

Did China Tire Safeguard Save U.S. Workers?*

Sunghoon Chung[†]

Joonhyung Lee[‡]

Thomas Osang[§]

January 24, 2013

Abstract

It has been well documented that trade adjustment costs to workers due to globalization are significant and that temporary trade barriers have been progressively used in many countries, especially during periods with high unemployment rates. Consequently, temporary trade barriers are perceived as a feasible policy instrument for securing domestic jobs in the presence of increased globalization and economic downturns. However, no study has assessed whether such temporary barriers actually save domestic jobs. To overcome this deficiency, we evaluate the China-specific safeguard case on consumer tires petitioned by the United States. Contrary to claims made by the Obama administration, we find that total employment and wages in the tire industry were unaffected by the safeguard using the ‘synthetic control’ approach proposed by Abadie et al. (2010). Further analysis reveals that this result is not surprising as we find that imports from China are completely diverted to other exporting countries due to the strong presence of multinational corporations in the world tire market, leaving the subject tire prices in the U.S. unchanged.

JEL Classification: F13, F14, F16

Keywords: China Tire Safeguard, Temporary Trade Barriers, Trade Diversion, Synthetic Control Method.

*We thank James Lake and Daniel Millimet for their constant feedback and discussions. We also thank Maggie Chen, Timothy Salmon, Romain Wacziarg, Leonard Wantchekon, as well as seminar participants at SMU for helpful comments. All errors are ours.

[†]Corresponding author, Department of Economics, Southern Methodist University, 3300 Dyer Street, Suite 301 Umphrey Lee Center, Dallas TX 75275, USA, Tel: 1-214-768-4337, Fax: 1-214-768-1821, Email: sunghoonc@smu.edu

[‡]Department of Economics, Fogelman College of Business and Economics, The University of Memphis, Email: jlee17@memphis.edu

[§]Department of Economics, Southern Methodist University, Email: tosang@smu.edu

“Over a thousand Americans are working today because we stopped a surge in Chinese tires, but we need to do more.”

- President Barack Obama, State of the Union Address, Jan 24th, 2012.

“The tariffs didn’t have any material impact on our North American business.”

- Keith Price, a spokesman for Goodyear Tire & Rubber Co., Wall Street Journal, Jan 20th, 2012.

1 Introduction

While trade barriers have reached historically low levels, a growing number of countries are worried about job losses as a consequence of the trade liberalization. The concern is well epitomized in the recent U.S. trade policy agenda. The Obama administration has filed trade dispute cases with the World Trade Organization (WTO) at a pace twice as fast as that of the previous administration. Moreover, the Interagency Trade Enforcement Center (ITEC) was set up in February 2012 to monitor and investigate unfair trade practices.¹ During the 2012 presidential election, both candidates pledged to take even stronger actions to protect U.S. businesses and workers.²

The incentives to secure jobs by raising trade barriers are well explained in the literature. Political economy of trade policy theory explains that higher risk of unemployment makes individuals more protectionist, which induces them to demand more protection through voting or union lobbying activity. The politicians who seek re-election then protect industries with high unemployment rates (Wallerstein 1987; Bradford 2006; Matschke and Sherlund 2006; Yotov 2012). In addition to political economy considerations, there are other models that justify protectionism. Costinot (2009) derives a model where the aggregate welfare can improve when highly unemployed industries are protected. Davidson et al. (2012) emphasize fairness or altruistic concern toward displaced workers as another incentive for protection. Bagwell and Staiger (2003) argue that trade policies are preferred to domestic redistributive policies because they *beggar thy neighbor*: While domestic policies come at the expense of domestic residents, trade policies cost foreigners.

Surprisingly, however, the literature so far has ignored to check whether such protective trade policies can actually save domestic jobs. In fact, studies have only focused on the other

¹See Rapoza (2012, January 25th) *Forbes*.

²In fact, ever-increasing imports from China were discussed as one of the greatest future threats to the national security of the U.S. in the debates for the 2012 presidential election.

direction, i.e., how trade liberalization affects employment or wages. Gaston and Trefler (1994) and Trefler (2004), for example, find that import competition due to tariff declines have negative effects on wages in the U.S. and employment in Canada. In recent studies, Autor et al. (2012a,b) estimate how much the import surge from China costs U.S. manufacturing employees, and find that the greater import competition causes higher unemployment, lower wages, less labor market participation, and greater chance of switching jobs and receiving government transfers. Roughly speaking, these costs account for one quarter of the aggregate decline in U.S. manufacturing employment. McLaren and Hakobyan (2012) also find a significant adverse effect of import exposure to Mexico on U.S. wage growth for blue-color workers after the implementation of the North American Free Trade Agreement (NAFTA).³

The evidence above seems to imply that re-imposing trade barriers would secure domestic jobs. However, most recent protection policies are enacted in the form of antidumping, countervailing duties, or safeguards, which are systematically different in their nature from the classical trade barriers such as Most-Favored-Nation (MFN) tariff rates and import quotas that have been lowered in recent decades. These policies, often collectively called temporary trade barriers (TTBs), are typically (i) contingent, (ii) temporary, and (iii) discriminatory in that duties are imposed for a limited time to a small set of products from particular countries.⁴ Due to their characteristics, there are at least two channels that may divert trade flows and weaken the impact of a TTB on domestic markets. First, the temporary feature of TTBs can allow targeted exporting firms to shift their sales to before or after the tariff intervention period. Second, perhaps more importantly, the discriminatory feature can divert the import of subject products from the targeted country to other exporters. Thus, whether – and the degree to which – a TTB can secure domestic jobs remains an unanswered empirical question.

Despite the lack of empirical evidence, many WTO member countries have already been opting for TTBs, especially in domestic recession phases with high unemployment rates. Knetter and Prusa (2003) link antidumping filings with domestic real GDP growth to find their counter-cyclical relationship during 1980-1998 in the U.S., Canada, Australia, and the European Union. Irwin (2005) extends a similar analysis to the period covering 1947-2002 in the U.S. case, and finds that the unemployment rate is an important determinant of antidumping investigations. More recently, two companion studies by Bown and Crowley (2012, forthcoming) investigate thirteen emerging and five industrialized economies, respectively, and report evidence that a high unemployment rate is associated with more TTB incidents.

This paper aims to fill the deficiency in the literature by evaluating a special safeguard case on Chinese tires (China Tire Safeguard or CTS, henceforth) that has received a great

³Similar patterns are observed in developing countries, too. See Goldberg and Pavcnik (2005) for Columbia, Menezes-Filho and Muendler (2011) and Kovak (2012) for Brazil, Topalova (2010) for India.

⁴An exception to discriminatory feature is Global safeguard measure, since it is imposed to all countries.

deal of public attention among recent TTB cases.⁵ Under section 421 China-specific safeguard, the U.S. imposed higher tariffs on certain Chinese passenger vehicle and light-truck tires for three years from the fourth quarter of 2009 to the third quarter of 2012. The safeguard duties were 35% ad valorem in the first year, 30% in the second, and 25% in the third on top of the MFN duty rates.⁶ The case has triggered not only Chinese retaliation on U.S. poultry and automotive parts, but also a serious controversy on its effectiveness for the U.S. tire industry.⁷ Even in lieu of such controversy, the CTS has been cited as a paragon of successful trade policy for job security during the 2012 presidential campaign by both candidates.

The CTS provides a uniquely advantageous setting for answering the question of this paper. While the CTS is representative in that it bears all three TTB characteristics described above, one important distinction of the CTS is that the safeguard duties are exogenously determined. In antidumping cases, which are the most pervasive form of TTB, duties are endogenously determined to offset the dumping margin. Even after the duties are in place, they are recalculated over time to adjust the dumping behavior changes of exporting firms.⁸ These endogenous tariff changes complicate the evaluation of a tariff imposition effect. Secondly, the change in the total import of subject Chinese tires before and after the safeguard initiation is considerably large in both levels and growth rates.⁹ If TTBs have labor market outcomes, this dramatic change should allow us to observe it. Third, contrary to most trade disputes for which producers settle a claim, the petition for the CTS was filed by the union representing employees. This implies that the petition is indeed intended for employees' benefits and thus labor market effects.¹⁰

Estimating the impact of the China Tire Safeguard brings some challenges that need to be addressed. Above all, estimates may be confounded by macroeconomic trends. Since the U.S. economy has been in recovery after the great recession of 2008-09, one may capture a spurious labor market effects that would have occurred even without tariff changes. A typical identification strategy in this case is to compare the tire industry with similar industries who have not experienced tariff changes. However, there is no clear criterion for choosing appropriate control industries in our case. To circumvent this problem, we exploit the synthetic control method (SCM) designed by Abadie and Gardeazabal (2003) and Abadie et al. (2010). The core strategy of the SCM is to construct a "synthetic" industry by optimally weighting a group of potential controls so that its outcome resembles the outcome of the tire industry as close as

⁵Prusa (2011, P. 55) describes the China Tire Safeguard as "one of the most widely publicized temporary trade barriers during 2005–9, garnering significant press attention both in the USA and in China."

⁶MFN duty rates are 4% for radial (or radial-ply) tires and 3.4% for other type (bias-ply) of tires.

⁷See also Bussey (2012, January 20th) in *Wall Street Journal*.

⁸This recalculation process is also called administrative review process. Many studies investigate the implication of the review process on exporting firm's pricing behavior. See, for example, Blonigen and Haynes (2002) and Blonigen and Park (2004).

⁹Detail statistics are provided in Section 3.

¹⁰Prusa (2011) argues that the last two features are the main reasons of receiving unusual public attention.

possible during the pre-treatment period. Hence, the synthetic industry will most likely mimic the tire industry for the post-treatment period as well, had not the safeguard measures been imposed.

The SCM estimates provide a striking result. Contrary to the Obama administration’s claim that the safeguard measures had a positive effect on the labor market (see quote above), we find that total employment and wages in the tire industry show no different time trends from those in the synthetic industries. Our result is supported by another finding that the substantial drop in Chinese tire imports is completely offset by the increase in imports from other countries. This complete import diversion leaves little room for domestic producers to change output or price of subject tires, which in turn induces no change in the labor market. Thus, our study highlights that the discriminatory feature of TTB plays a crucial role for the negligible labor market effect.

