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Joonhyung Lee[1]

Department of Economics
Southern Methodist University

ABSTRACT
The purpose of this paper is to evaluate the short-run effect of the tariffs on Chinese tires imposed by the US in September 2009. First, we investigated whether the tariffs were beneficial to the US domestic tire industry in terms of employment. Our empirical analysis found that there were no significant benefits to US employment in the tire industry. This result led us to the next question: Who benefited from the tariffs? We found that the tire imports to the US were significantly deviated from China to other countries such as Thailand and Korea.

Key words: Tariffs, Chinese Tires, Difference-in-Difference,

JEL Classification: F13, F14

[*] Department of Economics, Southern Methodist University, Dallas, TX 75206, Email: joonl@smu.edu

I. Introduction

In September 2009, the US government announced that it would impose 35% tariffs on automobile and light-truck tires imported from China. This decision was widely welcomed by the United Steelworkers, the union representing American tire workers. The Tire Industry Association has opposed the tariffs, however, and argued that they would not preserve American jobs but would instead cause manufacturers to relocate plants to other countries where they can produce tires cheaply.[2] After this event, the US-China Business Council (UCBC) released a report in 2010, saying that "The tariffs just meant more tires from other countries flooded the US market instead of boosting American tire makers."[3] The US government disagreed with the report, however. In the meantime, in December 2010, the WTO backed the US tariffs because China's tires significantly hurt the US domestic tire industry over the last few years.[4]

Before the actual implementation of the tariffs, Prusa (2009) estimated the potential effects of the proposed tariffs using a computable partial equilibrium model.[5] Some of his predictions are worth noting: (1) workers in the tire distribution and installation sectors would be hurt, (2) the tire manufacturing industry would experience little to no job creation, (3) the foreclosure of supply from China would lead some firms to shut down and lay off workers, and (4) the tariffs would result in "re-shuffling of the deck" in which other developing countries would increase their shipments.

Now, it has been more than one year since the tariffs has been imposed on Chinese tires. This paper attempts to evaluate the short-run impacts of the tariffs. There are few studies in the literature regarding the actual effects of the tariffs on US domestic employment in the tire industry and the import deviations from China to other countries after the tariffs was actually imposed in September 2009.[6] This paper attempts to answer these two questions.[7] Note that the

[2]See NY times, September 11, 2009.
[3]See the US-China Business Council Issue Brief of August 2010 and Marketplace from American Public Media from August 31, 2010.
[4] See The Wall Street Journal from December 13 2010. For the formal introduction of this issue, please see WTO report "UNITED STATES – MEASURES AFFECTING IMPORTS OF CERTAIN PASSENGER VEHICLE AND LIGHT TRUCK TIRES FROM CHINA"(DS399).
[5]The proposed tariffs by USITC when he conducted the analysis were 55%, while the actual rate is 35%. The former rate is used in his analysis.
[6]This trade deviation is conceptually similar to trade creation and trade diversion; the latter occurs when tariffs are removed among some countries. Please see Panagariya (2000) for a survey on trade creation and trade diversion. Recently, Datta (2011) examined the trade deviation resulting from the removal of textile quotas.
[7]Prusa (2009) additionally investigated the impact on the US tire price and US tire distribution and installation industries. Because the monthly data on the price and other downstream industries are not available, however, this paper focuses on the impact on the employment of the tire manufacturing industry.

quantitative effects may be sensitive to the point when the analysis was conducted, though the qualitative effects would not change. Thus, this paper can be said to examine the short-run (12-18 months) impacts of the tariffs.

One challenge in answering these questions is that we do not have data on what would have happened if there had been no changes in the US tariffs regime for Chinese tires. That is, the key is whether the effects of the tariffs under the situation in which there are changes in the tariffs is significantly different from the hypothetical situation in which there were no changes in the tariffs. Therefore, we selected other industries that are similar to the tire industry but did not experience changes in tariffs, and we assumed that the US domestic tire industry would have followed the trajectory of these industries over time if there had been no changes in the tariffs. Thus, we were able to determine whether the changes in the tariffs have a significant effect relative to the hypothetical situation. Accordingly, we employed a difference-in-difference (DID) estimator for this empirical analysis.

We selected ten industries as our control group. These industries have similar patterns to those of the US tire industry, at least in terms of employment, and have not experienced any tariffs changes during the period of comparison. First, other rubber product manufacturing was selected, which is in the same category as tire manufacturing in the North America Industry Classification System (NAICS). Next, we selected nine sub-industries belonging to motor vehicle parts manufacturing, assuming that the tire and the motor vehicle parts industries are similar in the sense that the goods are mainly used to produce motor vehicles. These nine industries include motor vehicle gasoline engine and engine parts manufacturing, vehicular lighting equipment manufacturing, other motor vehicle electrical and electronic equipment manufacturing, motor vehicle steering and suspension component (except springs) manufacturing, motor vehicle brake system manufacturing, motor vehicle transmission and power train parts manufacturing, motor vehicle seating and interior trim manufacturing, motor vehicle metal stamping, and other motor vehicle parts manufacturing.[8]

