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

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Abstract

This paper estimates how discriminatory tariffs on certain Chinese tires impact the U.S. import patterns as well as domestic tire industry. We find that although tariffs significantly reduced subject tire imports from China, the reduction was completely offset by increased imports from other countries. We further show that the U.S. tire industry had no gains in employment and wages from the protective policy.

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1 Introduction

From September 26th, 2009, the U.S. imposed higher tariffs on certain passenger vehicle and light-truck tires imported from China for three years, under section 421 China-specific safeguard (China tire safeguard, henceforth).[1] The case has been drawing exceptional attention from researchers and policymakers, not only because it triggered Chinese retaliation on U.S. poultry and automotive parts, but also because its effectiveness on domestic tire industry is under controversy. In particular, while the U.S. government claimed in the 2012 Presidential State of the Union Address that the policy saved over a thousand American workers, most manufacturers disagree with the claim.[2]

This paper formally evaluates China tire safeguard to clarify the conflicting views on its effectiveness. We first estimate how much U.S. imports of subject tires from China has been reduced due to the tariff change (i.e., trade destruction), and how much of the reduced imports from China has been replaced by imports from other countries (i.e., trade diversion). The magnitude of trade diversion has been used as a measure of the policy effectiveness in the literature (e.g., Prusa 1997; Konings and Vandenbussche 2005): The tariff impact diminishes as more trade diversion occurs. Next, narrowing our focus to labor market responses, we assess the tariff impact on employment and wages in U.S. tire industry. The reason for looking into labor market includes that the petition for safeguard investigation is filed by the union representing production workers, not by manufacturers, and hence worker's welfare is at the core of the controversy. Besides, historical evidences suggest that temporary trade barriers typically rise when domestic unemployment rates are high (e.g., Irwin 2005; Bown and Crowley 2012).

2 Data and Time Plots

Our data on quarterly imports 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. We also define the U.S. tire industry according to the North American Industry Classification System (NAICS) as 5-digit 32621. By definitions, the U.S. imported 57 tire and related products, among which 10 tires are subject to tariff change from 2009Q4.[3]

[1]The safeguard duties are 35% ad valorem in the first year, 30% in the second year, and 25% in the third year on top of the most-favored-nation duty rates.

[2]See, for example, Forbes (2012) about the controversy. Prusa (2011, P. 55) describes 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."

[3]The NAICS 32621 tire manufacturing comprises establishments primarily engaged in manufacturing tires and inner tubes from natural and synthetic rubber and retreading or rebuilding tires. This corresponds to 61 products in the HS 10-digit level (with heading 4011, 4012, and 4013). Among them, the U.S. imported 57 products during 2002-2011.

Figure 1 shows the time trends in U.S. imports of tire products. The solid line is the total import value of 10 subject Chinese tires. A sharp drop is observed since 2009Q4. This drop is even clearer when compared to total import value of other Chinese tires, which continues to grow, except for the period of the financial crisis in the U.S.. Thus, the tariff increase appears to induce trade destruction. The import trends from the rest of the world (RoW), however, does not tell whether the subject tire imports are diverted to other countries, as the total import value of the subject tires from RoW follows a similar time trend as of other tires from RoW. We will formally assess trade destruction and diversion effects in the next section.

Data on employment and wages in U.S. tire industry are from the Bureau of Labor Statistics Quarterly Census of Employment and Wages. In addition, we use data for certain industry characteristics that can predict employment and wages which are taken from the Annual Survey of Manufactures. The employment and wage trends of the U.S. tire industry are shown as solid lines in Figure 2. Both had experienced plunges around 2006Q3 and 2008Q4, due to the tire industry strike and the financial crisis, respectively. Although they have rebounded slightly since 2009Q4, it is not clear whether their improvements are due to the tariff change or the recovery from the financial crisis.