To our best knowledge, there is no study that investigates the effect of a TTB on domestic labor market outcomes. Some papers have looked at the exporting firms’ strategic responses to a TTB through price adjustments (Blonigen and Haynes 2002; Blonigen and Park 2004), quantity controls (Staiger and Wolak 1992), or tariff-jumping investment (Blonigen 2002; Belderbos et al. 2004). These firm behaviors alter the aggregate trade patterns, and these changes in trade patterns have been analyzed in the literature (Prusa 1997; Brenton 2001; Bown and Crowley 2007). Other studies have turned their attention to TTB effects on domestic firms, with particular interests in output (Staiger and Wolak 1994), markup (Konings and Vandenbussche 2005), profit (Kitano and Ohashi 2009), and productivity (Konings and Vandenbussche 2008; Pierce 2011).¹¹ Although these studies may have some implications for labor market outcomes, they are insufficient to draw definite conclusions on employment and wage effects.

We begin our study with an overview of the China safeguard and the U.S. tire industry in section 2. Section 3 describes data and time trends of Chinese tire imports and employment. Section 4 provides the empirical model and discusses the results, and section 5 explores a potential mechanism that has driven our results. Section 6 concludes with policy implications and the direction of future researches.

2 Overview of China Safeguard and the U.S. Tire Industry

The U.S. Trade Act of 1974 describes conditions under which tariffs can be applied and which groups can file a petition. In response, the International Trade Commission (USITC) makes a recommendation to the president. The president then makes a decision whether to approve or veto the tariff. Two sections (Section 201 and 421) of the Trade Act of 1974 deal with the use

¹¹These studies mostly deal only with antidumping cases. Blonigen and Prusa (2003) provide a comprehensive survey on the literature of antidumping.

of safeguard tariffs. Under Section 201 (Global Safeguard), USITC determines whether rising imports have been a substantial cause of “serious” injury, or threat thereof, to a U.S. industry. On the other hand, Section 421 (China-specific Safeguard or China Safeguard) applies only to China. China Safeguard was added by the U.S. as a condition to China’s joining the WTO in 2001 and is due to expire in 2013. Under Section 421, the USITC determines whether rising imports from China cause or threaten to cause a significant “material” injury to the domestic industry. During 2002 to 2009, seven China Safeguard cases had been filed, of which two were denied by the USITC and five were approved. Of these five approved cases, the president ruled in favor of only one, which is the tire case.

There are a number of noteworthy differences regarding Global Safeguard vs. China Safeguard. First, the term “serious” vs. “material” implies a significant difference. Simply put, China Safeguard can be applied under weaker conditions than Global Safeguard. For China Safeguard to be applied, rising imports do not have to be the most important cause of injury to the domestic industry, while this has to be the case for Global Safeguard. That is, the imports from China need not be equal to or greater than any other cause. Second, China Safeguard is discriminatory and allows MFN treatment to be violated.¹²

The U.S. tire industry has several characteristics to be considered for our analysis. First, tire production is dominated by a few large multinational corporations (MNCs) in both the U.S. and the world. As of 2008, ten firms produce the subject tires in the U.S., and eight of them are MNCs.¹³ Production of the subject tires are so concentrated that five major MNCs (Bridgestone, Continental, Cooper, Goodyear, and Michelin) control about 95% of domestic production and 60% of worldwide production.¹⁴ Except Continental, Seven MNCs of the ten domestic producers also have manufacturing facilities in China. Second, the subject tires are known to feature three distinct classes, flagship (high quality), secondary (medium quality), and mass market (low quality). The domestic producers have largely shifted their focus to higher-value tires since 1990s, leaving mass market tire productions to overseas manufacturers.

These characteristics explain why the petition was not welcomed by the U.S. tire producers. The temporary tariff protection may actually hurt the MNCs’ global production strategies. Moreover, the CTS would not have any positive influence to their domestic facilities that mainly produce high and medium quality tires, given that those tires are not well substitutable

¹²There are three other primary areas under the WTO in which exceptions to MFN-treatment for import restrictions are broadly permissible: (1) raising discriminatory trade barriers against unfairly traded goods under antidumping or countervailing duty laws; (2) lowering trade barriers in a discriminatory manner under a reciprocal preferential trade agreement; and (3) lowering trade barriers in a discriminatory manner to developing countries unilaterally, for example, under the Generalized System of Preferences (GSP). For an additional discussion of the China safeguard, see Messerlin (2004) and Bown (2010).

¹³The ten U.S. subject tire producers are Bridgestone, Continental, Cooper, Denman, Goodyear, Michelin, Pirelli, Specialty Tires, Toyo, and Yokohama. Eight firms except Denman and Specialty Tires are MNCs.

¹⁴Data source: Modern tire dealer (<http://www.moderntiredealer.com/stats/default.aspx>).

for low quality Chinese tires.¹⁵

3 Data and Descriptive Statistics

Our data on quarterly imports from 1998Q1 to 2012Q1 are taken from the U.S. International Trade Commission. Import data are available up to Harmonized System (HS) 10-digit, and each 10-digit code is defined as a “product”. Import value is measured by customs value that is exclusive of U.S. import duties, freight, insurance, and other charges. We also define each “industry” as the 5-digit industry in the North American Industry Classification System (NAICS). According to the definition, the tire industry is 32621, “Tire Manufacturing”, which comprises establishments primarily engaged in manufacturing tires and inner tubes from natural and synthetic rubber and retreading or rebuilding tires. This corresponds to 57 tire-related products in the HS 10-digit level (with heading 4011, 4012, and 4013) among which 10 tire products are subject to the safeguard measures.

Data on employment and wages in U.S. tire industry covering the same time period are from the Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW).¹⁶ In fact, Bureau of Labor Statistics provides two different industry-level employment databases, the QCEW and the Current Employment Statistics (CES). We use the QCEW in this paper, because it has total employment and wages statistics for all 5-digit industries, while the CES contains only part of them.¹⁷ For industry-level characteristics as predictors of employment and wages, we use data taken from the Annual Survey of Manufactures in 2008.

Figure 1 plots time trends of the aggregate import value of the ten tire products subject to the CTS as well as total employment in the U.S. tire industry from 1998Q1 to 2012Q1. The import of Chinese tires starts to surge in 2001, just before China’s accession to the WTO. It continues to grow dramatically until the activation of the CTS, except for a slight drop in early 2009 due to the global financial crisis.¹⁸ Specifically, the import increases by 300 times during ten years from \$5.2 million dollars in 1999 to \$1.56 billion dollars in 2008. In terms of relative size, China alone accounts for a quarter of the U.S. total import of subject tires in 2008, with tire imports from the rest of the world (ROW) at \$4.80 billion dollars in the same year. The value also amounts to 9.2% of gross value added of the U.S. tire industry in 2008, which stood at \$16.98 billion dollars.

¹⁵Because of these characteristics of the U.S. tire industry, Prusa (2009) predicted that the effect of the CTS would be negligible.

¹⁶While wages are reported on a quarterly basis, employment data are produced monthly. We construct quarterly employment data by simply averaging of the monthly data.

¹⁷Both databases have employment data in the tire industry. We checked the discrepancy between the two data, but there was no systematic or significant difference.

¹⁸As Staiger and Wolak (1994) finds, subject tire imports may also fall because of the safeguard investigation started from April in 2009.

The punitive tariffs substantially discourage the rising trend, reducing total imports from China by 62% between 2009Q3 to 2009Q4. A sharp rise between Q2 and Q3 followed by the sharp decline between Q3 and Q4 indicates that some importers in the U.S. bought the subject Chinese tires in advance of the CTS to avoid the higher expected price after 2009Q3. After 2009Q4, tire imports from China are relatively flat, albeit at a much lower level compared to pre-CTS levels.

Interestingly, the trend of employment in the U.S. tire industry stands in sharp contrast to the trend of Chinese tire imports. It starts to fall when the Chinese tire imports start to rise in 2001. In particular, the decline of employment in 2002Q1 coincides with China's WTO accession. Another falloff in 2006Q4 is caused by the strike in the U.S. tire industry and is not relevant to the Chinese tire imports. In terms of growth, employment in the U.S. tire industry falls by 30.5% from 2002Q1 to 2009Q3.¹⁹

The activation of the CTS seems to not only stop further decline in employment (with some lags) but also prompt a slight recovery thereafter. As the Obama administration claims, total employment increases from 52,388 in 2009Q3 to 53,912 in 2011Q4, an increase of more than fifteen hundred workers. However, the employment trend around 2009 is obviously confounded by the economic recovery from the global financial crisis, and thus the time-series data alone do not allow us to identify the safeguard effect on employment in the U.S. tire industry.

4 Empirical Method and Results

4.1 Empirical Method

A major challenge in evaluating the impact of safeguard measures on the U.S. tire industry concerns the issue of how to isolate the 'true' policy impact from other factors such as macroeconomic trends. A typical identification strategy in this case is the Difference-In-Differences (DID) design. In a conventional DID model, the treatment (tire) industry is compared with some control industries that have not experienced any policy change under the assumption that the treatment industry would have followed the same trend as control industries had the policy not changed. Therefore, the DID model requires a proper selection of a control group to satisfy the common trend assumption.

However, in our case study, there is no clear criterion which industries should be chosen as the control group. One naive solution would be, for example, to choose all other industries with the same NAICS 3-digit code (i.e., 326 Plastics and Rubber Product Manufacturing) since they

¹⁹Note that, however, there are many other industries that suffered from more severe employment losses than the tire industry over the same period. For example, we compare the employment growth rates of ten 5-digit industries under NAICS 326 Plastics and Rubber Products Manufacturing industry in Table 2. The table shows that three out of ten industries have lower employment growth rates than the tire industry has.

are classified within the same 3-digit code based on the similarity of industry characteristics. Another possible control group may consist of upstream or downstream industries such as rubber (upstream) or automobile (downstream). However, neither of these methods are convincing to satisfy the common trend assumption.

Even if we have appropriate control industries at hand, another problem in the conventional DID method occurs if the number of controls are small. As Bertrand et al. (2004) show in their Monte Carlo study of a placebo law effect, small number of units generally leads to an over-rejection of the null hypotheses of zero effect. According to Bertrand et al. (2004) we need about 40 to 50 control industries (with one treatment industry) in order to avoid the over-rejection problem. However, it is hard to find that many control industries in our case.