Based on the DID estimator, the tariffs on Chinese tires are not beneficial to the US tire industry in terms of employment. In addition, tire imports have deviated from China to other countries such as Korea and Thailand. Indeed, the effect of the tariffs is minimal with respect to the US economy but is beneficial to other countries. The tariffs decreased the share of Chinese tires out

[8] According to NAICS codes, tire manufacturing and other rubber products manufacturing are 32621 and 32629, respectively. There are no other industries under 3262. The other nine industries are 33631, 336321, 336322, 33633, 33634, 33635, 33636, 33637, and 33639. The list is the maximum disaggregated level of the publicly available data.

of total US tire imports by 2.7% per quarter during 4th quarter 2009 and 4th quarter 2010 and increased the share of tires imported from other countries.[9]

In next section, using plots, we review the general trend of US tire imports from abroad and specifically from China, US employment in the tire industry, and US imports and employment in the other industries included in our control group. These plots will give us a sense of how the key variables such as employment and imports changed over time. In section 3, we attempt to examine the effect of the tariffs using the DID estimator. The conclusion follows.

II. Data and Initial Look

Data on monthly imports were from the US International Trade Commission (USITC). Data on monthly employment were from the Bureau of Labor Statistics (BLS). The value of imports was deflated by the yearly price index by industry obtained from the Bureau of Economic Analysis (BEA). Note that the data were obtained from January 2002.[10] We took the quarterly moving average to avoid monthly noise.[11]

The relationship between imports and employment in the US tire industry is shown in Figure 1. The reference line is at 3rd quarter 2009, when the tariffs were imposed on Chinese tires. This figure shows that employment decreased while imports increased over time. The concern of United Steelworkers and the support for WTO's decision are clearly revealed in the figure.[12] Employment generally decreased and then became relatively stable after the tariffs were imposed. We do not know, however, whether this pattern is specific to the tire industry (that is, resulting from the imposition of the tariffs) or general to US economy as a whole because of the recovery from the financial crisis. The other line represents US tire imports from abroad. These imports generally increased over time, except in 2009, when the US was experiencing the global financial crisis. This figure also shows the dramatic recovery of tire imports since the beginning of 2010.

[9]These empirical results are generally consistent with Prusa (2009)'s predictions, though the actual quantitative results are different. Note that his analysis was based on a 55% tariffs rate. In addition, he predicted that Mexico, Brazil, and Indonesia would be among the largest gainers. According to this paper, however, the largest gainers are Korea and Thailand. The differences may be from the differences in the measurement of the imports. In our paper, imports were measured in monetary values, while Prusa's predictions were based on the import quantities. The publicly available data report the import quantities in kilograms in some countries and in numbers of items in other countries. Because of this difference, our analysis was based on the values of the imports.

[10]The analysis from 2002 avoids the negative shock of 'Dot-com' bubble.

[11]The analysis based on monthly data does not change the story of this paper.

[12]We are not sure why we had a bump between 2006 and 2007. The closing of four tire plants in the US might be related with this bump, but we do not know why there was sudden drop and a sudden recovery during that time. Statistical mistakes in BLS may be also possible.

Figure 2 shows the employment for the tire industry and the other industries in our control group. The log value of employment was normalized to 1 for 1st quarter 2005. As we suspected, the recovery beginning in late 2009 also applied to other industries in the control group. Note that motor vehicle parts manufacturing represents the total employment of the nine sub-industries. In general, the employment trajectories show similar patterns over time, which validates our control group. If there were indeed positive effects of the tariffs on Chinese tires on US employment, we should have found a significant uptick in the line representing the tire industry.

Figure 3 shows the pattern of the ratio of imports to employment. The index was also normalized to 1 for 1st quarter 2005. We have already seen the negative relationship over time between employment and imports for the tire industry in Figure 1. This pattern is similar to that of other industries in our control group. This similar pattern was still found even after 3rd quarter 2009, which might imply an insignificant effect of the US tire tariffs on the tire industry. If there were a positive effect, the line would have shown a significant drop relative to the other lines.

We have looked at the relationship between imports and US domestic employment so far. Our initial analysis does not seem to support the idea that the tariffs have a positive impact on the US domestic tire industry. We next turn to the share of major exporting countries out of total US imports. Here, we will see whether the imports were deviated from China to other countries. Figure 4 shows the import shares of five major exporting countries relative to the total US tire imports.[13] As the figure clearly shows, the imports from China plunged from the date that the tariffs were imposed. Before the tariffs went into effect, Chinese tires accounted for over 30% of imported tires at the peak. The proportions of Chinese tires decreased to 20% by 4th quarter 2010.