3 Empirical Methods and Results

3.1 Impact on U.S. Import Flows

In a DID design for the tariff effect on subject tire imports, a natural control group comprises the other 47 products not subject to a tariff change. One concern is that the common trend assumption is not convincing in this setup because subject tire imports were more rapidly increasing, both in level and percentage change terms, than the control tire imports, and the safeguard was declared based on these product-specific 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.[4] In this model, the treatment effect, τ_i, is assumed heterogeneous across products but constant over time. Let the import value of product i at time t (from either China or RoW), y_{it}, be a function of

$$y_{it} = exp(\delta_i + \lambda_t + \rho_i t + \tau_i D_{it} + \epsilon_{it}) \tag{1}$$

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. The standard

[4]We confine our sample period from 2007Q3 to 2011Q4 so that 9 quarters before and after the treatment can be compared, though extending the sample period does not change our results qualitatively.

empirical gravity model specification transforms equation (1) into log-linear form. Traditional fixed effect estimator, then, identifies the average treatment effect (ATE) on the treated, $\tau = E[\tau_i]$ (Wooldridge, 2005). However, Santos Silva and Tenreyro (2006) argue that the log-linear transformation may cause bias due to heteroskedasticity and zero trade values, and suggest a Poisson pseudo-maximum likelihood (PPML) estimator with the dependent variable in levels.

Estimation results for both estimation strategies are provided in Table 1.[5] Note that estimated effects are similar across the four specifications, implying that heteroskedasticity and zero trade values are not an issue. Panel A shows the ATE on the subject Chinese tire imports, i.e., trade destruction effect. Trade destruction is significant: the tariff change reduced subject tire imports from China by 63%.

Panel B shows trade diversion effect by estimating the ATE on the subject tire import from RoW. Trade diversion is both economically and statistically significant, with a 32% increase. This increase is substantial, given that the total import value of subject tires from the RoW in the pre-treatment period is, on average, three-times that from China. Thus, we find that trade destruction is effectively offset by trade diversion. Our finding is clearer when the ATE on the total U.S. import (including China) of subject tires is estimated. The result of no change in the total U.S. import shown in Panel C implies that trade diversion is almost *complete*.[6]

3.2 Impact on U.S. Tire Industry

Complete trade diversion implies that the gains of domestic tire industry from the China tire safeguard are minimal. To further explore this prediction, we assess the tariff effect on employment and wages in U.S. tire industry. In this case, however, we do not have a clear criterion which industries are suitable as controls, and once again we cannot guarantee the common trend assumption. As a result, we employ the Synthetic Control Method (SCM), developed by Abadie and Gardeazabal (2003) and Abadie et al. (2010), to resolve the problem. Specifically, an outcome y_{jt} (employment or wages) in industry j, for $j = 1, \cdots, J$, is determined as

$$y_{jt} = \theta_t \delta_j + \lambda_t + X_j \beta_t + \tau_{jt} D_{jt} + \epsilon_{jt} \tag{2}$$

where θ_t is a vector of unobserved common factors, δ_j is the associated vector of industry-specific slopes, and X_j is a vector of observed industry characteristics. D_{jt} and λ_t are same as equation (1). Equation (2) is a generalization of log-transformed equation (1): If $\theta_t = [1, t]$, the equation reduces to a random growth model. It also allows time-varying (heterogeneous) treatment effects. Clearly, such generalizations provide more candidates for control industries.

[5] Given 57 tire products, clustering standard errors at the product level is reasonably safe to avoid the over-rejection problem as discussed in Bertrand et al. (2004).

[6] This result is robust when the dependent variable is replaced by import quantity.

Given this flexibility, we choose all NAICS 5-digit industries (except for the tire industry) under the same 3-digit code, 326, as potential control industries, which generates nine control industries (i.e., $J = 10$). The sample period is 2002Q1 through 2011Q4.[7] Without loss of generality, let $j = 1$ be the tire industry. For the other nine control industries, a vector of weight, $w = [w_2, w_3, \cdots, w_{10}]$, is assigned such that

$$\sum_{j=2}^{10} w_j^{\star} y_{jt} = y_{1t}, \forall t \leq 2009Q3 \quad and \quad \sum_{j=2}^{10} w_j^{\star} X_j = X_1. \tag{3}$$

Once the optimal weight $w^{\star}$ is obtained,[8] the treatment effect is identified as

$$\tau_{1t} = y_{1t} - \sum_{j=2}^{10} w_j^{\star} y_{jt}, \quad \forall t \geq 2009Q4. \tag{4}$$

Table 2 shows the predictors of post-treatment outcomes for tire and synthetic industry, which include total value of shipments, total cost of materials, total inventories at the end of year, employer's cost for health insurance, and ratio of production worker to total employment, as well as four lagged dependent variables. All industry characteristics are 2008 values. Finally, Figure 2 shows the estimation results using SCM. It demonstrates that the synthetic industries mimic employment and wage trends of the tire industry quite well in the pre-treatment period, respectively, except for the period of the tire industry strike.[9] That said, we see no significant tariff effect on both employment and wages in the U.S. tire industry.