The Synthetic Control Method (SCM), designed by Abadie and Gardeazabal (2003) and Abadie et al. (2010), is appealing to deal with the present problems. They provide a method to generate a synthetic industry as the optimally weighted average over the outcomes of potential control industries such that the average provides the best fit with the treatment industry's outcome for the pre-treatment period. In other words, SCM chooses the best combination of any given (multiple) control industries in the pre-treatment period to generate the missing counterfactuals of the treatment industry in the post-treatment period, and thereby increases the likelihood of satisfying the common trend assumption. Thus, SCM is less demanding when it comes to choosing the "perfect" set of control industries.

To explain the method in our context, an outcome y_{jt} (employment or wages) in industry j , for $j = 1, \dots, J$, is determined as

$$y_{jt} = \theta_t \delta_j + \lambda_t + X_j \beta_t + \tau_{jt} D_{jt} + \epsilon_{jt} \quad (1)$$

where θ_t is a vector of unobserved common factors, δ_j is the associated vector of industry-specific slopes, λ_t is the time fixed effect, and X_j is a vector of observed time-invariant industry characteristics. The treatment assignment, D_{jt} , is one if industry j is treated at time $t \geq 2009Q4$, and zero otherwise. The equation (1) generalizes the conventional DID model by allowing interactive fixed effects ($\theta_t \delta_j$): industry-level unobserved characteristics are allowed to be time-varying.²⁰ It also allows time-varying heterogeneous treatment effects (τ_{jt}). Clearly, such generalizations provide more candidates for control industries.

Without loss of generality, let the tire industry be industry 1 among observable industries. For all $J - 1$ control industries, a vector of weight, $w = [w_2, w_3, \dots, w_J]$, is assigned such that

$$\sum_{j=2}^J w_j^* y_{jt} = y_{1t}, \forall t \leq 2009Q3 \quad \text{and} \quad \sum_{j=2}^J w_j^* X_j = X_1. \quad (2)$$

²⁰If θ_t is constant for all t , the equation (1) reduces to the conventional DID model.

The equation (2) implies that we can obtain the exact solution, w^* , only if $(\{y_{1t}\}_{t \leq 2009Q3}, X_1)$ belongs to the convex hull of $[(\{y_{2t}\}_{t \leq 2009Q3}, X_2), \dots, (\{y_{Jt}\}_{t \leq 2009Q3}, X_J)]$. If it is not the case, the optimal weight is set to minimize the differences between variables in the left- and right-hand sides in equation (2), but the fit may be poor. On the other hand, even if we were to obtain the exact solution, it may be compromised by interpolation bias if the control industries are too different from each others in terms of their characteristics or outcomes. Thus, while equation (2) provides a more relaxed criterion for the selection of potential control industries, we still need to select ones that are similar to the tire industry in their characteristics and outcomes. That said, we choose all NAICS 5-digit industries, other than the tire industry, that share the same 3-digit code (326) as our potential control industries. This selection gives us nine control industries.

Note that the optimal weight is obtained for the whole pre-treatment period. Abadie et al. (2010) show that, for a sufficiently long pre-treatment period, the outcome of the synthetic industry, $\sum_{j=2}^J w_j^* y_{jt}$, provides an unbiased estimator of the counterfactual y_{1t} for all t .²¹ Therefore, the estimated treatment effect on the tire industry is obtained by

$$\hat{\tau}_{1t} = y_{1t} - \sum_{j=2}^J w_j^* y_{jt}, \quad \forall t \geq 2009Q4. \quad (3)$$

Finally, we include the total value of domestic shipments, total cost of materials, total inventories at the end of year, employer's cost for health insurance, and the ratio of production worker to total employment as time-invariant pre-treatment characteristics that may predict employment and wage patterns in the post-treatment period. These industry characteristics are all in 2008 values. In our baseline analysis, all outcome variables and industry characteristics are log-transformed with exception of the ratio of production worker to total employment. The sample period in the baseline analysis ranges from 2002Q1 right after China joined the WTO to 2012Q1. Given the sample period, four lagged values of employment and wages (2002Q3, 2004Q4, 2007Q3, and 2009Q2) are also included as predictors.

4.2 Estimation Results

After the synthetic industries for employment and wages are constructed, their characteristics are compared to those of the tire industry as well as those of simple averages of the nine control industries in Table 1. All numbers indicate that the two synthetic industries are closer to the tire industry than the averages of nine controls in terms of all industry characteristics and lagged outcomes. In a conventional DID method, the simple average of nine controls would

²¹For more detail descriptions on estimation procedure and proofs, see Abadie et al. (2010).

be used as the counterfactual tire industry in the absence of the safeguard activation, but as its characteristics differ away from those of the tire industry, the common trend assumption is likely to be violated. In this sense, two synthetic industries are better candidates for the counterfactual tire industry.

Table 2 lists nine control industries under 326 Plastics and Rubber Products Manufacturing and shows how the two synthetic industries are constructed from these nine industries. Since employment and wages do not exhibit the same time trend, we expect the optimal weights for each synthetic industry to differ, which turns out to be true. This again supports the superiority of the synthetic industry approach over the equally weighted average of nine controls for both employment and wages.

Figure 2 compares the trends of employment and wages in the U.S. tire industry with those of the synthetic industries. In general, the synthetic industries mimic employment and wage trends of the tire industry quite well in the pre-treatment period. An exception is around 2006Q4 due to the strike in the U.S. tire industry. The Root Mean Squared Prediction Error (RMSPE) shown at the bottom of each figure measures the sum of discrepancies of all predictors (listed in Table 1) between tire and synthetic industry for the pre-treatment period. It will be used later as a criterion for whether a synthetic industry is constructed well enough to mimic the treatment industry.

Figure 2 shows the main result. For the post-treatment period, we see no significant differences between the U.S. tire industry and the synthetic industries for both employment and wages. To infer the significance of the treatment effects formally, the SCM suggests a set of placebo tests. A placebo test can be performed by choosing one of the control industries as the treated industry and the other eight industries as untreated industries. Specifically, we drop the tire industry from the sample, and treat industry 2 as the treatment industry. Then, we follow the same SCM procedure described above to obtain estimates of $\hat{\tau}_{2t}$ for $t \geq 2009Q4$ using the rest of industries 3 through 10 as control industries. This procedure is repeated for $j = 3, \dots, 10$. Since all control industries are not protected during the sample period, their treatment effects, $\hat{\tau}_{jt}$ for $j = 2, \dots, 10$, are expected to be zero. Hence, if the tire industry was affected by the safeguard measures, we should be able to observe significantly different $\hat{\tau}_{1t}$'s from all other $\hat{\tau}_{jt}$'s.

The results of two sets of placebo tests for employment and wages are displayed in Figure 3. Although nine placebo tests are conducted for employment and wages, respectively, we do not show the estimated treatment effects for industry 32613 and 32619 in the figure, because those two industries have poor synthetic industries with high RMSPEs.²² The vertical axis shows the estimated treatment effects of the tire and seven placebo industries over the sample

²²We exclude placebo treatment industries with RMSPE greater than 0.1 for both employment and wages.

period. All of them are close to zero whether they are before or after the activation of CTS, with exception of 2006Q4 in the case of the tire industry. In particular, the treatment effects in the tire industry after the CTS are well bounded by other placebo treatment effects. This confirms that neither employment nor wages in the tire industry are significantly affected by the safeguard measures.

We have conducted a couple of robustness checks for our findings. First of all, the results do not change when we drop the period of the tire industry strike (i.e., 2006Q4) from our sample period. Secondly, we extend our control group to include other auto parts producing industries. Formally, we include all 5-digit industries under NAICS 336 Transportation Equipment Manufacturing. This provides us eleven additional control industries including Automobile and Light Duty Motor Vehicle Manufacturing (33611), Motor Vehicle Body and Trailer Manufacturing (33621), and Motor Vehicle Electrical and Electronic Equipment Manufacturing (33632). However, the optimal weights are almost same as when only nine NAICS 326 industries are used, and the results do not change. Finally, our findings still hold when employment and wages are measured in levels instead of log transforms.²³

5 Potential Mechanism

Our evidence regarding the CTS raises the question of why there is no effect. In this section, we provide a potential mechanism through which the CTS had only a negligible impact on employment and wages in the U.S. tire industry. Specifically, we focus on the discriminatory nature of TTB as the key driving factor: Since the punitive tariff is imposed on a certain set of products made in only one or few countries, imports may be diverted to other non-tariffed countries who produce the same products. As Prusa (1997) argues, if this import diversion is complete in the sense that the import decline from the target countries is offset by the import increase from non-target countries, the price effect will be small and domestic producers have little room for changing output. Konings and Vandenbussche (2005) empirically support this argument by showing that domestic firms do not change their mark-up when they experience a strong import diversion after their industry is protected by antidumping action.

Given no change in both output and price, no change in labor market outcomes naturally follows. In our case, we indeed find a complete import diversion in terms of import value as well as volume (i.e., quantity). We also find that there is no change in the domestic producer price indices of subject tires, although the safeguard measures are mostly passed through. Obviously, however, not every TTB would produce the complete diversion as in our case, and we need to understand what determines the degree to which import is diverted. Although answering this

²³We do not report results for the robustness checks to keep focusing on the main results. The results are available upon request.

question is beyond the scope of our study, we provide some theoretical and anecdotal evidence that MNCs play an important role for the complete diversion at the end of this section.

5.1 Trade Diversion

To formally assess how the total imports of subject tires from China and the RoW change before and after the CTS, we exploit another variant of a standard DID design. In a DID design for the tariff effect on subject tire imports, a natural control group would comprise the other 47 tire-related products not subject to a tariff change. However, some of them are either not imported for many years or highly volatile in their import volumes. After dropping those products out of the control group, we have 34 control units.²⁴ We also confine our sample period from 2007Q2 to 2012Q1 so that ten quarters before and after the treatment can be compared, though extending the sample period does not change our results qualitatively.

