so perhaps the WTO was just a continuation of this pattern. I will address this argument by evaluating data before China joined the WTO and then comparing that with information from after to identify changes post policy. Furthermore, my analysis will control for year and industry fixed effects to account for the ongoing fluctuations in the economy. Similarly, it can be said that China's growth was the product of policies of globalization that would have happened regardless of the WTO. This is simply untrue. The WTO connected China to the global economy and granted it Most Favored Nation (MFN) treatment in many countries, which greatly increased its ability to export (Feng 2016). Lastly, there is skepticism on the overall amount of trade liberalization that China actually undertook post WTO entry, and that could be responsible for variations in industry growth. While this could be true, it

should be reflected in my analysis. If there is little change in the growth of certain firms I will look at if it was due to either a lack of change in policy in that region, or a lack of an impact to global exposure.

Literature Review

Most of the literature surrounding China's entry into the WTO focuses on its impact on other countries in the organization. Autor discusses how China's rising import competition from 1990-2007 has led to a drastic decrease in employment in American labor intensive markets. Specifically in manufacturing, there was a massive fall off in American employment (Autor 2013). However, his paper focuses on the impact of Chinese exports on America and does not put too much emphasis on the impact of the WTO. By the same token, Yang looks at how China's entry into the World Trade Organization would affect its trading partners. Through looking at historical data on how changes in China's openness towards globalization has impacted other nations, he ultimately predicts that China's partners will have adjustment costs in the short to medium term, but there are massive benefits to be made from China joining the WTO in the long run (Yang 2006). Yet again, such literature neglects to focus on the impact on China.

In terms of research focusing on effects of the WTO on the Chinese market, a tremendous amount of the literature is focused on policy. Whalley discusses the difficulties of China's liberalization of service industries and his skepticism of the completion of the policies outlined in the WTO. This tangentially relates to my thesis in terms of analyzing changes in growth in different sectors, but his paper is more speculative since it was published in 2003 (Whalley 2003). In a paper with Antkiewicz, Whalley similarly discusses the potential impact of other trade agreements made by China after the WTO, but yet again this is more speculative than

empirical. However, it is valuable to understand how other trade agreements can differentially affect certain industries, such as technology and construction (Antkiewicz 2004).

Later papers that look at Chinese enforcement of WTO laws seem to be more substantive. Harris discusses China's failure to enforce its intellectual property agreements and how such failures have led to the United States filing WTO complaints against China (Harris 2008). While this paper primarily focuses on law, it reflects how China has neglected to enforce some of its agreements, and brings into question how much the WTO actually changed domestic Chinese policy.

Focusing more on economics, there is relative uncertainty as to how the WTO changed the economy. Anderson projected that rural agricultural based economies would be negatively impacted by China entering to the WTO as a result of increased global competition. While rural non-farm incomes would rise due to an increase in demand for unskilled labor in rural areas in industries such as textiles and clothing. With this said, her model predicts that overall urban and rural income disparities will fall as a result of China's ascension to the global economy.

(Anderson 2004). Harwit also makes predictions on the impact of the WTO, but focuses solely on the changes that will take place in the automotive industry. He states that the automotive industry has been the victim of superfluous protection and as a result is very inefficient. His analysis shows that if the Chinese liberalize their economy as they are supposed to, the automobile industry will not be able to compete with foreign technology (Harwit 2001). While some authors are rather negative in their predictions of the influence of the WTO, Fan predicted in her PRC-GEM (People's Republic of China-Global Environmental Multiscale) model that the WTO would positively impact the economy and lead to an increase in efficiency (Fan 2001). However, her model is rather broad and vague, and hinges on a multitude of assumptions. It is a

predictive model, rather than an empirical analysis, and thus distinct from the research I am trying to conduct. Shantong Li's model, created in 2000, additionally predicted that labor intensive firms would succeed, while capital-intensive firms would fail (Li 2000).

Both Brambilla et. al, and Huang et. al, focus on the impact of the WTO on textiles and agriculture respectively and have waited long enough to see an impact of the change in policy. Both their findings show an explosion in these industries post 2001, however, they neglect to do the industry by industry analysis that I propose (Brambilla 2010; Huang 2008). Brambilla utilizes an OLS regression to determine the change that took place of the WTO in agriculture production on a set of countries and regions, and ultimately shows how China changed more than its peer set. While her analysis is somewhat applicable to mine, her variables of choice are very agriculture specific. However, her usage of dummy variables to indicate if a country is bound by quota productions or unbound, is most certainly beneficial to my analysis.

More generally, over the past two decades there have been notable trends in academic research shifting away from trade policy towards other various restrictions to trade. As the world progressively liberalizes, the marginal benefit to increasing trade diminishes. Harvard Economist Lant Pritchett articulated this in 2008:

“Relative to when I started working as a trade economist in the early 1980s, the world is completely liberalized. So the incremental gains from anything that could happen as a result of WTO negotiations are just infinitesimal”

However, P.K. Goldberg et.al addresses that a multitude of areas within trade policy have yet to be researched. The bulk of analysis focuses on strictly tariffs, yet does not address other barriers. Analyzing the WTO as a shock to China's economy while still controlling for tariffs will allow me to more properly identify the impacts of other aspects of WTO policy, such as China's MFN

treatment and restrictions to non-tariff barriers (Goldberg 2016). Keyu Jin bolsters P.K. Goldberg's point by constructing a theoretical model proving that an increase in trade liberalization leads to a rise in asset prices in emerging markets due to its positive impact on wages and aggregate saving (Jin 2012). However, her model lacks the empirical nature of the analysis that I am conducting. The most similar analysis to mine is that of Handley and Limao (2016). They show that the WTO had a positive impact for China's exporting to the U.S. due to the establishment of trade policy certainty. China already had Most Favored Nation (MFN) treatment from the U.S. before the WTO, but the change in policy established certainty that the friendly treatment would remain. This certainty spurred investment and growth. While relatively similar to mine, they focus solely on China's relationship with America – not its overall economy. After conducting a review of the literature in this field, I firmly believe that my research topic is original and will add great value to the understanding of how the WTO differently impacted industries in China.

2. Data

The data set I will be focusing on contains firm level information from the Chinese Manufacturing Enterprise Database. Analyzing changes at the company level allows for determining if there were any common changes that happened across multiple companies after 2001. The data contains information about a plethora of companies that had over 500,000 RMB (roughly \$80,000) in sales a year from 1998-2005. Each company reports a range of standard financial and operational information. The data is from a Chinese Manufacturing Enterprise database, but additionally has information about firms in a multitude of other sectors. While there may be skepticism as to how reliable the firm data is, considering it is a firm instead of a government agency reporting the data it can be inferred that the information is trustworthy.

Looking at firm performance from 1998-2005 is ideal because exogenous shocks such as the 2008 financial crisis are removed. The reported items of interest pertinent to my research are Revenue, Spending on Materials, Province, Sector, Tariffs, Firm Size, Capital Stock, Depreciation, and Ownership. Additionally, the Year and WTO variables present in my industry level analysis will similarly be used for analyzing firm level information.

I will first begin with describing the creation of my outcome variables. While examining firms it is essential that the accounting data is converted into economic values. Spending on materials for a firm in year t will be estimated as following:

$$(2.2.1) P_M \mu_t = \text{Revenue}_t - \text{Industrial Value Added}_t$$

Economic value added is given with the data set. $P_M \mu$ = Spending on Materials.

Total Costs will be estimated as following:

$$(2.2.2) \text{Total Costs}_t = w_t L_t + P_M \mu_t + R_t K_t$$

Such that wL = wages payable, $P_M \mu$ = Spending on Materials, and RK = cost of capital.