SCM suggests a set of placebo tests for inference. 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. Following the SCM procedure described above, we can obtain estimates of $\hat{\tau}_{jt}$ for $j = 2, \cdots, 10$ and $t \geq 2009Q4$. If the tire industry was affected by the tariff change, we should be able to observe significantly different $\hat{\tau}_{1t}$'s from all other $\hat{\tau}_{jt}$'s, all of which are expected to be zero. However, in Figure 3, neither employment nor wages indicate any significant difference between the treatment effect on the tire industry and the placebo industries.

4 Concluding Remark

Our empirical results indicate that (i) subject tire imports from China have fallen after the tariff change. However, (ii) the import reduction is completely diverted to imports from other

[7] SCM works better for longer pre-treatment periods.

[8] For more detailed descriptions on estimation procedure, see Abadie et al. (2010). They also provide a STATA code for the estimation, which we used in this paper.

[9] The Root Mean Squared Prediction Error (RMSPE) that measures the discrepancy of outcomes between tire and synthetic industry is provided in Figure 2 and 3.

countries, and hence (iii) the U.S. tire industry experienced no gains in employment and wages. These results are consistent with the literature that the impact of discriminatory trade policy (DTP) may significantly be hampered by trade diversion.

Although informative as an evaluation of China tire safeguard, further research is warranted to draw more general implications for policy designs. For example, an investigation of what caused the complete trade diversion would be worthwhile. As Prusa (2011) argues, one potential reason may be that the worldwide tire industry is highly concentrated such that a few multinational corporations can reallocate productions to non-tariffed countries in response to a DTP. However, such argument needs more systematic evidence, especially given the proliferation of networked multinationals and DTPs in recent decades.

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Table 1: Impact of the U.S. Tariffs on Tire Import Flows

Estimator Dep. Variable	OLS log(import)	OLS log(import+1)	PPML import>0	PPML import
Panel A: Import from China				
$\hat{\tau}$	-1.005**	-0.915**	-0.979**	-0.979**
	(0.177)	(0.163)	(0.110)	(0.110)
% change	-63.96	-60.49	-62.66	-62.66
Observations	860	1,026	860	1,026
R^2	0.944	0.947	0.975	0.976
Panel B: Import from RoW				
$\hat{\tau}$	0.287*	0.276*	0.286**	0.286**
	(0.124)	(0.120)	(0.101)	(0.101)
% change	32.24	30.90	32.47	32.47
Observations	1,020	1,026	1,020	1,026
R^2	0.963	0.963	0.991	0.991
Panel C: Total Import				
$\hat{\tau}$	-0.045	-0.060	-0.004	-0.004
	(0.145)	(0.145)	(0.082)	(0.082)
% change	-5.377	-6.807	-0.765	-0.766
Observations	1,021	1,026	1,021	1,026
R^2	0.967	0.966	0.990	0.990

Notes: 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 2: Predictors of Employment and Wages

	log(employment)		log(wage)	
Variables	Tire	Synthetic	Tire	Synthetic
log(shipments)[a]	7.966	7.913	7.966	7.863
log(material cost)[a]	8.399	8.456	8.399	8.482
log(inventory)[a]	5.914	6.077	5.914	6.189
log(health insurance)[a]	4.739	4.345	4.739	4.572
production worker ratio	0.812	0.788	0.812	0.765
$\log(y_{j,2002Q3})$	4.321	4.271	13.716	13.696
$\log(y_{j,2005Q1})$	4.216	4.211	13.704	13.708
$\log(y_{j,2007Q3})$	4.092	4.127	13.623	13.644
$\log(y_{j,2009Q2})$	3.993	3.952	13.460	13.446

[a] Values are measured in thousand dollars.