One concern is that the common trend assumption is not convincing even after dropping bad control units. The reason is that subject tire imports were more rapidly increasing than the control tire imports both in level and percentage change terms, and the safeguard measures are selectively applied to some tire products based on the import growth rates. To deal with this selection bias, we employ a random growth model that allows product-specific growth rates to be correlated with the treatment assignment, D_{it} , which is one if product i is treated at time $t \geq 2009Q4$, and zero otherwise. In this model, the treatment effect, τ_i , is assumed heterogeneous across products but constant over time. Let the import value (or volume) of product i at time t (from either China or RoW), y_{it} , be given by

$$y_{it} = \exp(\delta_i + \lambda_t + \rho_i t + \tau_i D_{it}) \epsilon_{it} \quad (4)$$

where δ_i and λ_t are product and time fixed effects, respectively, $\rho_i t$ captures the product-specific (linear) growth rate, and ϵ_{it} is the idiosyncratic shock with zero mean. As is typical for empirical trade models of this type, we transform equation (4) into log-linear form. The fixed effect (FE) estimator, then, identifies the average treatment effect (ATE) on the treated, $\tau = E[\tau_i]$ (see Wooldridge 2005). However, Santos Silva and Tenreyro (2006) argue that the log-linear transformation may cause a bias due to heteroskedasticity or zero trade values, and suggest a Poisson pseudo-maximum likelihood (PPML) estimator with the dependent variable in levels. Hence, we use both estimation strategies.

Estimation results are provided in the first four columns in Table 3. Note that the magni-

²⁴As emphasized in the main analysis, there is no clear criterion for selecting control unit. Our finding in this section is robust anyway even when we include these volatile products in the control group. Also, given 44 tire-related products, clustering standard errors at the product level is reasonably safe to avoid the over-rejection problem as discussed in Bertrand et al. (2004) and Angrist and Pischke (2008).

tudes of the estimated effects are mostly similar between FE and PPML estimations, except when quantity is used as the dependent variable in Panel A. This implies that we do not have to be concerned with heteroskedasticity and zero trade values in our case. Panel A shows the ATE on the subject Chinese tire imports, i.e., the trade destruction effect.²⁵ Trade destruction is both statistically and economically significant: The FE estimates show that safeguard measures reduced subject tire imports from China by around 63% more than non-subject Chinese tire product imports both in terms of total value and quantity.

Panel B shows trade diversion effect by estimating the ATE on the subject tire import from RoW. Trade diversion is also significant, with around a 30% increase. This increase is substantial, given that the total import value of subject tires from the RoW in the pre-treatment period are, on average, three-times that from China. To examine whether the trade diversion was actually complete, we estimate the ATE on the total U.S. import (including China) of subject tires (see Panel C). Statistically and economically insignificant estimates in Panel C imply that the total U.S. tire imports, whether they are measured by value or volume, are not affected by the CTS. Thus, we find that trade destruction is completely offset by trade diversion.

5.2 Price Effect

We first look at how import unit values from China and the RoW change with the tariff. The variables are available at the 10-digit HS level. As Treffer (2004) notes, changes in unit values within an HS 10 digit is likely to reflect changes in prices. We use the same setup as equation (4) with import unit values as the dependent variable instead. The unit value is defined as the ratio of customs value to total quantity imported. Hence, it is the value prior to the import duty. The unit value of a tire product from RoW is the weighted average of each country's product unit value with its import share being used as the weight.

Estimation results are provided in the last two columns in Table 3. Panel A of the table estimates the ATE in unit values of the subject Chinese tire products. The estimated effect is close to zero and statistically insignificant for both FE and PPML estimators. This implies that the safeguard measures are mostly passed through which in turn is consistent with the notion that the import destruction effect was substantial. Moreover, the estimation results for the RoW case in Panel B are equally insignificant. These results together imply that the reduction in tire imports from China is completely offset by a rise in RoW tire imports at the pre-TTB unit price. This may suggest that we should not expect the domestic U.S. tire price to change as a result of the China safeguard. But is this really the case?

To confirm whether domestic prices of subject tires are affected by the CTS, we construct

²⁵The term, trade destruction, follows Bown and Crowley (2007).

the synthetic commodity prices using U.S. Producer Price Index (PPI) commodity data, which measures the average change over time in the selling prices received by domestic producers for their output. The commodity-level PPIs are available monthly from the Bureau of Labor Statistics, from which we obtain the PPIs of passenger car tires and truck tires. These two commodity PPIs are the best available data measuring domestic prices of subject tires.²⁶ The construction procedure is same as before, but now the synthetic PPIs are constructed out of 18 potential control commodities in the category of Rubber and Plastic products.²⁷ Our sample period ranges from from 2004Q1 to 2012Q1. The original monthly PPI data is rescaled so that the PPI in December 2003 is set to 100, and then simply averaged to generate quarterly data. Also, we only use five lagged PPIs (2005Q1, 2006Q3, 2007Q4, 2008Q4, 2009Q2) as our predictors for PPIs in the post-treatment period.

Figure 5 compares the trend of PPIs of the U.S. made subject tires with those of synthetic commodities. In general, the synthetic commodity PPIs do not look significantly different from the passenger car and truck tires before and after the CTS activation. Although the PPI of passenger car tires does not rise as much as the synthetic commodity PPI after 2011Q1 as shown in Figure 5a, it is not likely to be caused by the safeguard measures, because the time gap is longer than five quarters. The results of placebo tests in Figure 6 also confirm that the treatment effects on PPIs are well bounded by other placebo treatment effects.

5.3 The Role of MNCs

The potential mechanism described above implies that the labor market effect of a TTB would crucially depend on the degree to which an import diversion occurs. Although the existing literature has not provided a rigorous explanation for the degree of diversion, we can expect that factors such as the level of protection, industry structure, and substitutability between foreign and domestic goods would affect the magnitude of import diversion. In the CTS case, low substitutability between Chinese and domestic tires might stimulate the import diversion from China to other countries who produce similar quality tires. Also, as Konings et al. (2001) argue, high concentration of the subject tire market might increase the strategic rivalry which in turn offsets the effects of the safeguard measures.²⁸

In our view, however, a more crucial reason for the ‘complete’ diversion is that the world

²⁶The match is not perfect, though, since the truck tires also include some other tires that are not subject to the punitive tariffs.

²⁷In the category of Rubber and Plastic products, there are 31 6-digit level commodity PPIs, including Passenger car pneumatic tires (120104) and Truck and bus (including off-the-highway) pneumatic tires (120105). However, some commodity PPIs are not available during our sample period. We simply drop such commodities, which leaves only 18 control commodities.

²⁸Konings et al. (2001, p. 294-5) discuss a couple of possible reasons why the import diversions in the European Union are generally weaker than in the U.S. The reasons include lower duty level, lower market concentration, higher uncertainty in decision making process, and more tariff-jumping FDI.

market for subject tire productions is dominated by MNCs. If there were no MNCs and the tires were produced by pure exporters, trade diversion would require that U.S. importers begin to look for new exporters from other countries and contract with them. Hence, there would be more frictions in replacing trade partners making trade diversion more costly. Even if trade partners are replaced, the new exporters might not be able to meet the domestic demand because of capacity constraints. On the other hand, MNCs who already have production facilities in both China and other countries can substantially reduce such frictions by simply reallocating tire productions. Donnenfeld (2003) and Ekholm et al. (2007) theoretically support this view. They both show that trade liberalization between two countries promotes an outside country to build plants inside the free trade area. Consequently, interbloc trade (i.e., imports from outside country) is completely diverted to intrabloc trade. Applying their insight to our context, the CTS would induce MNCs to shift productions to non-tariffed countries. This behavior is also in line with tariff-jumping foreign direct investment (FDI) suggested by Blonigen (2002), although the destination of FDI is not the importing country (i.e., the U.S.), but other exporting countries that have comparative advantage in producing low to medium quality tires.

We cannot formally test this hypothesis due to the lack of adequate data. However, anecdotal evidence combined with U.S. import data corroborates our argument. Table 4 lists the top 10 subject tire exporting countries to the U.S. in order of export percentage growth. All of these countries have manufacturing facilities of the world's major tire MNCs. For example, Thailand, the highest ranked country in the table, has production facilities of large MNCs such as Bridgestone, Goodyear, Michelin, Sumitomo, and Yokohama. The Japanese business magazine, *Nikkei*, reports that Thailand has become a key export base for these MNCs after the CTS activation.²⁹ Indonesia has the subject tire plants of Bridgestone, Goodyear, and Sumitomo. Particularly, Bridgestone in Indonesia has expanded its production capacity to meet increased demands in 2010.³⁰

In terms of the dollar value of the net increase, it is South Korea who has benefited the most. There are two major MNCs headquartered in South Korea (Hankook and Kumho) which also have plants in China. These two MNCs shifted large shares of their productions from China to South Korea and other countries to circumvent the safeguard measures. Especially, Hankook Tire Co., the biggest foreign tire producers in China and the world's fastest-growing tire company, clearly reports that "the [America] regional headquarters diversified production sources to circumvent the additional 35 percent safeguard tariff on Chinese-made tires that was imposed from the fourth quarter of 2009." (Hankook Tire Annual Report 2010, p. 44).

In the case of Taiwan, *Asia Times* (2011, September 10th) reports that Bridgestone Taiwan,

²⁹ Article source: <http://www.thetruthaboutcars.com/2010/07/trade-war-watch-15-thai-tires-trump-chinese/>. The original article is available at http://www.nikkei.com/article/DGXNASDD210AG_R20C10A7MM8000/

³⁰ Article source: <http://www.bridgestone.com/corporate/news/2010051401.html>

which in the past did not export tires to the U.S., began to export one million tires to the U.S. in 2009 in response to the tariff. Furthermore, Cooper, headquartered in Ohio, did not start sourcing tires from its U.S. plants to replace the Chinese imports. Instead, the company switched to its partners in Taiwan and South Korea to supply the U.S. market. These pieces of evidence altogether support that the discriminatory tariff induced MNCs to switch productions from China to other countries.

Finally, it is noteworthy to compare our findings to another safeguard protection case, the tariff on imports of heavyweight motorcycles from Japan between 1983 and 1987. This case is often heralded as a great success of safeguard protection.³¹ While the nature of the Japan safeguard is similar to the CTS in that it was temporary and distortionary as well, there is a major difference between them: The major motorcycle companies at the time were not MNCs. Had Japanese or American (i.e., Harley-Davidson) firms been MNCs in the 80s with plants outside the U.S. and Japan, our analysis suggests that the impact would have been much weaker.

6 Concluding Remarks

Two branches in the trade literature independently document that trade adjustment costs to workers due to the globalization are significant and that TTBs have been progressively used across countries during periods of high unemployment rates. Our interpretation of these two phenomena is that temporary trade barriers are perceived as a feasible policy instrument for securing domestic jobs in the presence of increased globalization. Recent U.S. foreign trade policies are also in line with our interpretation. Particularly, during the recent presidential election in 2012, both candidates pledged stronger protection policies against China to save domestic jobs while citing the China-specific safeguard case on consumer tires as a successful example. This paper formally asks whether the CTS actually saved domestic jobs. Using the synthetic control method to estimate the impact of the CTS, we find that the U.S. tire industry experienced no gains in both employment and wages.