Wages payable is available in the data. With regards to RK, the capital stock (K) is given. The Rental rate (R) will be estimated as 10%.

Profit in my analysis will be calculated in the following manner:

$$(2.2.3) \textit{Profit}_t = \textit{Sales}_t - \textit{Total Costs}_t$$

This profit metric is identifying an economic value of profit, but not the necessary accounting profit that would be identified on a financial statement (which would net out interest payments and depreciation but not the required return on equity).

The Investment variable calculates total investment as a percentage of a company's revenue. Total investment in year t for a specific company will be calculated as followed:

$$(2.2.5) I_t = K_{t+1} - K_t + D_t$$

Such that I_t = investment in year t , K_t = capital stock in year t , and D_t = depreciation in year t .

Depreciation information is not given, so I will assume that depreciation in year t is a constant 5% of capital in that specific year.

(2.2.6) explains how investment will be calculated for my regression:

$$(2.2.6) \frac{\textit{Total Investment}}{\textit{Revenue}} = \frac{I_t}{\textit{Firm revenue}_t}$$

Gross Markup Ratio will look at how pricing varied with costs over the course of my analysis. Equation 2.2.6 identifies how I am calculating Gross Markup for a firm in year t :

$$(2.2.7) \textit{Gross Markup Ratio}_t = \frac{\textit{Revenue}_t}{\textit{Total Costs}_t}$$

Theoretically Gross Markup Ratio is calculated dividing marginal revenue by the marginal cost of an additional unit. Equation 2.2.6. assumes that the marginal revenue and marginal cost are proportional to the total amounts.

I will use the following information to create my dependent variables: Year, WTO, Province, Sector, Tariff, Firm Size, Capital Stock, and Ownership. Year and WTO will indicate

the specific year of interest and if that year is before or after the passing of the WTO. While China entered the WTO in 2001, it took place in December of 2001, so WTO will equal 1 if the year of interest is after 2002. The Province and Sector variables are both discrete variables, that are specific ID numbers. See the appendix for information on province and sector ID's.

Regarding provinces, I will compare provinces with Special Economic Zones against the rest of the states. Guangdong, Fujian, Hainan, Shanghai, and Tianjin were provinces with Special Economic Zones inside of them, meaning they faced more free market policies and had various tax and business incentives to attract foreign investment and technology (Zeng 2015). I will use a `free_trade` dummy variable that will be equal to 1 if the province of interest is a Special Economic Zone and 0 if otherwise. With regards to sector, I will focus mostly on comparing textile firms to the rest of the economy. The bulk of the literature analyzing how China was impacted by the WTO focuses primarily on the agriculture and textile industries. The data has an insufficient number of agricultural firms, thus I will focus primarily on textile companies to evaluate previous analyses. The Tariff variable will represent the amount of tariff a specific industry has in a particular year. I will use information from the WTO's tariff database about China's average import tariff in each industry. The Firm Size variable is referring specifically to the amount of people employed by the firm in a specific year. The Capital Stock variable numerically refers to the amount of capital each firm owns. Lastly, Ownership is an indicator variable. I will create a dummy variable, which is 1 if the firm is government or collectively owned, and 0 if not. See Table 6 in the appendix for information regarding the ownership key. In addition to this information, I will be using tariff information from the WTO website.

3. Methodology

Given that the research I am proposing is original, there is not a direct methodology that I can copy. However, Brambilla's utilization of dummy variables in her OLS regression, served as a blueprint for my study design. I intend to use a difference in difference approach to answering my question. The analysis will be broken up in to two main parts: first I will start with an overview of the WTO's impact on the Chinese economy by looking at industry level data and comparing which types of business seemingly gained from the change in policy. The second and more extensive piece of analysis will be analyzing the impact in a more granular way by diving into specific firm data and seeing which specific changes took place at a company level.

3.1. Firm Level Analysis

Looking at the firm level information, I intend to identify the impacts of the WTO at a more granular level. I will first focus on how revenues for a firm changed from 1998-2007.

$$(3.2.1) \ln(\text{Revenue}) = \alpha + \mu * \text{Year} + \eta * \text{year}^2 + \beta * \text{WTO} + \rho * \text{capital_share} + \chi * \text{free_trade} + \psi * \text{Tariffs} + \delta * \text{textiles} + \kappa * \text{public} + \gamma * \text{WTO} * \text{capital_share} + \theta * \text{WTO} * \text{free_trade} + \omega * \text{WTO} * \text{public} + \varphi * \text{WTO} * \text{textiles} + \varepsilon$$

Equation (3.2.1.) controls for fixed effects, while identifying heterogeneity across a plethora of variables.

Additionally, I will run these same tests on spending on materials and profits for these companies. While revenue analysis will serve as a good proxy for how companies fared after the WTO, analysis on costs and profits will illuminate if the benefits of the WTO spurred cost reduction and greater firm efficiency.

$$(3.2.2) \ln(P_M \mu_t) = \alpha + \mu * Year + \eta * year^2 + \beta * WTO + \rho * capital_share + \chi * free_trade + \psi * Tariffs + \delta * textiles + \kappa * public + \gamma * WTO * capital_share + \theta * WTO * free_trade + \omega * WTO * public + \varphi * WTO * textiles + \varepsilon$$

$$(3.2.3) \ln(Profit) = \alpha + \mu * Year + \eta * year^2 + \beta * WTO + \rho * capital_share + \chi * free_trade + \psi * Tariffs + \delta * textiles + \kappa * public + \gamma * WTO * capital_share + \theta * WTO * free_trade + \omega * WTO * public + \varphi * WTO * textiles + \varepsilon$$

With regards to costs, it is essential to note that I am focusing on spending on materials– not total costs. Spending on materials focuses specifically on the costs of inputs instead of other operational costs such as sales and marketing, depreciation, or rent which would likely be left unchanged by the WTO.

The next piece of my methodology focuses on gross markup ratio. The gross markup ratio looks at how prices and costs vary together.

$$(3.2.4) \text{Gross Markup Ratio} = \alpha + \mu * Year + \eta * year^2 + \beta * WTO + \rho * capital_share + \chi * free_trade + \psi * Tariffs + \delta * textiles + \kappa * public + \gamma * WTO * capital_share + \theta * WTO * free_trade + \omega * WTO * public + \varphi * WTO * textiles + \varepsilon$$

Evaluating Gross Markup Ratio will analyze heterogeneity in pricing pressure in China due to the WTO.

Additionally, I will look at how specifically exporting changed for firms. This will isolate the specific values to global trade that the WTO brought to the Chinese economy.

$$(3.2.5) \frac{\text{Export}}{\text{Revenue}} = \alpha + \mu * \text{Year} + \eta * \text{year}^2 + \beta * \text{WTO} + \rho * \text{capital_share} + \chi * \text{free_trade} + \psi * \text{Tariffs} + \delta * \text{textiles} + \kappa * \text{public} + \gamma * \text{WTO} * \text{capital_share} + \theta * \text{WTO} * \text{free_trade} + \omega * \text{WTO} * \text{public} + \varphi * \text{WTO} * \text{textiles} + \varepsilon$$

Further regressions of mine will look at how the WTO impacted investment at the firm level.

$$(3.2.7) \frac{\text{Total Investment}}{\text{Revenue}} = \alpha + \mu * \text{Year} + \beta * \text{WTO} + \chi * \text{Geography} + \psi * \text{Tariffs} + \delta * \text{Sector} + \eta * \text{Firm Size} + \rho * \text{Capital Stock} + \kappa * \text{Ownership} + \gamma * \text{WTO} * \text{Geography} + \theta * \text{WTO} * \text{Sector} + \omega * \text{WTO} * \text{Firm Size} + \varphi * \text{WTO} * \text{Capital Stock} + \tau * \text{WTO} * \text{Ownership} + \varepsilon$$

Investment is a valuable proxy for business confidence. A higher amount of investment signals that firms are optimistic for future gains. Moreover, investment illustrates the extent to which firms are focused on long-term gains.