If there were no deviations across countries, we should have found no significant changes in terms of the share across countries. In the case of Canada, the share generally decreased over time, increased around the time in which the tariffs was imposed, and then returned to the 2008 level. As of 4th quarter 2010, the share of Canadian tires was approximately 15%. Japan's share generally decreased over time and then became stable around the time at which the tariffs went into effect. More dramatic changes were found for Korean tires. The share of Korean tires hovered at slightly less than 10% and suddenly spiked after the tariffs went into effect. The share was over 10% in 4th quarter 2010. For Thailand, the share increased, especially after 2004, and seemed to increase more after the tariffs was imposed. However, it is hard to tell whether there was dramatic change after the tariffs went into effect from the figure alone. Because the share

[13]This ranking is based on the import value in the US. In terms of import quantity, the fifth exporting country is Indonesia, as in Prusa's paper (2009).

continuously increased even before the changes in the tariffs, we need to analyze this change using econometric tools.

Figure 5 shows the pattern of the imports share from each country across sectors. In particular, whether the changes in the share are different between tire industry and other industries is roughly evaluated. For instance, a scenario in which Korea and Thailand have sudden gains in the share of the US imports in other industries as well as the tire industry since late 2009 would represent the general improvement of the comparative advantages of these countries applying to all industries; thus, the gains would not be specific to the tire industry. In other words, the gains of these countries are not the result of the tariffs changes if the gains are also experienced by other industries.

Figure 5.a shows the import share for China across sectors. This figure clearly shows the effect of the tariffs on the Chinese tire industry. The imports from China increased over time for other industries and for the tire industry. The share for the tire industry plunged after the tariffs were imposed, however, while the share did not have any significant change in other industries. Figure 5.b shows the data for Canada. The share generally decreased over time across sectors, increased right after the tariffs were imposed, and returned to the normal trend. From the figure alone, however, it is difficult to tell whether there was a significantly different pattern after the tariffs were imposed between the tire industry and other industries. The data for Japan is shown in Figure 5.c. The share in the tire industry seems to increase after the tariffs went into effect, but the pattern was similar to that for other rubber products, which makes it difficult to tell whether the effect on the tire industry is a specific effect resulting from the tariffs changes or if the observed effect is the result of Japan's general gain in global competitiveness. As in Figure 4, the most dramatic change was for Korea in Figure 5.d. The Korean share was stable across industries before the changes in the tariffs, but there was a dramatic increase in the share for the tire industry after the tariffs went into effect. In the case of Thailand in Figure 5.e, it is a difficult to compare the tire industry with other industries because the patterns are different for the different sectors. The share for the tire industry increased since 2004 and continued to grow after the changes in the tariffs structure, while the share was quite stable for other industries. We need to use econometric tools to determine the real effect of the tariffs changes.

III. Econometric Analysis

This section discusses the results based on econometric analysis. The key of the empirical analysis was to determine what would have happened if there had been no changes in the tariffs

on Chinese tires. That is, what matters is whether the changes after the tariffs were imposed are significantly different from the changes that would have occurred with no tariffs changes.

Because the hypothetical data for no tariffs imposition do not exist, we assumed that the tire industry would have had a pattern similar to those of the other industries in our control group. We assumed that an industry in the same industry category would be the most similar to the tire industry. For this reason, we first selected the other rubber products industry. Note that, according to the NAICS codes, the tire industry is 32621, and the other industry under the 3262 group is other rubber products. In addition, because the tariffs were on automobile and light-truck tires, we selected motor vehicle parts manufacturing as another control group, assuming that industries supplying goods to motor vehicles would be similar. There are nine sub-industries under this category that have publicly available data.

To check the validity of our control group, Table 1 reports the mean values of the key variables before 3rd quarter 2009. If the values are similar to one another, we assumed that our control group was valid. As the table shows, the mean values were not substantially different. Particular attention should be given to the fourth and fifth columns, that is, the quarterly changes in employment and imports. Because we will eventually compare the quarterly changes in the variables between the tire industry and control group, a key criterion is to have no significant differences in terms of quarterly changes across sectors. These values are not significantly different across sectors, which validates the credibility of our control group.[14] That is, the tire industry and other industries had similar patterns in terms of quarterly changes in employment and imports before 3rd quarter 2009.

We attempted to examine the effects of the tariffs using the difference in difference estimator. The estimation equation is as follows:

$$\Delta Y_{it} = \alpha_1 + \alpha_2 \Delta DID_{it} + \alpha_3 D(t \geq 4Q, 2009) + D_i + D_{qr} + D_{yr} + \varepsilon_{it},$$

$$DID_{it} = \begin{cases} 1 & if\ i = Tire\ \&\ t \geq 4Q, 2009 \\ 0 & otherwise \end{cases}, \qquad D(t \geq 4Q, 2009) = \begin{cases} 1 & t \geq 4Q, 2009 \\ 0 & otherwise \end{cases}$$

Note that the empirical analysis is based on quarterly data. We have other dummy variables such as industry, quarter, and year. The industry dummy variable controls for industry-specific trends. For instance, when investigating Thailand's share of imports, the upward trend of Thailand's tires in Figure 5.e will be controlled for by this industry dummy variable. In addition, year dummy variable controls for year-specific shocks such as the financial crisis. The variable of interest is

[14]We conducted a mean difference test, and the test statistic is not significant.