The negligible labor market effects are not surprising as further analysis reveals that imports from China were completely diverted to other exporting countries leaving subject tire prices in the U.S. unchanged. We also provide a potential reason for the complete import diversion. Since the world tire industry is dominated by a small number of multinational corporations, the reallocation of production across countries is relatively frictionless. MNCs with production facilities in multiple countries can simply diversify subject tire production to non-tariffed coun-

³¹There is some controversy on whether the safeguard protection actually saved Harley-Davidson, the only heavyweight motorcycles maker in the U.S. at the time, but the safeguard surely gave some breathing room to Harley-Davidson on the brink of bankruptcy. See Feenstra (2004, Chapter 7) and Kitano and Ohashi (2009).

tries who, compared to U.S. production facilities, have a comparative advantage in producing similar quality tires. As a consequence, countries such as Thailand, Indonesia, South Korea, Mexico, and Taiwan became the predominant beneficiaries of the discriminatory tariff policy, but not the U.S. Although we provide anecdotal evidence for the crucial role that MNCs played in making the complete trade diversion possible, a more systematic analysis with adequate data is left for future work.

Our study predicts that similar TTB should have little impact on domestic labor markets in industries where MNCs are major players. This prediction is particularly important given the remarkable trend in recent years toward the proliferation of massive networked MNCs. Hence, negligible TTB effect should be even more pronounced in the future. Accordingly, an optimal trade policy design must take the presence of MNCs into account.

References

- Abadie, Alberto, Alexis Diamond, and Jens Hainmueller (2010) ‘Synthetic control methods for comparative case studies: Estimating the effect of california’s tobacco control program.’ *Journal of the American Statistical Association* 105(490), 493–505
- Abadie, Alberto, and Javier Gardeazabal (2003) ‘The economic costs of conflict: A case study of the basque country.’ *American Economic Review* 93(1), 113–132
- Angrist, Joshua D., and Jorn-Steffen Pischke (2008) *Mostly Harmless Econometrics: An Empiricist’s Companion* (Princeton University Press)
- Asia Times (2011, September 10th) ‘US drivers pay steep price for china tire tariff.’ Retrieved from http://www.atimes.com/atimes/China_Business/MI10Cb01.html
- Autor, David H., D. Dorn, G. H. Hanson, and J. Song (2012a) ‘Trade adjustment: Worker level evidence.’ Working paper
- Autor, David H., David Dorn, and Gordon H. Hanson (2012b) ‘The china syndrome: Local labor market effects of import competition in the united states.’ NBER Working Paper 18054, May
- Bagwell, Kyle, and Robert W. Staiger (2003) ‘Protection and the business cycle.’ *Advances in Economic Analysis & Policy* 3(1), 1–43
- Belderbos, R., H. Vandenbussche, and R. Veugelers (2004) ‘Antidumping duties, undertakings, and foreign direct investment in the EU.’ *European Economic Review* 48(2), 429–453

- Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan (2004) ‘How much should we trust differences-in-differences estimates?’ *The Quarterly Journal of Economics* 119(1), 249–275
- Blonigen, Bruce A (2002) ‘Tariff-jumping antidumping duties.’ *Journal of International Economics* 57(1), 31–49
- Blonigen, Bruce A., and Jee-Hyeong Park (2004) ‘Dynamic pricing in the presence of antidumping policy: Theory and evidence.’ *The American Economic Review* 94(1), 134–154
- Blonigen, Bruce A, and Stephen E Haynes (2002) ‘Antidumping investigations and the pass-through of antidumping duties and exchange rates.’ *American Economic Review* 92(4), 1044–1061
- Blonigen, Bruce A., and Thomas J. Prusa (2003) ‘Antidumping.’ In *Handbook of International Trade*, ed. E. Kwan Choi and James Harrigan (Blackwell Publishing Ltd) p. 251–284
- Bown, Chad P. (2010) ‘China’s WTO entry: Antidumping, safeguards, and dispute settlement.’ In *China’s Growing Role in World Trade*, ed. Robert C. Feenstra and Shang-Jin Wei (University of Chicago Press) pp. 281–337
- Bown, Chad P., and Meredith A. Crowley (2007) ‘Trade deflection and trade depression.’ *Journal of International Economics* 72(1), 176–201
- Bown, Chad P., and Meredith A Crowley (2012) ‘Emerging economies, trade policy, and macroeconomic shocks.’ Federal Reserve Bank of Chicago Working Paper 2012-18
- (forthcoming) ‘Import protection, business cycles, and exchange rates : evidence from the great recession.’ *Journal of International Economics*
- Bradford, Scott (2006) ‘Protection and unemployment.’ *Journal of International Economics* 69(2), 257–271
- Brenton, Paul (2001) ‘Anti-dumping policies in the EU and trade diversion.’ *European Journal of Political Economy* 17(3), 593–607
- Bussey, John (2012, January 20th) ‘Get-tough policy on chinese tires falls flat.’ *Wall Street Journal*. Retrieved from <http://online.wsj.com/article/SB10001424052970204301404577171130489514146.html>
- Costinot, Arnaud (2009) ‘Jobs, jobs, jobs: A ”New” perspective on protectionism.’ *Journal of the European Economic Association* 7(5), 1011–1041

- Davidson, Carl, Steven J. Matusz, and Douglas Nelson (2012) ‘A behavioral model of unemployment, sociotropic concerns, and the political economy of trade policy.’ *Economics & Politics* 24(1), 72–94
- Donnenfeld, Shabtai (2003) ‘Regional blocs and foreign direct investment.’ *Review of International Economics* 11(5), 770–788
- Ekhholm, Karolina, Rikard Forslid, and James R. Markusen (2007) ‘Export-platform foreign direct investment.’ *Journal of the European Economic Association* 5(4), 776–795
- Feenstra, Robert C. (2004) *Advanced International Trade: Theory and Evidence* (MIT Press)
- Gaston, Noel, and Daniel Trefler (1994) ‘Protection, trade, and wages: Evidence from U.S. manufacturing.’ *Industrial and Labor Relations Review* 47(4), 574–593
- Goldberg, Pinelopi Koujianou, and Nina Pavcnik (2005) ‘Trade, wages, and the political economy of trade protection: evidence from the colombian trade reforms.’ *Journal of International Economics* 66(1), 75–105
- Hankook Tire (2010) ‘Hankook tire annual report 2010.’ *Hankook Tire Corporation*
- Irwin, Douglas A. (2005) ‘The rise of US anti-dumping activity in historical perspective.’ *World Economy* 28(5), 651–668
- Kennedy, Peter E. (1981) ‘Estimation with correctly interpreted dummy variables in semilogarithmic equations.’ *The American Economic Review* 71(4), 801
- Kitano, Taiju, and Hiroshi Ohashi (2009) ‘Did US safeguards resuscitate harley-davidson in the 1980s?’ *Journal of International Economics* 79(2), 186–197
- Knetter, Michael M., and Thomas J. Prusa (2003) ‘Macroeconomic factors and antidumping filings: evidence from four countries.’ *Journal of International Economics* 61(1), 1–17
- Konings, Jozef, and Hylke Vandenbussche (2005) ‘Antidumping protection and markups of domestic firms.’ *Journal of International Economics* 65(1), 151–165
- (2008) ‘Heterogeneous responses of firms to trade protection.’ *Journal of International Economics* 76(2), 371–383
- Konings, Jozef, Hylke Vandenbussche, and Linda Springael (2001) ‘Import diversion under european antidumping policy.’ *Journal of Industry, Competition and Trade* 1(3), 283–299
- Kovak, Brian K. (2012) ‘Local labor market effects of trade policy: Evidence from brazilian liberalization.’ Working paper

- Matschke, Xenia, and Shane M. Sherlund (2006) ‘Do labor issues matter in the determination of U.S. trade policy? an empirical reevaluation.’ *The American Economic Review* 96(1), 405–421
- McLaren, John, and Shushanik Hakobyan (2012) ‘Looking for local labor market effects of NAFTA.’ Working paper
- Menezes-Filho, Naécio Aquino, and Marc-Andreas Muendler (2011) ‘Labor reallocation in response to trade reform.’ NBER Working Paper 17372
- Messerlin, Patrick A. (2004) ‘China in the world trade organization: Antidumping and safeguards.’ *The World Bank Economic Review* 18(1), 105–130
- Pierce, Justin R. (2011) ‘Plant-level responses to antidumping duties: Evidence from U.S. manufacturers.’ *Journal of International Economics* 85(2), 222–233
- Prusa, Thomas J. (1997) ‘The trade effects of U.S. antidumping actions.’ In *The Effects of U.S. Trade Protection and Promotion Policies*, ed. Robert C. Feenstra (University of Chicago Press) pp. 191–214
- (2009) ‘Estimated economic effects of the proposed import tariff on passenger vehicle and light truck tires from china.’ Technical Report. Retrieved from <http://www.cbe.csueastbay.edu/~alima/courses/4700/Articles/PrusaTireTariffAnalysis.pdf>
- (2011) ‘USA: evolving trends in temporary trade barriers.’ In *The Great Recession and Import Protection: The Role of Temporary Trade Barriers*, ed. Chad P. Bown (London: Centre for Economic Policy Research) pp. 53–83
- Rapoza, Kenneth (2012, January 25th) ‘Obama’s half-truth on china tire tariffs.’ *Forbes*. Retrieved from <http://www.forbes.com/sites/kenrapoza/2012/01/25/obamas-half-truth-on-china-tire-tariffs/>
- Santos Silva, J. M. C., and Silvana Tenreyro (2006) ‘The log of gravity.’ *Review of Economics and Statistics* 88(4), 641–658
- Staiger, Robert W., and Frank A. Wolak (1992) ‘The effect of domestic antidumping law in the presence of foreign monopoly.’ *Journal of International Economics* 32(3–4), 265–287
- (1994) ‘Measuring industry-specific protection: Antidumping in the united states.’ *Brookings Papers on Economic Activity. Microeconomics* 1994, 51–118
- Topalova, Petia (2010) ‘Factor immobility and regional impacts of trade liberalization: Evidence on poverty from india.’ *American Economic Journal: Applied Economics* 2(4), 1–41