3.2. Qualifications

After conducting such analyses, I will have a general idea of how the WTO affected industries. Some interesting robustness checks for each industry could be looking at profits in each sector instead of revenues or perhaps employee size to look at how the change in policy impacted employment. Further research that is beyond the scope of my project could be looking at how the penetration of SOEs in certain industries had an impact on the growth of a sector. Or potentially looking at how innovation differed before and after China's accession to the WTO, however, most data on innovation at an industry level is not available.

My firm level analysis is intended to take a holistic approach to identifying how the WTO impacted China's economy; yet it is important to understand that I am only looking at the most important parts of the economy. My profit calculations do not account for debt repayments or taxes. However, debt repayment and taxation are the product of capital structure and financial engineering, not necessarily real economic value. Focusing deeper on investment, it could potentially be valuable to control for heterogeneity in investment in my revenue, costs, and profit regressions. However, I refused to use investment as an independent variable because it is difficult to directly conclude when investment will have an impact on profits, revenues, or costs in the future for each respective industry in my data set. In such a case, it is best to use investment as a proxy for business confidence as opposed to a driver of economic growth. Additionally, my regression neglects to control for non-tariff barriers to trade, such as import licensing, rules of origin, or pre-shipment inspection. I do not include non-tariff barriers for two reasons: first, it is difficult to create a numerical proxy for non-tariff barriers to include as a variable. There have been various studies focused on estimating non-tariff barriers, including papers written by the United States International Trade Commission and Lima et. al, yet their analysis is rather specific in nature and does not apply to China. The second reason my analysis does not include non-tariff barriers is that non-tariff barriers to trade are subjected to discipline by the WTO. Thus, the impact of these non-tariff barriers will be reflected in the WTO variable.

Lastly, it is essential to mention that I will not be conducting my analysis in a panel format, but rather taking a holistic approach to analyzing the data. Looking at Neyman and Scott's groundbreaking 1948 paper, there are incidental parameter problems that can be generated by analyzing information in a panel format (Neyman et.al 1948). While I want to

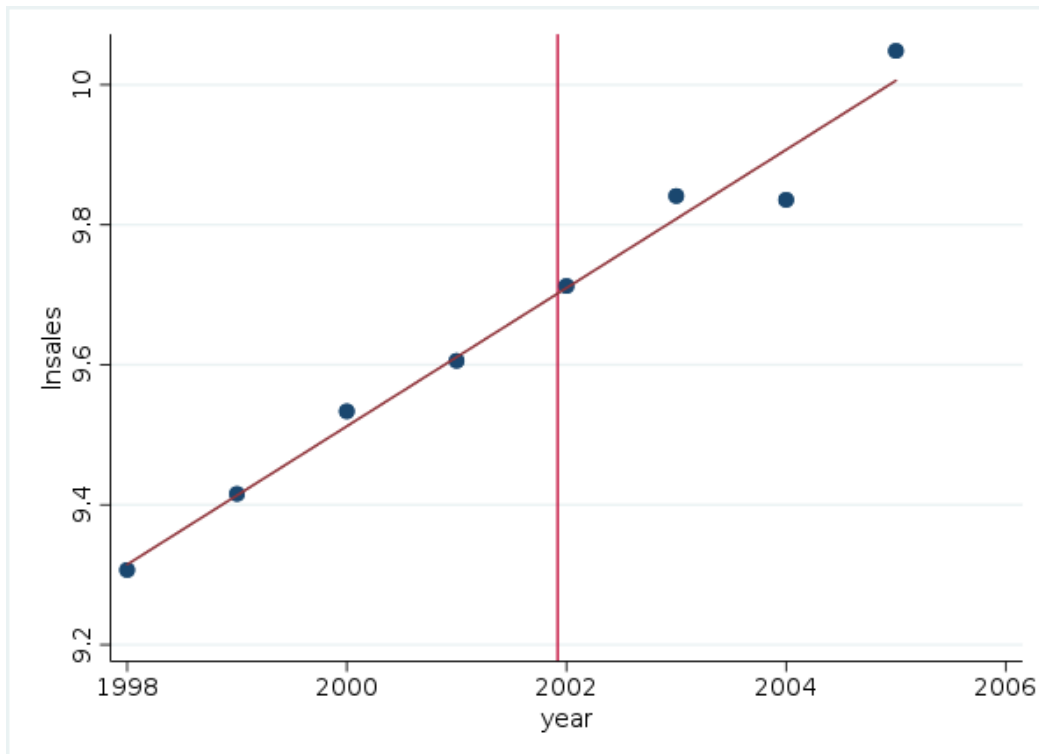
control for firm effects, if I try to estimate too many things I could distance things out as fixed effects, which really could just be temporary trends.

4. Results

4.1 Revenue

I will begin with describing information from my revenue regression.

Graph 1:



As visible in the plot above, the Chinese economy has rapidly grown from 1998-2005. The vertical red line represents when China entered the WTO in December of 2001. It is difficult to tease out the causal impact of the WTO due to the growth China was experiencing before 2001. To account for this problem, I controlled for year and industry fixed effects in my regressions.

Let's look at how heterogeneity in capital intensiveness at the firm level differentiated the impact of the WTO. When solely analyzing the relationship between the WTO and capital share, it appears that more capital-intensive firms benefitted from the WTO in comparison to labor-intensive companies.

Table 1:

VARIABLES	(1) lnsales	(2) lnsales	(3) lnsales	(4) lnsales	(5) lnsales	(6) lnsales
year	-3.504*** (1.115)	-8.492*** (1.109)	-8.653*** (1.109)	-10.16*** (1.106)	-21.81*** (1.106)	-21.71*** (1.106)
year2	0.000901*** (0.000278)	0.00215*** (0.000277)	0.00219*** (0.000277)	0.00257*** (0.000276)	0.00546*** (0.000276)	0.00544*** (0.000276)
1.WTO	-0.0162*** (0.00544)	-0.151*** (0.00671)	-0.153*** (0.00671)	-0.102*** (0.00699)	-0.240*** (0.00726)	-0.203*** (0.00746)
capital_share		0.310*** (0.00861)	0.306*** (0.00861)	0.368*** (0.00864)	0.396*** (0.00851)	0.430*** (0.00856)
1.WTO#c.capital_share		0.395*** (0.0111)	0.400*** (0.0111)	0.381*** (0.0111)	0.386*** (0.0110)	0.359*** (0.0111)
tariff			0.00552*** (0.000267)	0.00493*** (0.000267)	0.00226*** (0.000263)	0.00122*** (0.000266)
1.free_trade				0.313*** (0.00456)	0.172*** (0.00457)	0.165*** (0.00457)
1.WTO#1.free_trade				-0.150*** (0.00581)	-0.0393*** (0.00579)	-0.0327*** (0.00579)
1.public					-0.687*** (0.00412)	-0.670*** (0.00414)
1.WTO#1.public					0.237*** (0.00558)	0.223*** (0.00562)
1.textiles						0.203*** (0.00598)
1.WTO#1.textiles						-0.168*** (0.00737)
Constant	3,415*** (1,116)	8,402*** (1,110)	8,563*** (1,110)	10,074*** (1,107)	21,770*** (1,107)	21,669*** (1,107)
Observations	1,323,439	1,320,925	1,320,925	1,320,925	1,320,925	1,320,925
R-squared	0.025	0.033	0.033	0.038	0.068	0.069

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Even as more variables are introduced this interaction between capital share and WTO remains significantly positive. This rejects my initial hypothesis that labor intensive firms would stand to benefit more from this policy.