α_2. If this variable is significant, then we can say that the imposition of tariffs on Chinese tires since September 2009 has had a statistically significant impact on the tire industry.

The effect of the tariffs on Chinese tires on employment in the US tire industry is reported in Table 2. If there were positive effects on employment in the US tire industry, as the Steelworkers union had hoped there would be, then the coefficient of the DID should be positive. It is actually negative, however, though it is not significant. This result is interesting. The tariffs were not expected to have a negative impact on US domestic employment. One possible explanation is that, as the US tire industry lost competitiveness with the price increase due to the tariffs, the US downstream industry may have changed tire sourcing from domestic to foreign suppliers. Another possible explanation is that, as Prusa (2009) suggested, the foreclosure of low-end tire supply from China led already economically distressed firms to shut down and lay off workers. The variable D(t>=4Q,2009) is positive, reflecting the recovery of the US economy found across all sectors in Figure 2.

Given that there was no positive effect on the US domestic economy, we next examined whether the tariffs simply deviated imports from China to other countries in a significant way. First, we tested whether the imports from China were significantly affected by the tariffs. In this case, the dependent variable was the share of Chinese goods out of the total US imports in each industry. The results are reported in first column of Table 3. As expected, the tariffs on Chinese tires had a significant negative effect. As for the magnitude, the China's share decreased by 2.7% each quarter after 3rd quarter 2009 relative to other sectors. This estimation result is consistent with the idea of the empirical analysis design. As shown in Figure 5.a, the share was predicted to have been approximately 35% in 4th quarter 2010 if there had been no changes in the tariffs. On the other hand, the real share was lower, at 20%. Therefore, the difference is equivalent to the decrease in the share, which was an average of 2.7% per quarter from 4th quarter 2009 to 4th quarter 2010.

The next series of columns shows the estimates for other major exporting countries, Canada, Japan, Korea, and Thailand. In the case of Canada and Japan, there was no significant deviation from China. On the other hand, the next two countries experienced significant gains in terms of import share relative to the total US tire imports. The share increased by 0.38% to 0.65% per quarter. We also attempted to estimate other countries' share and found no significant gains in those countries.[15]

[15] Ten major exporting countries to the US in tire industry are China, Canada, Japan, Korea, Thailand, Mexico, Taiwan, Germany, Indonesia, and Brazil.

There are a few experiments to test the validity of the DID estimator. One could argue that the results might depend on the time length of pre-tariff period. If the pre-tariff period was significantly different between the treatment group and the control group, the estimation results might be due to the pre-tariff differences rather than the effect of the tariffs. To resolve this concern, we try various pre-tariff periods such as January 2008 as the starting point of the analysis. Our estimation results do not change. For this particular experiment, it is worth noting the effect in the case of Thailand. The DID variable was still positive and significant even after taking the pre-tariff period from 1st quarter 2004. It implies that the gain after the tariffs were imposed was not due to the general Thailand's competitiveness, but due to specifically the tariff changes. Another experiment is to try various hypothetical tariff points such as 1st quarter 2008 instead of 3rd quarter 2009, after removing the data from 4th quarter 2009. If we could still find the significant coefficient of the DID variable in this experiment, the coefficient in Table 2 is not due to the tariff changes. As Table 4 shows the results of this experiment assuming the tariffs changes hypothetically occurred in 1st quarter 2008.[16] The DID variable is not significant in any case, which validates the DID estimator.

IV. Conclusion

This paper analyzed the short-run effects of the tariffs imposed on Chinese tires by the US in September 2009. Unlike the expectations of the US government and the Steelworkers union, we did not find any significant positive impact on US domestic employment in the tire industry. Rather, the tire imports from Korea and Thailand increased while the imports from China dropped. These results support the argument proposed by the US-China Business Council that the tariffs would not spur the success of the US domestic tire industry; rather, the tariffs would deviate tire imports from China to other countries.

Note that this paper focuses on the short-run effect of the tariffs. Multinational corporations with multiple plants abroad, which supply most of the tires to the US market, might have temporarily have deviated their production allocation from China to other countries. It is possible, however, that they will reallocate their production back to China in the long run. Analysis of the long-run effects will be conducted no sooner than in three years because the tariffs on Chinese tires will be removed then.

[16] We tried various hypothetical tariffs changes. In most cases, the DID variable was not significant. When it was significant, it had an opposite sign from our original results in Table 3, which reinforces the story of this paper.