- Trefler, Daniel (2004) 'The long and short of the canada-U.S. free trade agreement.' *American Economic Review* 94(4), 870–895
- Wallerstein, Michael (1987) 'Unemployment, collective bargaining, and the demand for protection.' *American Journal of Political Science* 31(4), 729–752
- Wooldridge, Jeffrey M. (2005) 'Fixed-effects and related estimators for correlated random-coefficient and treatment-effect panel data models.' *Review of Economics and Statistics* 87(2), 385–390
- Yotov, Yoto V. (2012) 'Trade adjustment, political pressure, and trade protection patterns.' *Economic Inquiry* pp. 1–19

Table 1: Predictors of Employment and Wages

Variables	log(employment)			log(wage)		
	Tire	Synthetic	Average ^a	Tire	Synthetic	Average ^a
log(shipments)	7.966	7.915	7.486	7.966	7.869	7.486
log(material cost)	8.399	8.454	8.075	8.399	8.512	8.075
log(inventory)	5.914	6.090	5.792	5.914	6.212	5.792
log(health insurance)	4.739	4.351	3.932	4.739	4.512	3.932
production worker ratio	0.812	0.783	0.777	0.812	0.761	0.777
log($y_{j,2002Q3}$)	4.321	4.276	3.976	13.716	13.678	13.074
log($y_{j,2004Q4}$)	4.237	4.227	3.950	13.788	13.774	13.205
log($y_{j,2007Q3}$)	4.092	4.125	3.922	13.623	13.629	13.156
log($y_{j,2009Q2}$)	3.993	3.946	3.739	13.525	13.421	12.989

^aThe average of all potential control industries

Notes: Shipments, material cost, inventory, health insurance (all in thousand dollars), and production worker ratio are 2008 values. y_j is (log of) employment for the first three columns and wages for the last three.

Table 2: 5-digit industries under NAICS 326 Plastics and Rubber Products Manufacturing

NAICS	Industry Name	Employment		Wages	
		Weight	Growth ^a	Weight	Growth ^a
Treatment Industry					
32621	Tire Manufacturing (Mfg)	n/a	-0.305	n/a	-0.230
Potential Control Industries					
32611	Unsupported Plastics Film, Sheet, & Bag Mfg	0.308	-0.104	0	0.047
32612	Plastics Pipe, Pipe Fitting, & Unsupported Profile Shape Mfg	0	-0.236	0	-0.059
32613	Laminated Plastics Plate, Sheet, & Shape Mfg	0	-0.328	0.231	-0.274
32614	Polystyrene Foam Product Manufacturing	0	-0.067	0	-0.063
32615	Urethane & Other Foam Product (except Polystyrene) Mfg	0	-0.098	0	-0.084
32616	Plastics Bottle Mfg	0.183	-0.113	0.095	0.087
32619	Other Plastics Product Mfg	0	-0.320	0.376	-0.179
32622	Rubber and Plastics Hoses and Belting Mfg	0	-0.228	0.005	-0.079
32629	Other Rubber Product Mfg	0.509	-0.424	0.292	-0.352

^aGrowth rate is calculated as the % change from 2002Q1 to 2009Q3.

Table 3: Impact of the U.S. Tariffs on Tire Import Flows

Dep. Variable	Import (customs) Value		Quantity		Unit Value	
	FE	PPML	FE	PPML	FE	PPML
Panel A: Import from China						
$\hat{\tau}$	-0.983** (0.208)	-0.941** (0.113)	-0.976** (0.236)	-0.611** (0.210)	-0.007 (0.144)	0.006 (0.214)
% change	-63.37	-61.22	-63.35	-46.89	-1.709	1.70
Observations	809	880	809	880	809	809
R^2	0.943	0.973	0.930	0.943	0.909	0.720
Panel B: Import from RoW						
$\hat{\tau}$	0.307* (0.145)	0.256** (0.073)	0.347* (0.168)	0.336** (0.095)	-0.046 (0.104)	-0.032 (0.151)
% change	34.51	28.82	39.43	39.26	-5.05	-4.28
Observations	880	880	880	880	880	880
R^2	0.963	0.993	0.970	0.981	0.937	0.804
Panel C: Total Import						
$\hat{\tau}$	-0.044 (0.166)	-0.014 (0.068)	-0.099 (0.183)	0.038 (0.132)	0.038 (0.102)	0.094 (0.146)
% change	-5.60	-1.57	-10.96	2.98	3.360	8.710
Observations	880	880	880	880	880	880
R^2	0.966	0.991	0.965	0.970	0.934	0.826

Notes: The sample includes 44 products with 20 quarter periods. All specifications include product-specific fixed effect and linear time trend, and time dummies. Robust standard errors for coefficients are clustered at product level in parentheses. Calculation of percentage changes are based on Kennedy (1981). **significant at 1%; *significant 5%.

Table 4: Top 10 Subject Tire Exporting Countries to the U.S. by Export Percentage Growth

Country	Export to the U.S. (million \$)		Net Increase	% Growth
	Before CTS	After CTS		
Thailand	396.35	1,105.7	709.35	179
Indonesia	426.9	989.59	562.69	131.8
South Korea	1,630.49	3,076.67	1,446.18	88.7
Mexico	660.96	1193.76	532.8	80.6
Taiwan	301.86	502.98	201.12	66.6
Canada	2,853.71	3,781.06	927.35	32.5
Germany	535.99	680.04	144.05	26.9
Japan	2,227.83	2,749.18	521.35	23.4
Costa Rica	227.91	279.01	51.1	22.4
Brazil	598.09	704.91	106.82	17.9

Notes: The total import volumes are calculated for ten quarters before and after the CTS activation ranging from 2007Q2 to 2012Q1. Countries with export greater than hundred million dollars before the CTS activation are only listed.

Figure 1: Trends of subject tire imports and the U.S. tire industry employment during 1998Q1-2012Q1

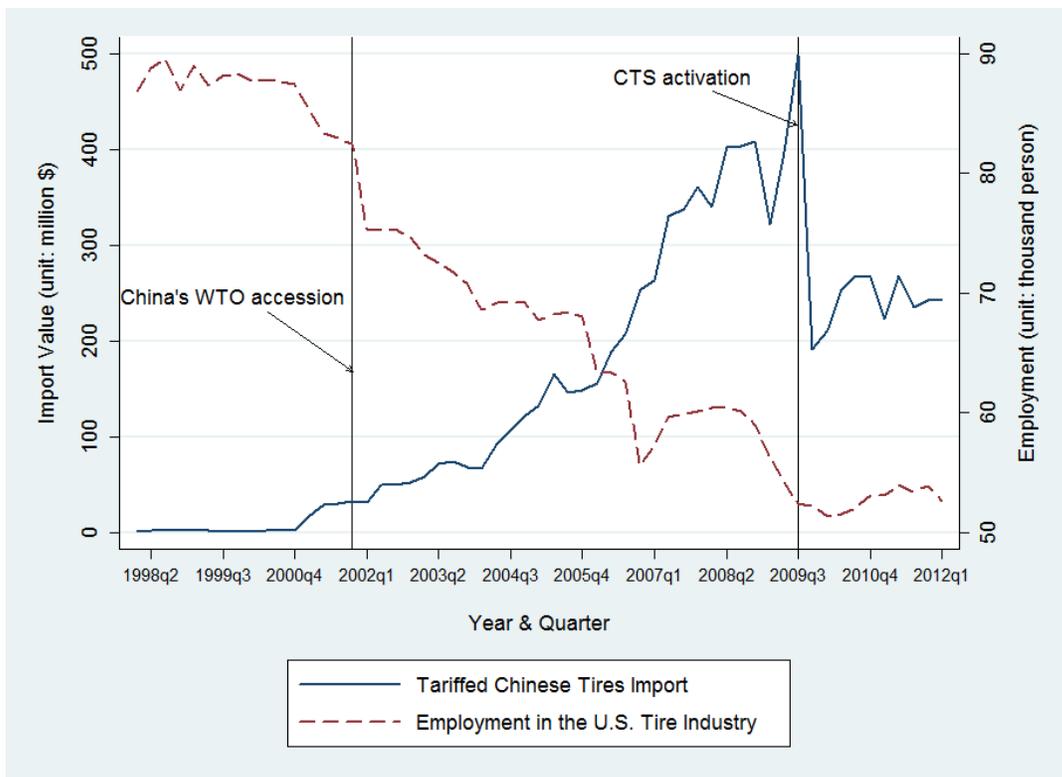
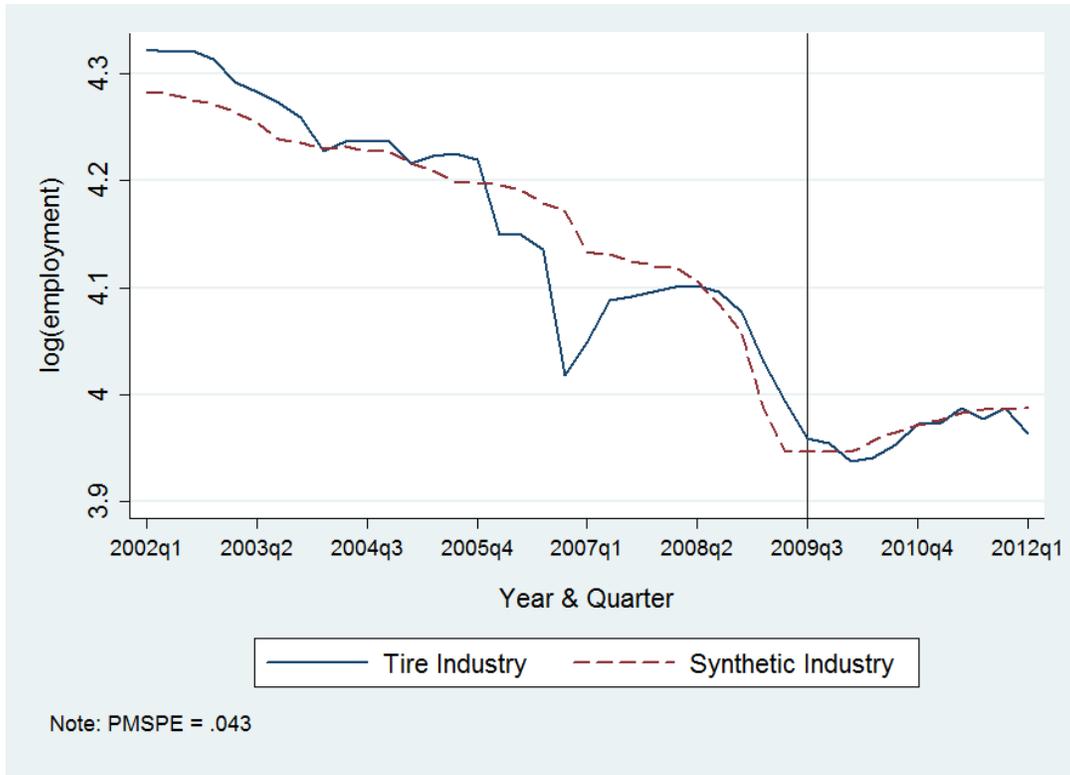