Next, I looked at the impact of geography on how firms fared in China due to the WTO.

To do this, I used the free_trade dummy variable, as described earlier, which isolates provinces

that had already been exposed to free trade versus those that were not. Initially, it appeared that Special Economic Zones were less successful than their counterparts, but as more variables were introduced this underperformance became relatively small.

However, as more variables are introduced the negative impact of these free trade provinces is reduced by over 75%, albeit still significantly negative.

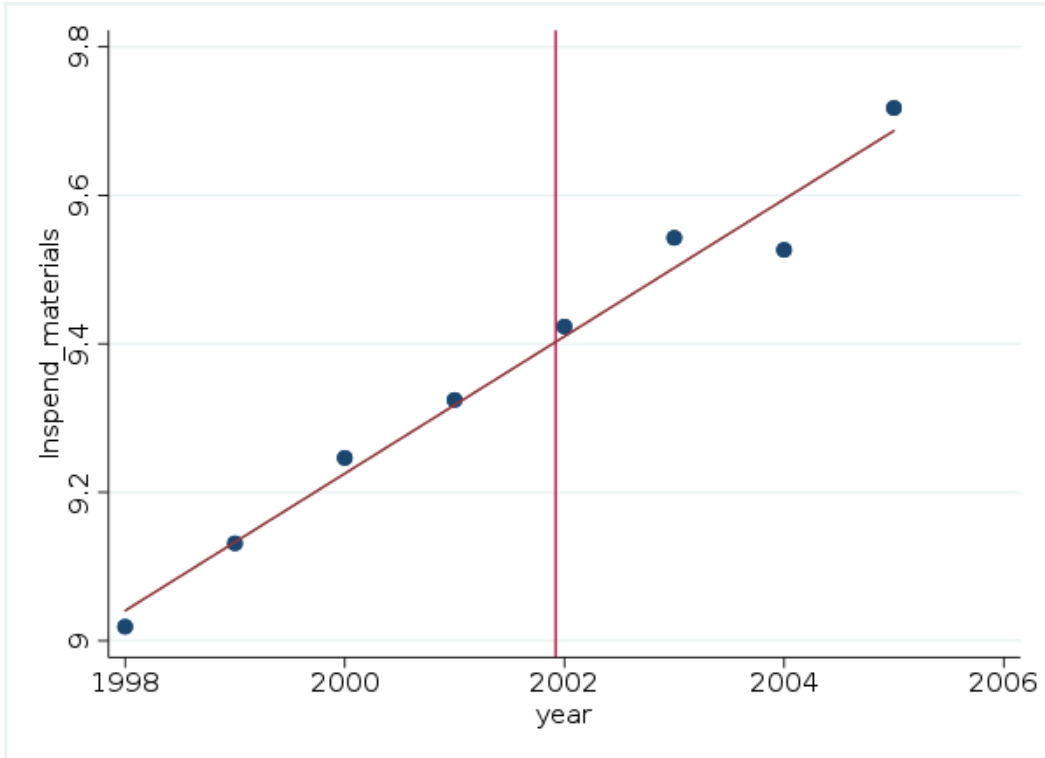
Regarding ownership, the revenue of state and collectively owned companies grew much more from the WTO than their privately-owned peers. Publicly owned firms had 27% higher sales than their privately-owned counterparts. This number remains robust as other variables are introduced. This result was rather shocking as one would assume the influx of foreign private companies into China would render the inefficient SOEs obsolete.

Regarding analysis on industries, surprisingly, textiles performed 28% worse than their peers post WTO. This number remained significant as other variables were controlled for.

4.2 Spending on Materials

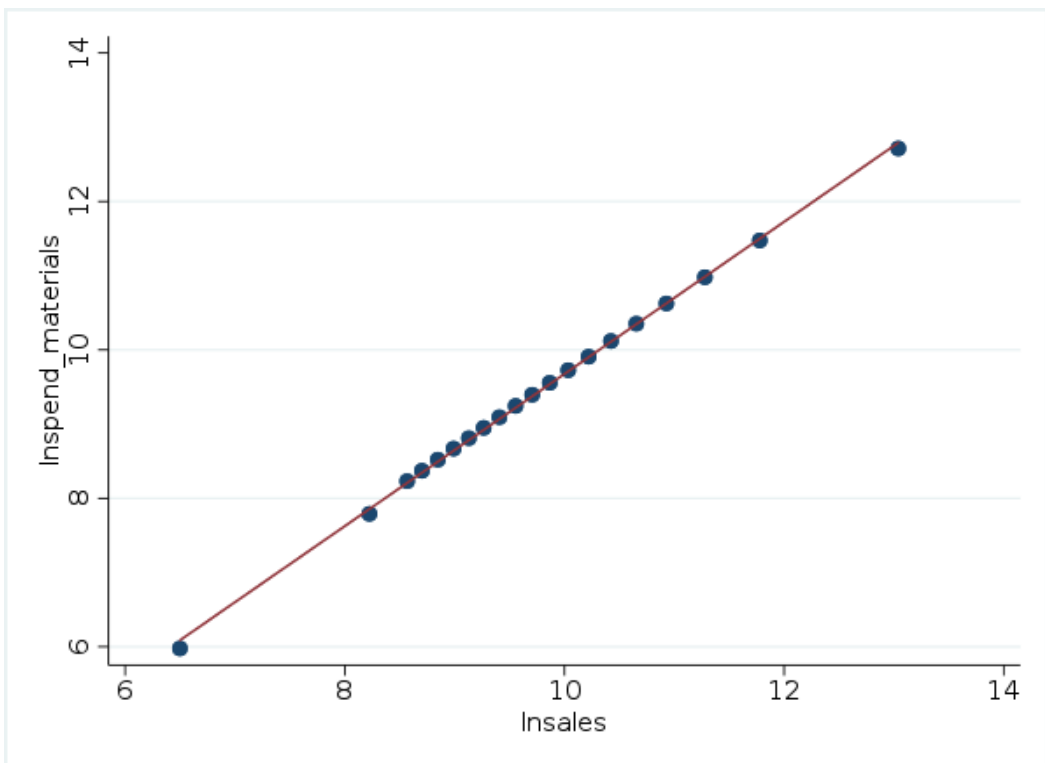
Next I will look at how the WTO impacted spending on materials at the corporate level.

Graph 2:



As you can see, the graph above mirrors the scatter plot of year vs. Insales.

Graph 3:



This graph shows an almost perfect correlation between sales and spending on materials.

Table 2:

VARIABLES	(1) Inspend_mate rials	(2) Inspend_mate rials	(3) Inspend_mate rials	(4) Inspend_mate rials	(5) Inspend_mate rials	(6) Inspend_mate rials
year	4.162*** (1.173)	-0.837 (1.168)	-1.035 (1.168)	-2.456** (1.165)	-13.81*** (1.165)	-13.74*** (1.164)
year2	-0.00102*** (0.000293)	0.000234 (0.000292)	0.000284 (0.000292)	0.000639** (0.000291)	0.00346*** (0.000291)	0.00345*** (0.000291)
1.WTO	-0.0140** (0.00572)	-0.146*** (0.00705)	-0.148*** (0.00705)	-0.0925*** (0.00735)	-0.224*** (0.00763)	-0.184*** (0.00784)
capital_share		0.318*** (0.00913)	0.314*** (0.00913)	0.374*** (0.00916)	0.394*** (0.00901)	0.434*** (0.00907)
1.WTO#c.capital_s hare		0.391*** (0.0117)	0.397*** (0.0117)	0.373*** (0.0118)	0.384*** (0.0116)	0.356*** (0.0117)
tariff			0.00644*** (0.000281)	0.00586*** (0.000281)	0.00296*** (0.000276)	0.00166*** (0.000279)
1.free_trade				0.304*** (0.00480)	0.159*** (0.00481)	0.152*** (0.00481)
1.WTO#1.free_trad e				-0.163*** (0.00610)	-0.0504*** (0.00608)	-0.0430*** (0.00608)
1.public					-0.705*** (0.00433)	-0.686*** (0.00436)
1.WTO#1.public					0.214*** (0.00588)	0.199*** (0.00592)
1.textiles						0.233*** (0.00626)
1.WTO#1.textiles						-0.179*** (0.00771)
Constant	-4,251*** (1,174)	746.2 (1,169)	944.3 (1,169)	2,367** (1,166)	13,775*** (1,166)	13,709*** (1,165)
Observations	1,290,637	1,288,198	1,288,198	1,288,198	1,288,198	1,288,198
R-squared	0.020	0.028	0.028	0.033	0.063	0.064