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Figure 1. Tire Imports to the US and Employment of the US Tire Industry

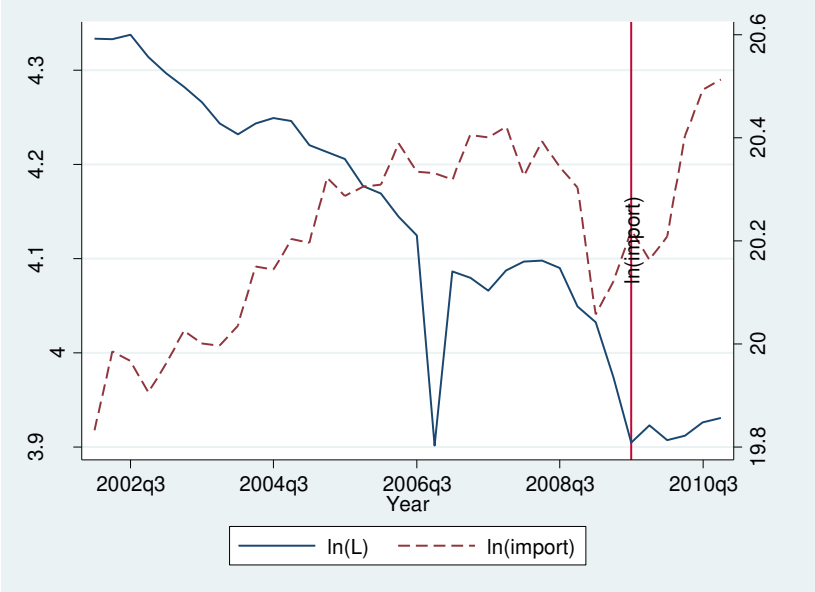
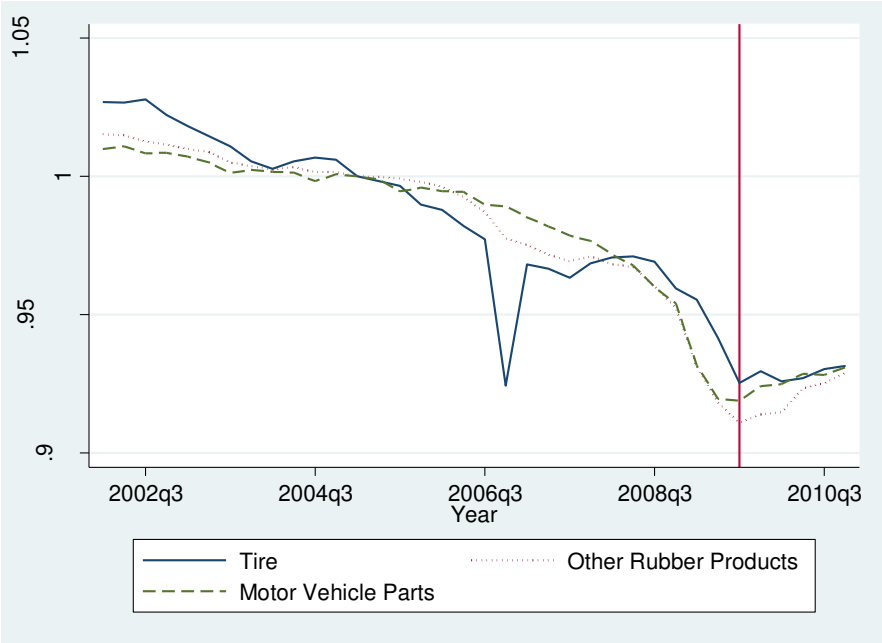
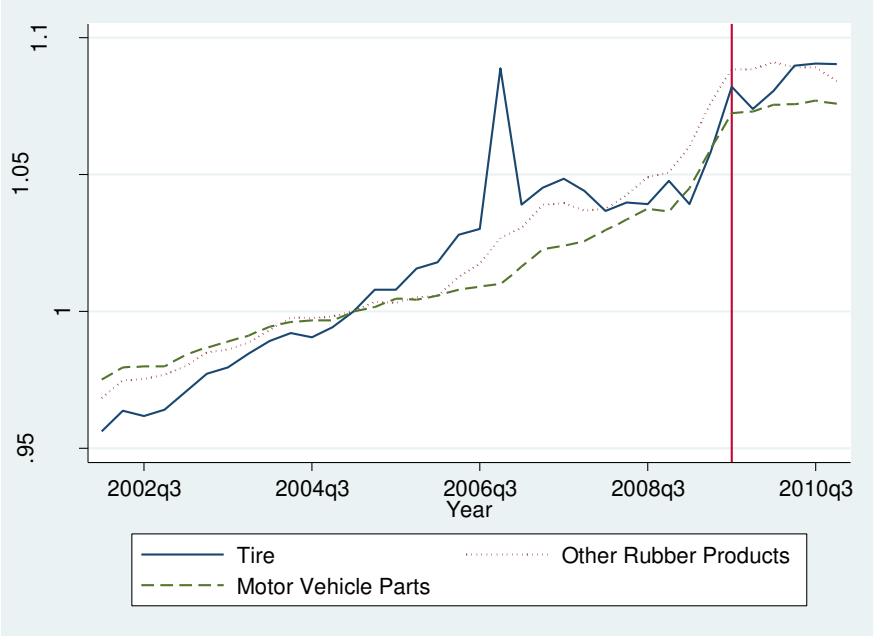


Figure 2. Employment of the Tire Industry and Other Control Group Industries



Note: ln(L) was normalized into 1 for January 2005.