Figure 2: Trends in the U.S. Tire vs. Synthetic Industry during 2002Q1–2012Q1

(a) Total Employment



(b) Total Wage

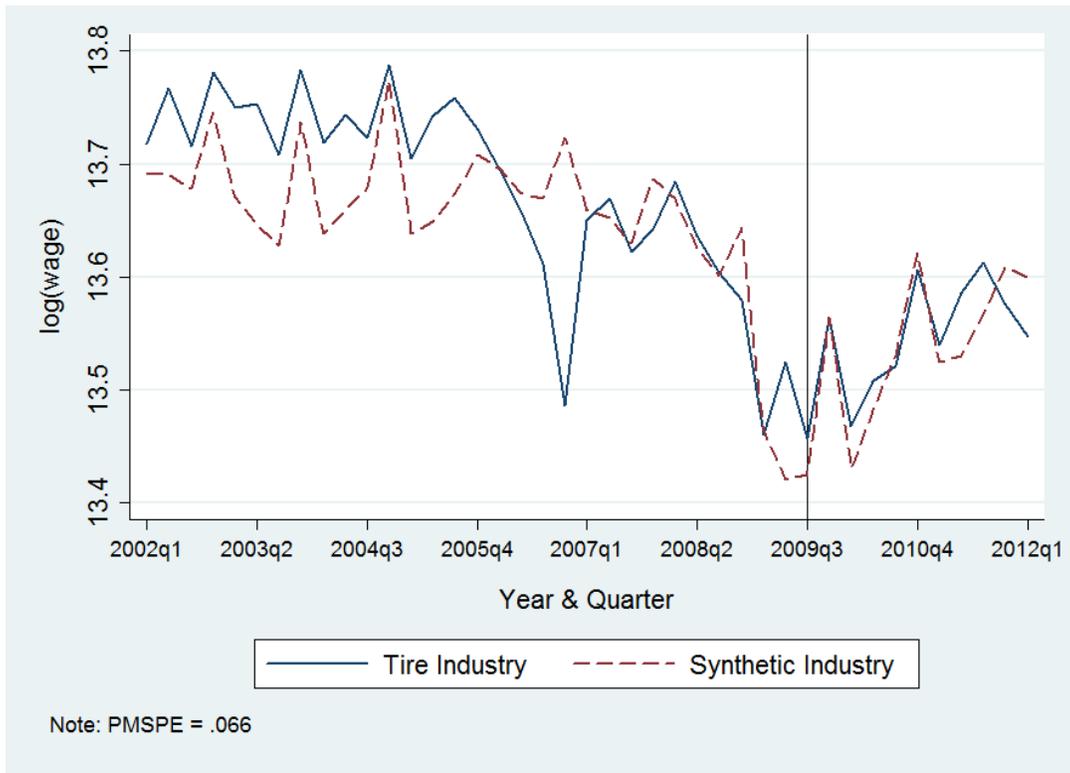
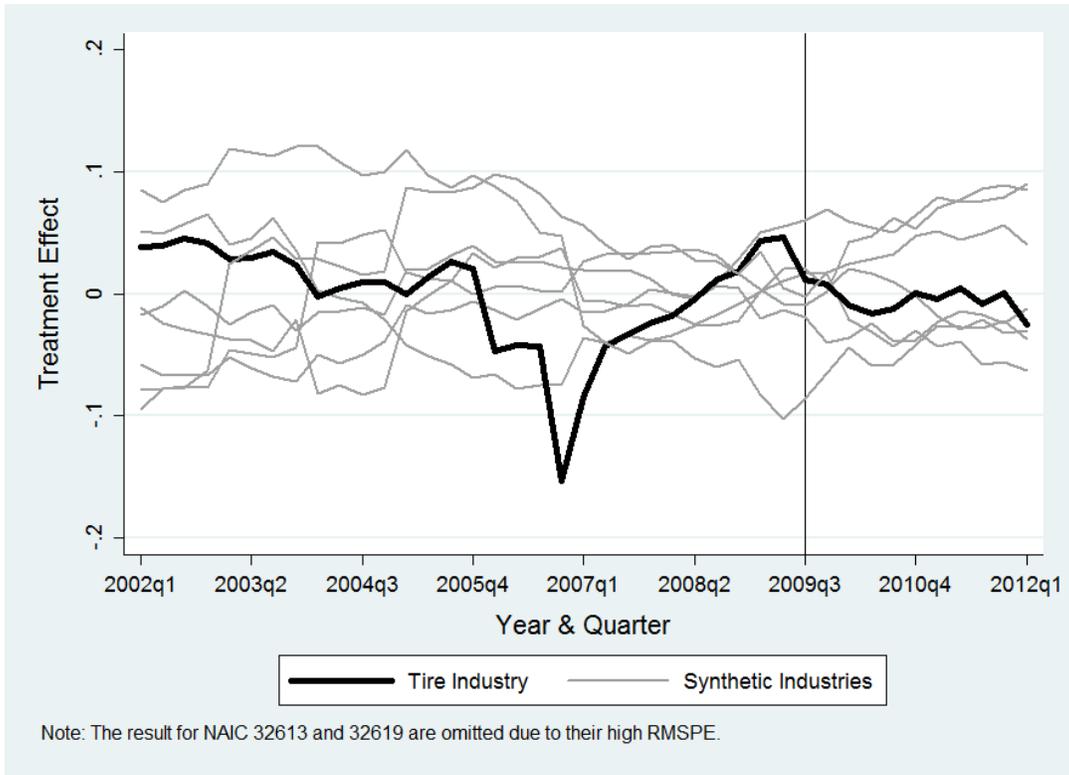