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

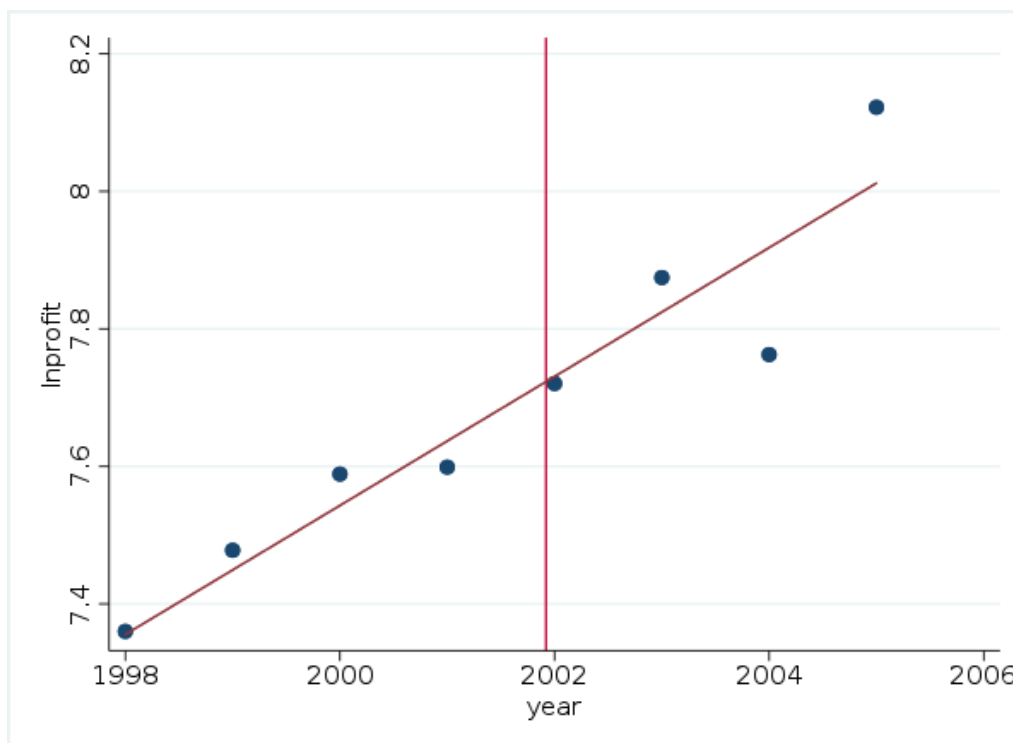
While the regressions regarding spending on materials were eerily like those on revenue, it seems that the increase in spending on materials from more capital-intensive firms actually outpaced the growth in sales.

This is particularly interesting as every other regression with spending on materials as an outcome variable fell directly in line with the sales regressions.

4.3 Profit

At first glance it seems that the WTO had little to no impact on firm profits. In fact, it had a small negative impact on profits.

Graph 4:



However, I will dive deeper into the analysis to see if any groups of firms disproportionately became more profitable than others.

The regression shows that capital-intensive firms tended to be more successful than their labor-intensive counterparts.

Table 3:

VARIABLES	(1) lnprofit	(2) lnprofit	(3) lnprofit	(4) lnprofit	(5) lnprofit	(6) lnprofit
year	-24.35*** (1.561)	-33.30*** (1.538)	-33.59*** (1.537)	-34.77*** (1.537)	-48.02*** (1.556)	-47.58*** (1.556)
year2	0.00611*** (0.000390)	0.00834*** (0.000384)	0.00842*** (0.000384)	0.00871*** (0.000384)	0.0120*** (0.000389)	0.0119*** (0.000388)
1.WTO	-0.0369*** (0.00763)	-0.115*** (0.00925)	-0.118*** (0.00925)	-0.0818*** (0.00969)	-0.223*** (0.0102)	-0.191*** (0.0104)
capital_share		1.195*** (0.0129)	1.188*** (0.0129)	1.231*** (0.0129)	1.208*** (0.0129)	1.210*** (0.0130)
1.WTO#c.capital_share		0.269*** (0.0161)	0.279*** (0.0161)	0.265*** (0.0162)	0.287*** (0.0162)	0.260*** (0.0163)
tariff			0.0102*** (0.000361)	0.00995*** (0.000360)	0.00884*** (0.000360)	0.00957*** (0.000363)
1.free_trade				0.203*** (0.00639)	0.118*** (0.00648)	0.117*** (0.00649)
1.WTO#1.free_trade				-0.101*** (0.00797)	-0.0228*** (0.00804)	-0.0217*** (0.00805)
1.public					-0.422*** (0.00591)	-0.421*** (0.00595)
1.WTO#1.public					0.306*** (0.00793)	0.294*** (0.00798)
1.textiles						0.0130 (0.00846)
1.WTO#1.textiles						-0.132*** (0.0102)
Constant	24,275*** (1,563)	33,223*** (1,540)	33,519*** (1,539)	34,695*** (1,538)	47,979*** (1,557)	47,544*** (1,557)
Observations	984,268	983,902	983,902	983,902	983,902	983,902
R-squared	0.016	0.046	0.047	0.048	0.054	0.054