Figure 3. The Ratio of Imports to Employment for the Tire and Control Group Industries



Note: ln(Imports)/ln(L) was normalized into 1 for January 2005.

Figure 4. Tire Import Shares of Major Exporting Countries

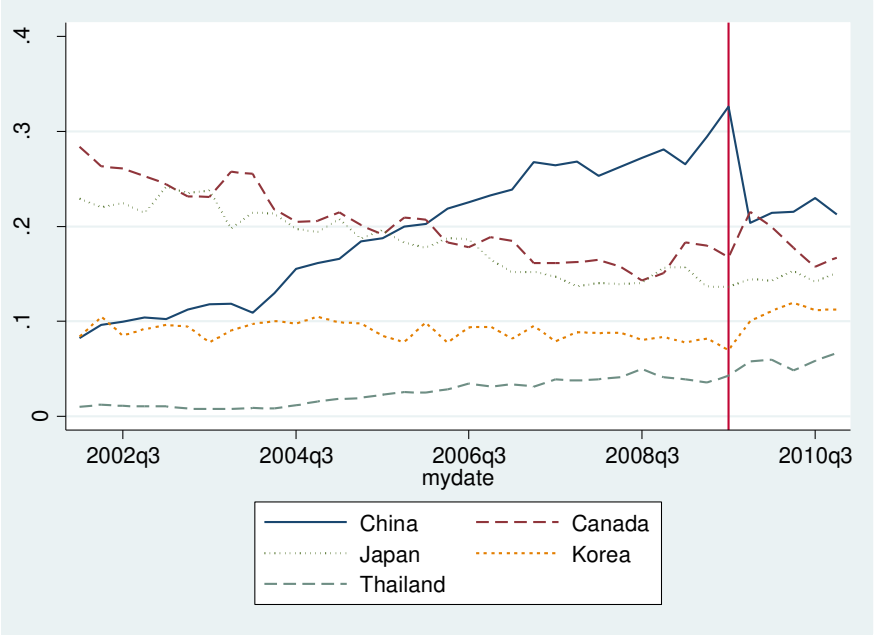
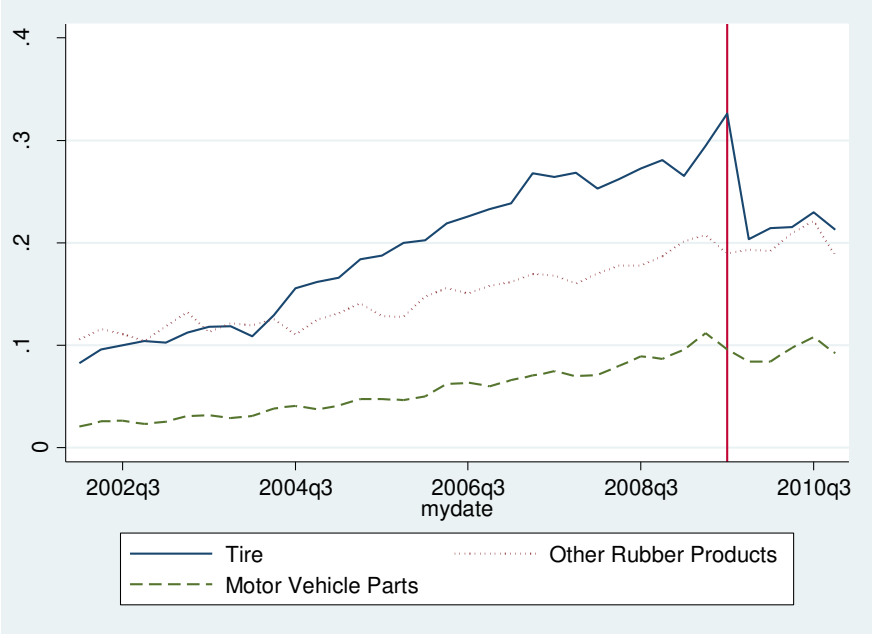
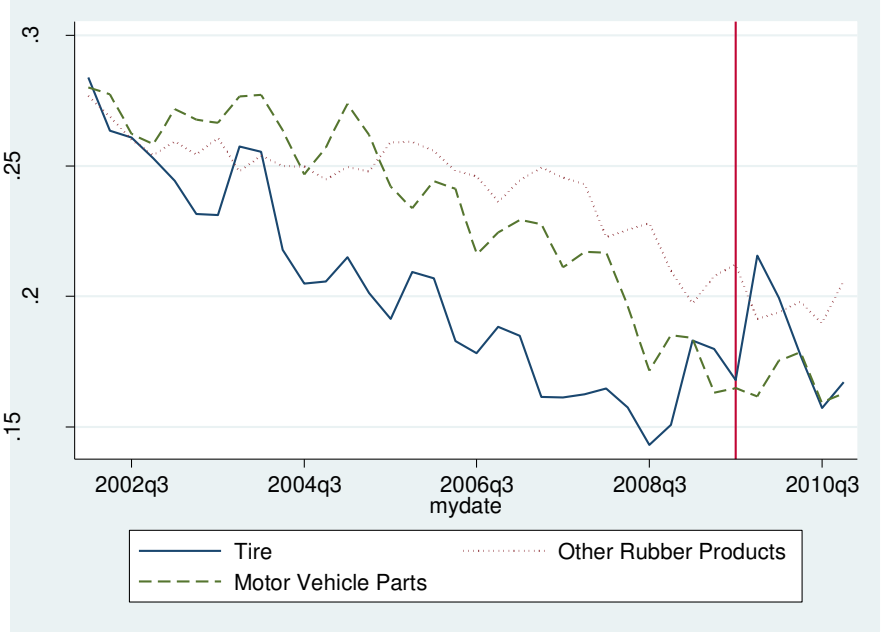