Figure 3: Placebo Tests for the CTS Effect on Labor Market Outcomes

(a) Total Employment



(b) Total Wage

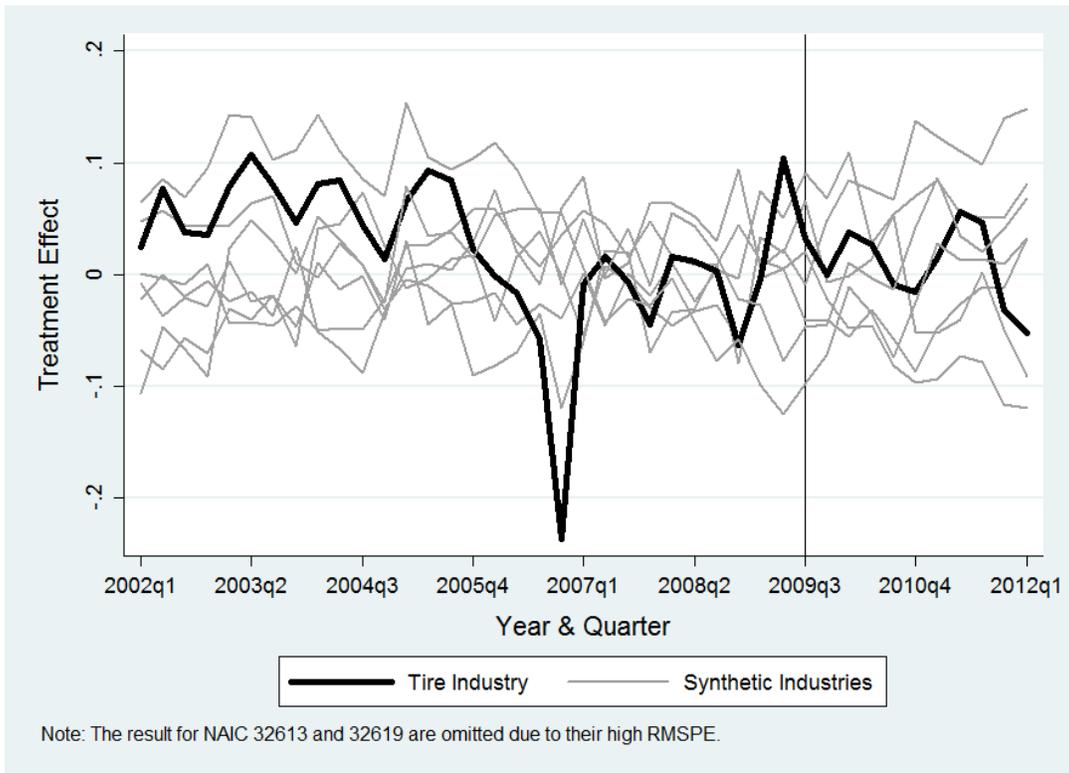


Figure 4: Trend in the U.S. Tire Import during 2002Q1-2011Q4

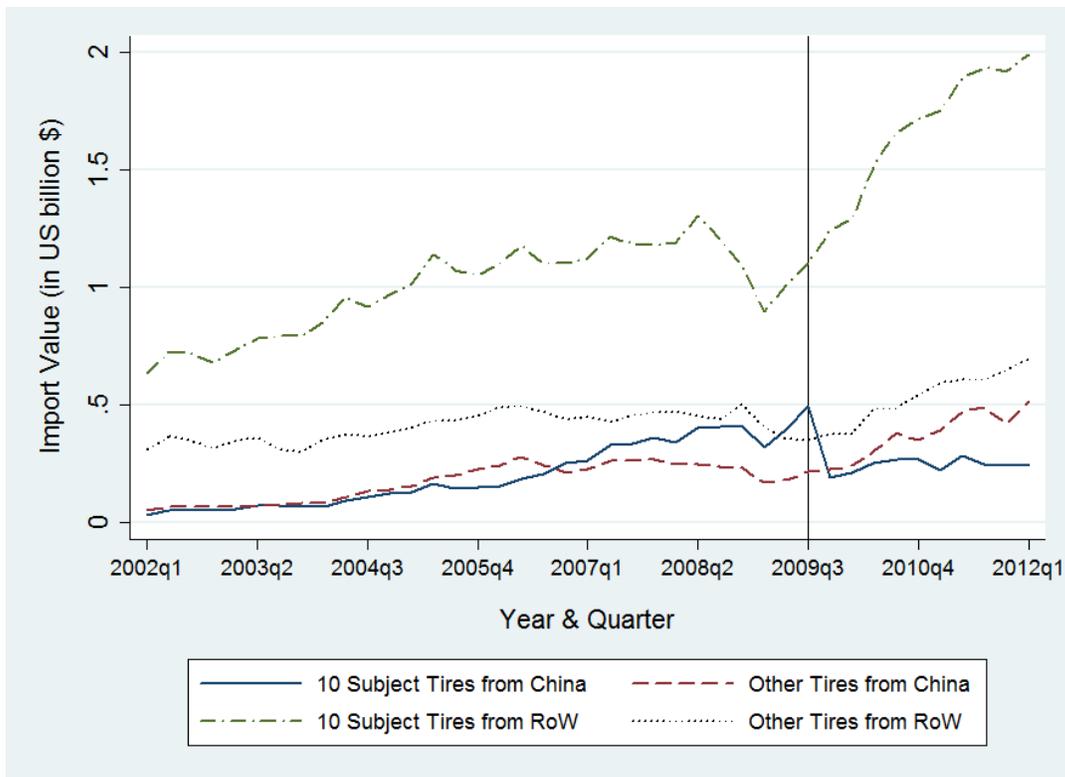


Figure 5: Trends in domestic PPIs of subject Tires vs. Synthetic PPIs during 2004Q1–2012Q1

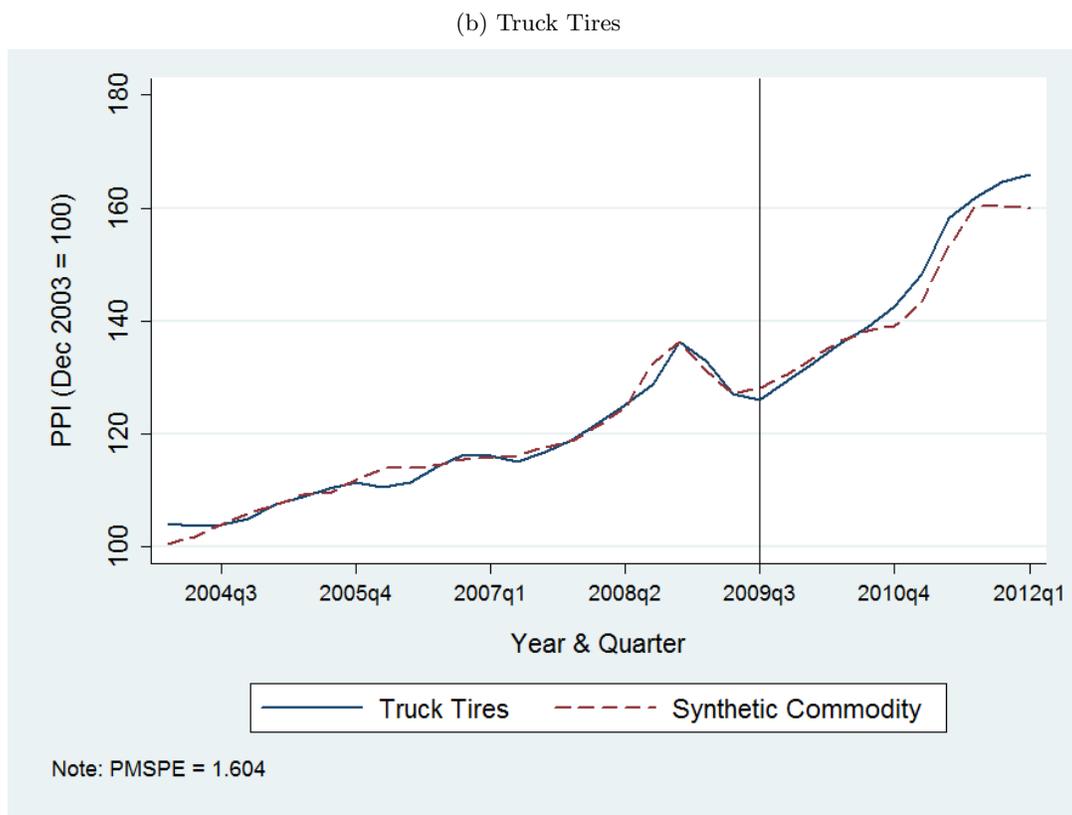
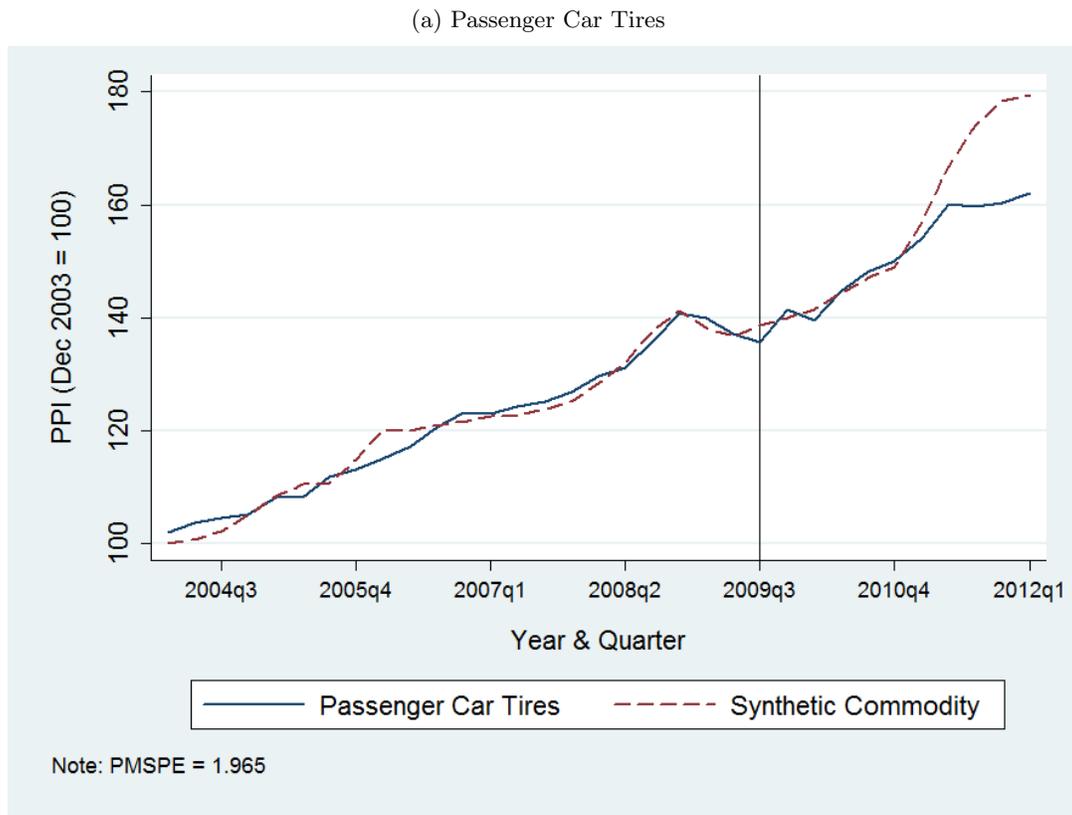
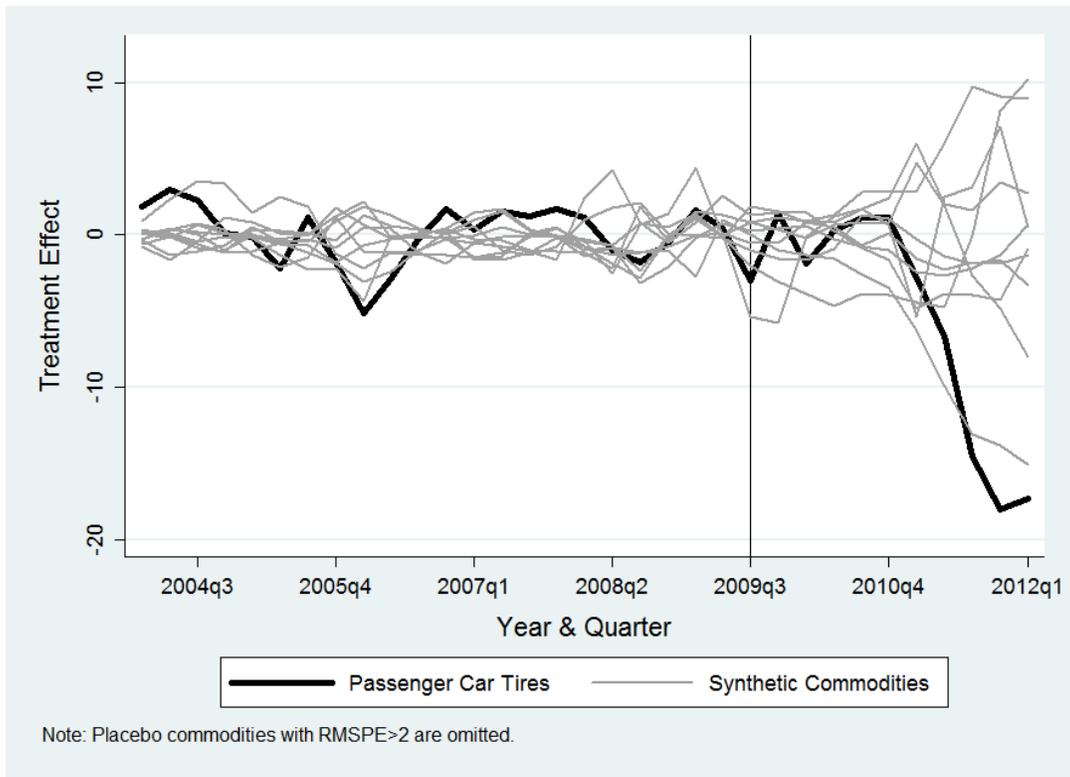


Figure 6: Placebo Tests for the CTS Effect on Domestic Prices

(a) Passenger Car Tires



(b) Truck Tires