Standard errors in parentheses

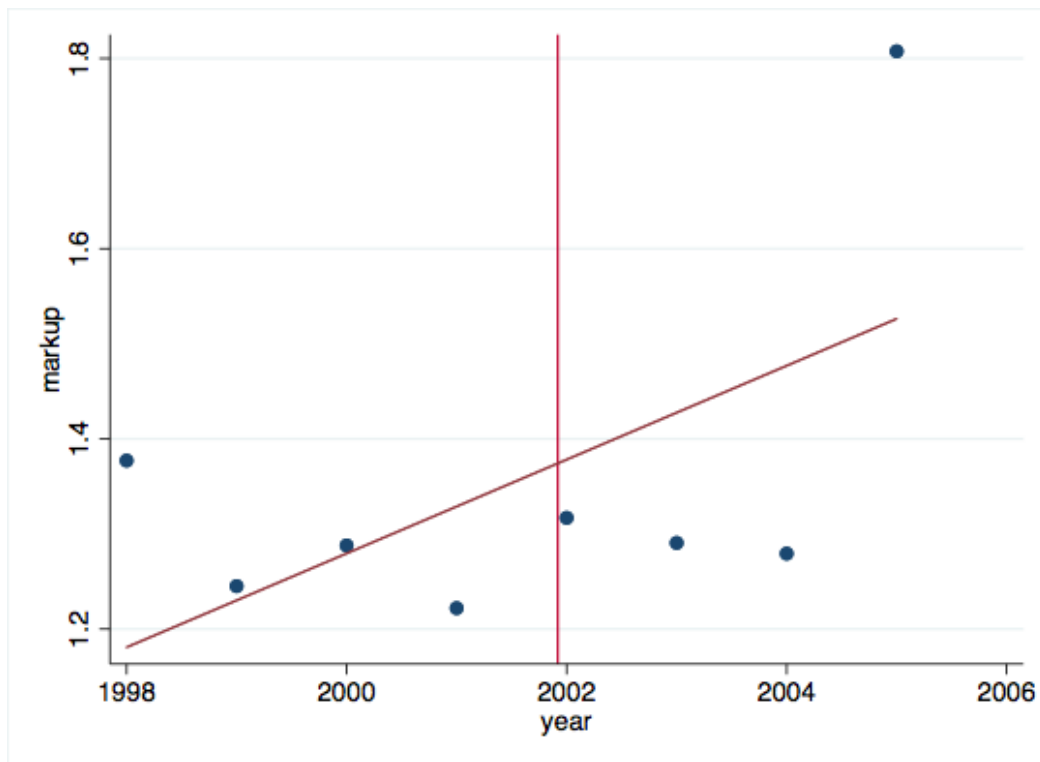
*** p<0.01, ** p<0.05, * p<0.1

Similar to previous analysis, special economic zones performed worse than their peers, and public firms tended to do better.

4.4 Gross Markup Ratio

Looking at gross markup ratio will allow me to more accurately determine the relationship between revenues and costs.

Graph 5:



While there is noise in the data causing the numbers for 2005 to be exorbitantly high, it appears that the gross markup ratio has positively increased over time. What this means is that revenue has outpaced total costs for Chinese firms, meaning that these companies have become more efficient.

Unfortunately, few of the regressions looking at gross markup ratio had any sort of significance. Confirming the findings in my revenue regression, public firms had a noticeable increase in their gross margin relative to their private counterparts, illustrating a greater efficiency in these companies.

Table 4:

VARIABLES	(1) markup	(2) markup	(3) markup	(4) markup	(5) markup	(6) markup
year	-115.8** (52.08)	-86.08* (51.08)	-87.05* (51.08)	-88.15* (51.08)	-105.2** (51.88)	-104.7** (51.88)
year2	0.0289** (0.0130)	0.0215* (0.0128)	0.0218* (0.0128)	0.0220* (0.0128)	0.0263** (0.0130)	0.0262** (0.0130)
1.WTO	-0.0948 (0.254)	0.00663 (0.307)	-0.00437 (0.307)	-0.143 (0.322)	-0.341 (0.338)	-0.331 (0.348)
capital_share		-0.228 (0.384)	-0.247 (0.384)	-0.245 (0.387)	-0.246 (0.387)	-0.271 (0.389)
0b.WTO#co.capital_share		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
1.WTO#c.capital_share		-0.333 (0.499)	-0.304 (0.499)	-0.206 (0.502)	-0.260 (0.503)	-0.271 (0.506)
tariff			0.0313** (0.0123)	0.0307** (0.0123)	0.0321*** (0.0123)	0.0340*** (0.0124)
1.free_trade				0.00682 (0.211)	0.00495 (0.214)	0.0101 (0.215)
1.WTO#1.free_trade				0.391 (0.268)	0.427 (0.271)	0.424 (0.271)
1.public					-0.00640 (0.193)	-0.0189 (0.194)
1.WTO#1.public					0.543** (0.261)	0.539** (0.263)
1.textiles						-0.160 (0.279)
1.WTO#1.textiles						-0.0245 (0.344)
Constant	115,787** (52,129)	86,084* (51,126)	87,063* (51,128)	88,162* (51,134)	105,184** (51,927)	104,688** (51,933)
Observations	1,315,311	1,312,891	1,312,891	1,312,891	1,312,891	1,312,891
R-squared	0.000	0.000	0.000	0.000	0.000	0.000

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.5 Export

Exports paint a very different picture of how China's economy responded to the WTO. A greater capital share of total costs led to less exporting over this period.

Table 5:

VARIABLES	(1) export_sales	(2) export_sales	(3) export_sales	(4) export_sales	(5) export_sales	(6) export_sales
year	10.16*** (0.589)	11.33*** (0.566)	10.19*** (0.558)	9.778*** (0.548)	7.312*** (0.547)	6.785*** (0.541)
year2	-0.00254*** (0.000147)	-0.00283*** (0.000141)	-0.00255*** (0.000139)	-0.00244*** (0.000137)	-0.00183*** (0.000137)	-0.00170*** (0.000135)
1.WTO	0.0151*** (0.00284)	0.0308*** (0.00327)	0.0298*** (0.00323)	0.0441*** (0.00340)	0.0286*** (0.00345)	0.0269*** (0.00362)
capital_share		-0.472*** (0.00489)	-0.432*** (0.00484)	-0.400*** (0.00477)	-0.398*** (0.00471)	-0.358*** (0.00473)
1.WTO#c.capital_share		-0.0781*** (0.00619)	-0.0794*** (0.00611)	-0.0762*** (0.00603)	-0.0704*** (0.00596)	-0.0671*** (0.00600)
tariff			0.0132*** (0.000131)	0.0133*** (0.000128)	0.0131*** (0.000127)	0.0110*** (0.000128)
1.free_trade				0.158*** (0.00205)	0.125*** (0.00208)	0.128*** (0.00206)
1.WTO#1.free_trade				-0.0318*** (0.00256)	-0.00627** (0.00258)	-0.00263 (0.00256)
1.public					-0.153*** (0.00222)	-0.149*** (0.00220)
1.WTO#1.public					0.00209 (0.00330)	0.00555* (0.00327)
1.textiles						0.124*** (0.00225)
1.WTO#1.textiles						-0.00916*** (0.00279)
Constant	-10,165*** (589.9)	-11,333*** (566.4)	-10,196*** (558.4)	-9,780*** (548.8)	-7,305*** (547.5)	-6,779*** (541.8)
Observations	351,547	351,382	351,382	351,382	351,382	351,382
R-squared	0.001	0.080	0.106	0.137	0.158	0.176

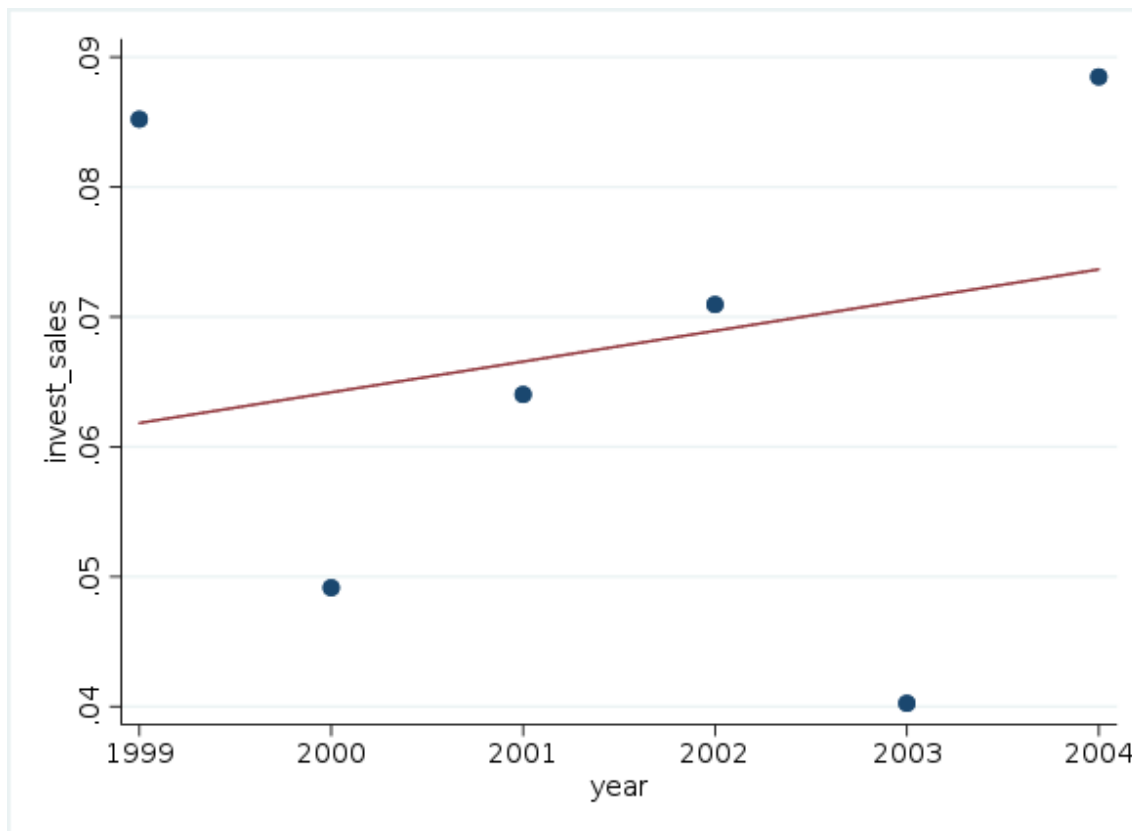
Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