Figure 1: Trend in the U.S. Tire Import during 2002Q1-2011Q4

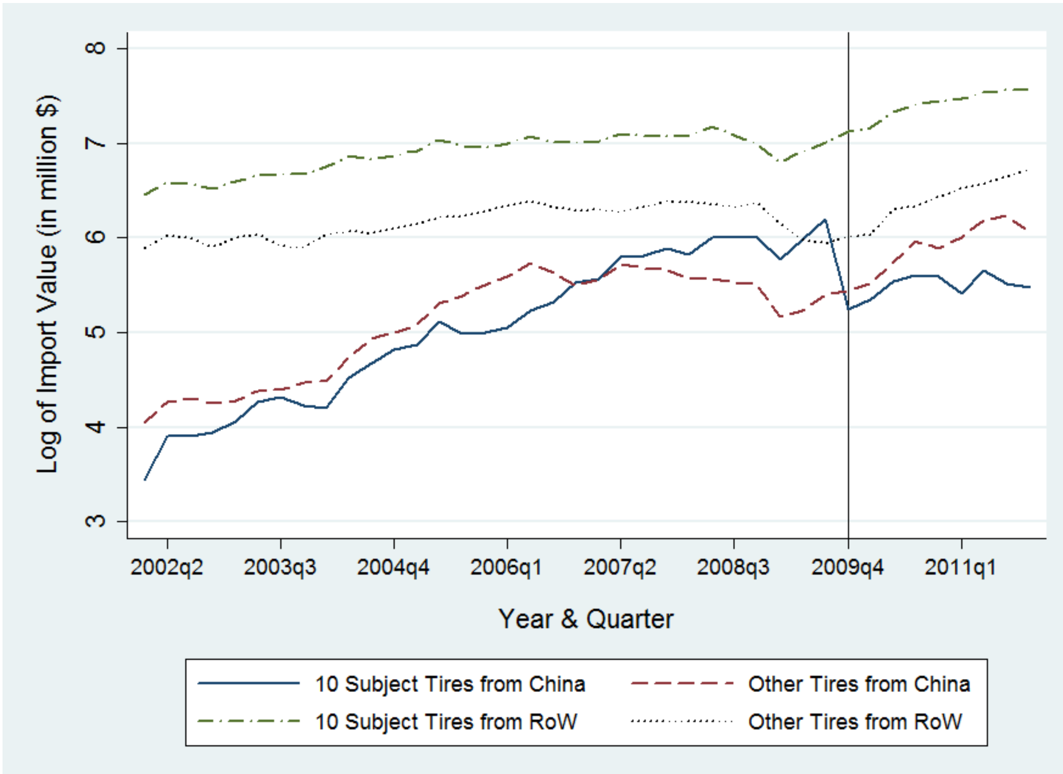


Figure 2: Trends in the U.S. Tire vs. Synthetic Industry during 2002Q1–2011Q4

(a) Total Employment