Figure 5. The Share of Imports of Tires and Control Products

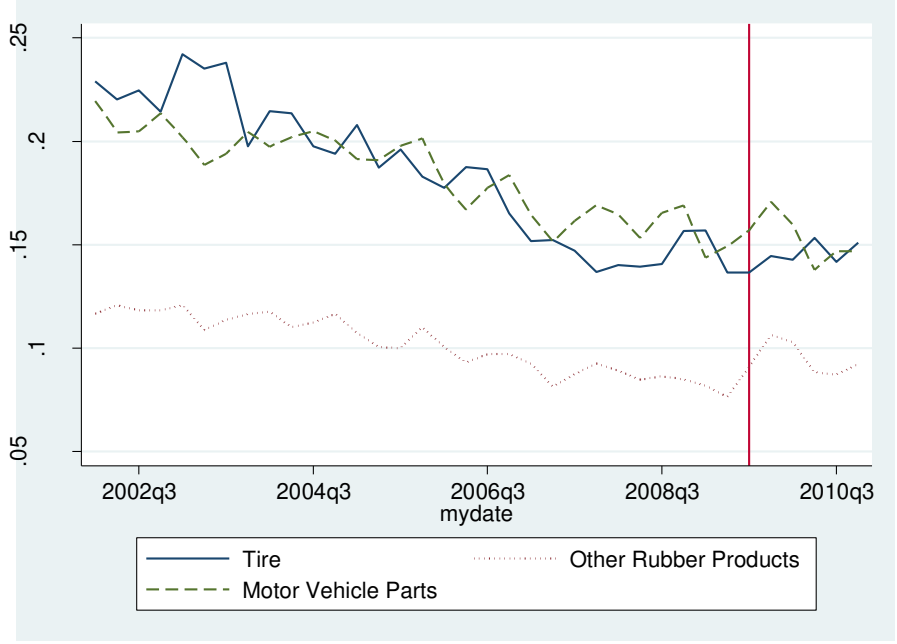
a. China



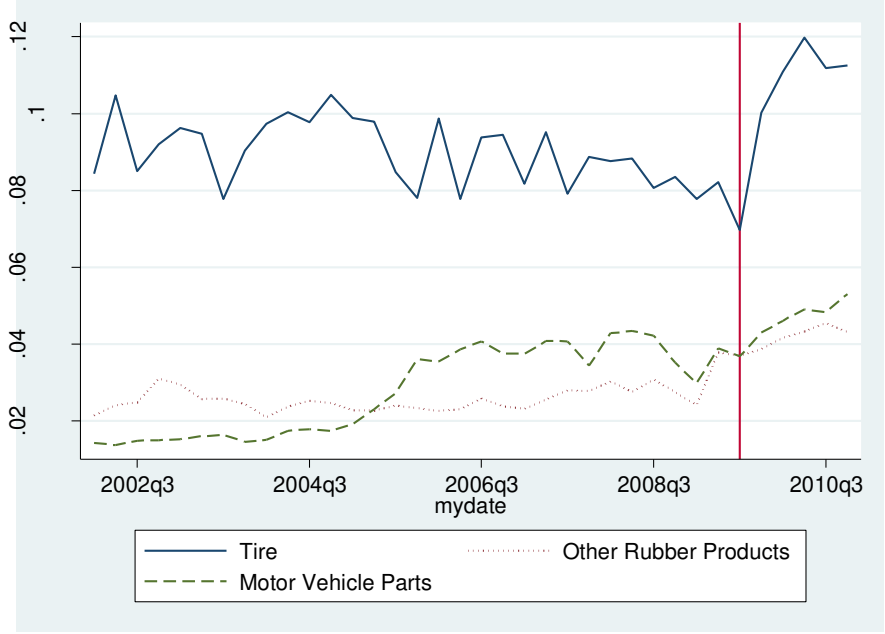
b. Canada



c. Japan



d. Korea



e. Thailand

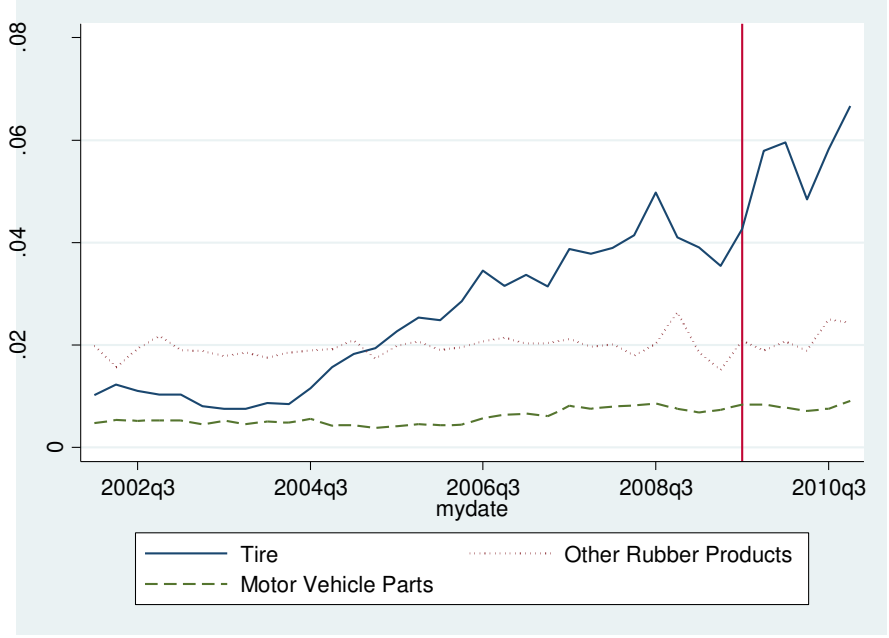

.08
.06
.04
.02
0
2002q3
2004q3
2006q3
2008q3
2010q3
mydate
Tire
Other Rubber Products
Motor Vehicle Parts

Table 1. Mean of Variables across Sectors

	ln(L)	ln(Imports)	dln(L)	dln(Imports)
Tire	4.1642	20.1935	-0.0145	0.0127
Other Rubber Products	4.5508	19.4702	-0.0160	0.0052
Motor vehicle gasoline engine & engine parts	4.2858	20.6591	-0.0250	-0.0061
Vehicular lighting equipment	2.7179	18.5537	-0.0135	0.0124
Other motor vehicle electrical & electronic equipment	4.2857	20.3672	-0.0265	-0.0003
Motor vehicle steering & suspension component	4.3708	20.5692	-0.0194	0.0034
Motor vehicle brake system	4.0942	19.5078	-0.0111	0.0041
Motor vehicle transmission & power train parts	4.4970	17.4606	-0.0253	-0.0126
Motor vehicle seating & interior trim	5.0752	21.2536	-0.0149	0.0037
Motor vehicle metal stamping	3.6883	19.4898	-0.0188	0.0087
Other motor vehicle parts	3.6528	19.51985	-0.0237	0.0093

Note: Mean difference between Tire and other sectors are not significant.

Table 2. Results for Employment in US Tire Industry