This falls more in line with my hypothesis that labor-intensive firms would benefit more from less barriers to trade globally.

4.6 Investment

Investment is essential to analyze because it serves as a proxy for business confidence. If a specific type of firm began investing more it illustrates optimism for the future.

Graph 5:



Looking at the graph above there is a rough general increase in investment from 1999-2004. This confirms Handley and Limao's thesis that the WTO provided trade certainty, which would lead to a general increase in Chinese investment. The graph ends at 2004 instead of 2005 because we have no capital stock for the year 2006 to base investment in 2005 off. The regression outputs are in the appendix.

4.7 Further Analysis

Capital had a massive impact on how firms developed in China over this period. In order to further delineate between the impact of capital versus labor, I regressed the capital to labor ratio.

Below is my regression output for how the capital to labor ratio was impacted by various variables.

Table 6:

VARIABLES	(1) lncap_labor	(2) lncap_labor	(3) lncap_labor	(4) lncap_labor	(5) lncap_labor
year	-19.30*** (1.741)	-18.70*** (1.739)	-18.72*** (1.736)	-26.05*** (1.757)	-24.58*** (1.737)
year2	0.00484*** (0.000435)	0.00468*** (0.000434)	0.00469*** (0.000433)	0.00652*** (0.000439)	0.00615*** (0.000434)
1.WTO	-0.114*** (0.00633)	-0.114*** (0.00633)	-0.0425*** (0.00655)	-0.115*** (0.00706)	-0.0953*** (0.00712)
1.free_trade			0.0324*** (0.00537)	0.0128** (0.00545)	0.0354*** (0.00539)
1.WTO#1.free_trade			-0.270*** (0.00647)	-0.245*** (0.00654)	-0.257*** (0.00648)
1.public				-0.102*** (0.00487)	-0.146*** (0.00485)
1.WTO#1.public				0.173*** (0.00622)	0.158*** (0.00620)
1.textiles					-0.573*** (0.00697)
1.WTO#1.textiles					-0.0635*** (0.00823)
tariff		-0.0129*** (0.000287)	-0.0125*** (0.000286)	-0.0124*** (0.000287)	
Constant	19,267*** (1,743)	18,659*** (1,742)	18,681*** (1,738)	26,020*** (1,759)	24,548*** (1,739)
Observations	1,124,022	1,124,022	1,124,022	1,124,022	1,124,022
R-squared	0.004	0.006	0.009	0.010	0.033

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Interestingly, it appears that the capital to labor ratio fell over this period due to the WTO.

However, firms with larger proportions of capital tended to have an increase in their capital to labor ratio, as did public firms. However, firms in SEZ's had drops in their capital to labor ratio, illustrating that labor may have become relatively cheaper in these districts.

5. Discussion

Within the analysis there were some shocking conclusions. Ultimately my hypothesis that labor-intensive firms would stand to benefit from China entering the WTO was rejected. From both a revenue and profit standpoint, capital-intensiveness was tied to higher growth post-WTO at a 95% significance level. In fact, as other variables were introduced and controlled for, capital-intensiveness was still noticeably an important determinant of success at a 95% level of significance. However, capital intensive firms did export less post-WTO, thus my hypothesis was not entirely incorrect.

Furthermore, my results showed that the WTO had a small negative impact on the Chinese economy in terms of revenues and profits. However, it cannot be concluded that the WTO necessarily hurt the Chinese economy. There are diminishing marginal returns to economic growth. Perhaps the WTO lessened China's fall in growth instead of causing it.

The relationship between capital and economic success from 1998-2005 in China explains the outcomes of other variables. For example, knowing that capital-intensive firms tended to benefit, it makes sense that the textile industry did not fare well in the results. The mean capital amount in the data was \$35,417, when the average capital of a textile firm was \$13,815.72.

Looking more deeply into the capital-labor trade-off in China, there was a significant amount of heterogeneity in how firms utilized their inputs. Overall there tended to be a drop in the capital to labor ratio in the general economy, illustrating either a fall in wages compared to capital rents or an increase in relative productivity of labor. Given the development of the Chinese economy, it can be assumed that productivity of labor increased. However, the capital to labor ratio was positively tied to the capital share variable, meaning that the more capital

intensive firms saw a more serious shift towards utilizing capital. This reflects a greater usage of comparative advantage by these firms.

Such analysis challenges the conventions of economic analysis on China's economy. The previous research from economists like Brambilla and Huang emphasizes the gains that were made in labor intensive industries, such as textile and agriculture. Yet my industry by industry comparison shows that previous discussions have overstated how relevant these types of firms are. Additionally, the results challenge Li's prediction that capital-intensive firms would lose due to the WTO. More sophisticated firms capitalized on the WTO than their labor-dependent counterparts.

My results lead to fascinating conclusions about the role of capital in a country's response to demand shocks spurred by trade liberalization. The bulk of western economics literature focuses on China in relation to how it exports to America and Europe and extrapolates from these analyses the overall condition of the Chinese economy. Yet the internal growth in China was pushed by firms that were utilizing their capital.

An interesting extension of my research would be looking at what specifically changed about capital over this period. Looking to other papers, it seems that China is a nation fixated on utilizing capital to stimulate growth. According to David Dollar from the World Bank, China's investment to GDP ratio was at 40% in 2005, which is incredibly high relative to the global economy (Dollar). Furthermore, the returns to capital have been falling. According to Tsinghua University professors Chong-En Bai et. al, there have been noticeable diminishing returns to capital. Averaging 25% from 1978-1993, the return to capital averaged 20% from 1998-2006 (Bai 2006). While the actual rate of return on capital may be falling, my analysis proves that the

influx of capital that China pushed into the economy has outweighed the diminishing marginal returns to investment.

6. Conclusion

The WTO has been one of the most influential organizations in ensuring global prosperity. Examining how it impacted the world's now second largest economy is essential to understand how it impacts its partner nations.

My analysis proves that capital-intensive firms tended to benefit more from the WTO than their labor-intensive counterparts. Such a conclusion challenges the notion that labor-intensive firms prospered the most in China from 2001-2005. Moreover, it shows that trade liberalization does not disproportionately benefit segments in an economy that have a comparative advantage.

China has a very complex and unique economic and political sector. To corroborate my findings, research should be continued with a different database of firms. Moreover, there are still a range of different metrics to analyze regarding how the WTO impacted China's economy. There are still opportunities to look at how innovation or market saturation varied after 2002. Furthermore, different industries were given different protection against foreign competitors. To find more concrete findings one could try to create a variable controlling for industry protection.