(b) Total Wage

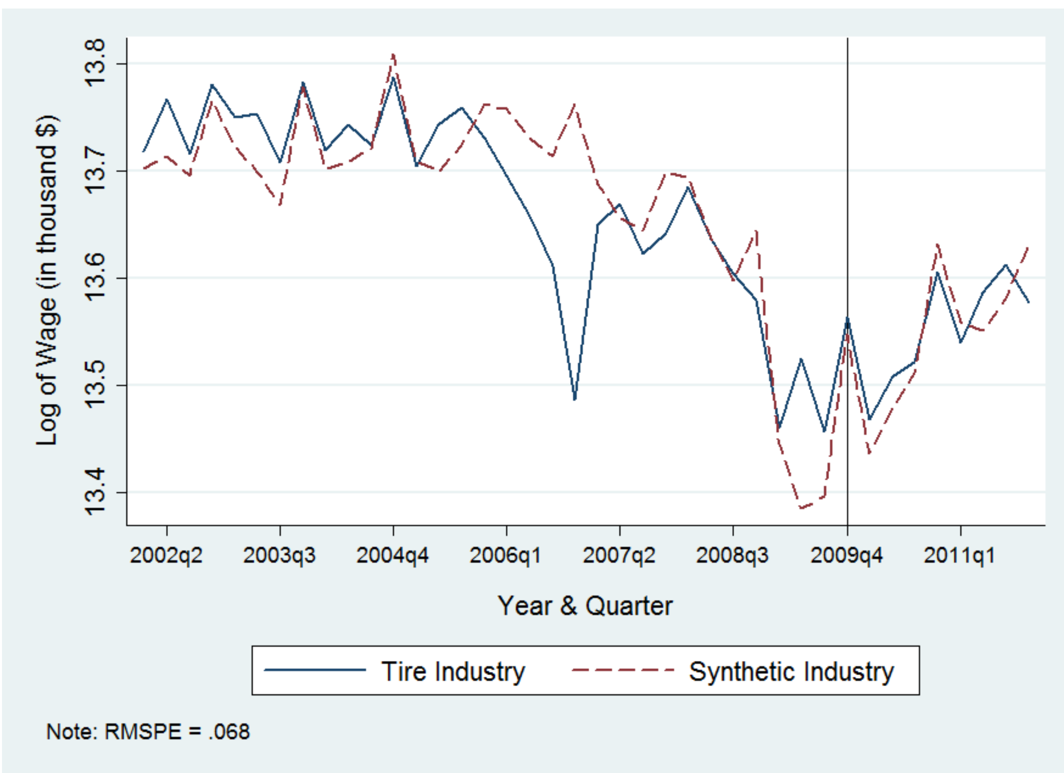
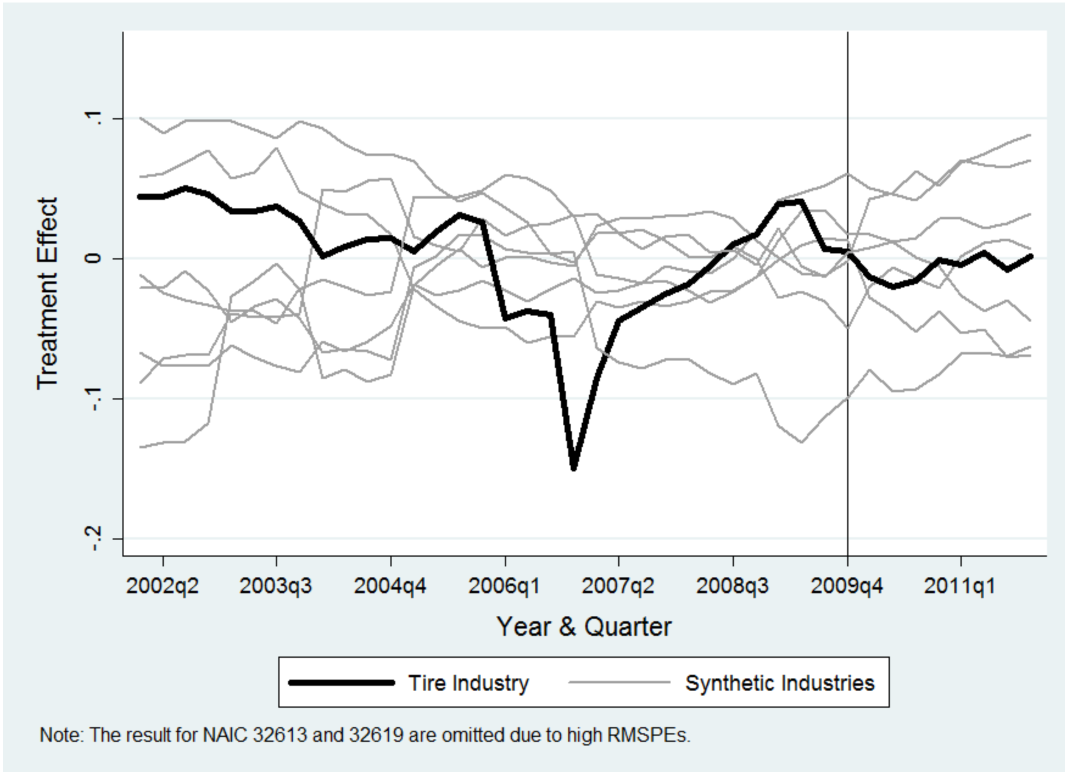


Figure 3: Placebo Tests for Synthetic Control Analysis

(a) Total Employment



(b) Total Wage