DID	-0.0134
	(0.0149)
D(t>=4Q, 2009)	0.0962***
	(0.0109)
Industry	Yes
Quarter	Yes
Year	Yes
Observations	396
R-squared	0.378

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 3. Results for the Share of Major Exporting Countries relative to total US Imports

	China	Canada	Japan	Korea	Thailand
DID	-0.0275***	0.000852	0.00383	0.00649*	0.00381***
	(0.00572)	(0.0112)	(0.00743)	(0.00364)	(0.00102)
D(t>=4Q, 2009)	-0.0126***	0.00168	0.00614	0.00791***	0.00117
	(0.00421)	(0.00825)	(0.00547)	(0.00268)	(0.000752)
Industry	Yes	Yes	Yes	Yes	Yes
Quarter	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Observations	396	396	396	396	396
R-squared	0.243	0.073	0.233	0.092	0.175

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4. Hypothetical Tariffs Changes in 1st quarter 2008

	US empl	China	Canada	Japan	Korea	Thailand
DID	0.0219	0.00291	0.0112	0.000712	-0.00230	-0.000393
	(0.0145)	(0.00451)	(0.0111)	(0.00723)	(0.00347)	(0.000865)
D(t>=2Q, 2008)	-0.0186	0.00471	0.00494	0.00151	-0.00668**	-0.000689
	(0.0114)	(0.00355)	(0.00871)	(0.00569)	(0.00273)	(0.000681)
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Quarter	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	341	341	341	341	341	341
R-squared	0.329	0.179	0.071	0.223	0.070	0.145