China is increasingly becoming more important as a global leader. To understand international economics, an understanding of China is essential. It is an honor to have contributed to the body of literature surrounding China's economy.

7. Appendix

Table 6: Ownership ID

Ownership Key	Ownership Type
10	State-owned
20	Collectively-Owned
30	Privately Owned
40	Owned by Hong Kong, Taiwan, or Macau
50	Enterprises with foreign investment
90	Other

Table 7: Province ID

Province Code	Province name	Province Code	Province name
11	Beijing	46	Hainan
12	Tianjin	50	Chongqing
13	Hebei	51	Sichuan
14	Shanxi	52	Guizhou
15	Inner Mongolia	53	Yunnan

21	Liaoning	54	Xizang
22	Jilin	61	Shaanxi
23	Heilongjiang	62	Gansu
31	Shanghai	63	Qinghai
32	Jiangsu	64	Ningxia
33	Zhejiang	65	Xinjiang
34	Anhui		
35	Fujian		
36	Jiangxi		
37	Shandong		
41	Henan		
42	Hubei		
43	Hunan		
44	Guangdong		
45	Guangxi		

Table 8:
Province Groupings:

Province Group	Province Codes
Free Trade	12 (Guangdong), 31 (Fujian), 35 (Hainan), 44 (Shanghai), 46 (Tianjin)
Other	Rest

Source: Zeng (2015)

Table 9:
Sector ID's:

Industry code	Industry name	Industry code	Industry name
06	Coal mining and washing industry	27	Pharmaceutical manufacturing
07	Oil and gas exploration	28	Chemical fiber manufacturing
08	Ferrous metal mining industry	29	Rubber products industry
09	Non-ferrous metal mining industry	30	Plastic products industry
10	Non-metallic mining industry	31	Non-metallic mineral products industry
11	Other mining industry	32	Ferrous metal smelting and rolling processing industry
13	Agricultural and food processing industry	33	Non-ferrous metal smelting and rolling processing industry
14	Food manufacturing	34	Metal products industry
15	Beverage manufacturing	35	General equipment manufacturing

16	Tobacco industry	36	Special equipment manufacturing
17	Textile Industry	37	Transportation equipment manufacturing
18	Textile, Apparel, Shoes and Cap Manufacturing	39	Electrical machinery and equipment manufacturing
19	Leather, fur, feathers (velvet) and its	40	Communication equipment, computers and other electronics
	Product industry		Equipment manufacturing
20	Wood processing and wood, bamboo, rattan, brown,	41	Instrumentation, Culture, Office Machines
	Grass products industry		Machinery Manufacturing
21	Furniture manufacturing	42	Crafts and other manufacturing
22	Paper and paper products industry	43	Waste resources and waste materials recycling
23	Printing and recording media replication		Processing Industry
24	Culture, Education and Sporting Goods Manufacturing	44	Electricity, heat production and supply
25	Petroleum processing, coking and nuclear fuel	45	Gas production and supply
	Processing Industry	46	Water production and supply
26	Chemical raw materials and chemical products manufacturing		

Table 10:
Sector Groupings:

Industry Group	Industry Codes
----------------	----------------

Textiles	17, 18, 19
Agriculture	13, 14, 15, 16
Manufacturing	21, 28, 35, 36, 37, 41 42
Natural Resources	7, 8, 9, 10, 11, 20, 25, 26, 32, 33, 34, 45
Technology	39, 40

Table 11: Investment

VARIABLES	(1) invest_sales	(2) invest_sales	(3) invest_sales	(4) invest_sales	(5) invest_sales	(6) invest_sales
year	-17.30*** (2.951)	-18.77*** (2.960)	-18.66*** (2.960)	-18.50*** (2.960)	-17.22*** (3.000)	-17.21*** (3.001)
year2	0.00432*** (0.000737)	0.00469*** (0.000739)	0.00466*** (0.000739)	0.00462*** (0.000739)	0.00430*** (0.000749)	0.00430*** (0.000749)
1.WTO	0.00200 (0.00767)	-0.0200** (0.00953)	-0.0197** (0.00953)	-0.0167* (0.0100)	-0.00794 (0.0105)	-0.00808 (0.0108)
capital_share		0.0297** (0.0131)	0.0298** (0.0131)	0.0279** (0.0132)	0.0282** (0.0132)	0.0273** (0.0133)
1.WTO#c.capital_share		0.0669*** (0.0172)	0.0660*** (0.0172)	0.0637*** (0.0173)	0.0655*** (0.0173)	0.0655*** (0.0175)
tariff			-0.00124*** (0.000398)	-0.00120*** (0.000398)	-0.00129*** (0.000399)	-0.00125*** (0.000404)
1.free_trade				-0.00795 (0.00648)	-0.00866 (0.00658)	-0.00854 (0.00658)
1.WTO#1.free_trade				-0.00823 (0.00836)	-0.00960 (0.00845)	-0.00971 (0.00845)
1.public					-0.00387 (0.00597)	-0.00425 (0.00602)
1.WTO#1.public					-0.0237*** (0.00822)	-0.0237*** (0.00828)
1.textiles						-0.00441 (0.00863)
1.WTO#1.textiles						0.000949 (0.0108)
Constant	17,318*** (2,954)	18,784*** (2,963)	18,676*** (2,963)	18,515*** (2,963)	17,238*** (3,003)	17,220*** (3,004)

Observations	564,840	564,162	564,162	564,162	564,162	564,162
R-squared	0.000	0.000	0.000	0.000	0.000	0.000

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 12: Economic Value Added

VARIABLES	(1) lnEVA	(2) lnEVA	(3) lnEVA	(4) lnEVA	(5) lnEVA	(6) lnEVA
year	-69.21*** (1.950)	-71.05*** (1.940)	-71.25*** (1.940)	-72.35*** (1.937)	-90.22*** (1.949)	-90.20*** (1.949)
year2	0.0173*** (0.000487)	0.0178*** (0.000484)	0.0178*** (0.000484)	0.0181*** (0.000484)	0.0226*** (0.000487)	0.0225*** (0.000487)
1.WTO	-0.00717 (0.00710)	-0.155*** (0.00849)	-0.156*** (0.00849)	-0.115*** (0.00886)	-0.221*** (0.00919)	-0.201*** (0.00944)
capital_share		0.297*** (0.0113)	0.295*** (0.0113)	0.354*** (0.0114)	0.402*** (0.0113)	0.419*** (0.0114)
1.WTO#c.capital_share		0.452*** (0.0138)	0.455*** (0.0138)	0.436*** (0.0139)	0.410*** (0.0139)	0.395*** (0.0140)
tariff			0.00434*** (0.000320)	0.00384*** (0.000319)	0.00195*** (0.000318)	0.00151*** (0.000321)
1.free_trade				0.264*** (0.00601)	0.165*** (0.00606)	0.162*** (0.00606)
1.WTO#1.free_trade				-0.118*** (0.00726)	-0.0377*** (0.00729)	-0.0343*** (0.00729)
1.public					-0.534*** (0.00538)	-0.526*** (0.00542)
1.WTO#1.public					0.245*** (0.00690)	0.237*** (0.00695)
1.textiles						0.103*** (0.00788)
1.WTO#1.textiles						-0.0913*** (0.00928)
Constant	69,168*** (1,953)	71,003*** (1,943)	71,202*** (1,943)	72,305*** (1,940)	90,223*** (1,952)	90,201*** (1,952)
Observations	1,125,832	1,125,252	1,125,252	1,125,252	1,125,252	1,125,252
R-squared	0.027	0.035	0.035	0.038	0.050	0.050

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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