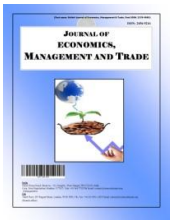

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Comparative Analysis of Tariffs-Restricted Trade Wars between the United States and China Under the Recent Past Four Presidents: Did they Achieve Their Objectives?

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

This paper provides a comparative analysis of the tariffs-restricted trade wars between the United States and China under the recent past four presidents of the United States by using the difference-in-differences estimator framework. The overarching objective of three of the four presidential administrations that engaged in trade wars was to reduce the United States' trade deficits with China. This raised some research questions. Did each administration achieve its objective of reducing the trade deficits with China? If so, which administration more effectively reduced the trade deficits in comparison to their immediate predecessor? What lessons can future administrations and governments around the world draw from the outcomes of the tariffs-restricted

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trade wars between the United States and China? To determine which president – Trump, Obama, and Bush – most effectively utilized import tariffs to reduce the trade deficits with China, we specified and tested three different sets of hypotheses. In sync with a controlled experiment, we tested another three sets of hypotheses in which we compared Presidents Trump, Obama, and Bush to President Clinton who did not impose tariffs on China. Based on our estimated results, we rejected all the null hypotheses in favor of the alternative hypotheses, which suggest that Presidents Trump, Obama, and Bush did not achieve any significant reduction in the United States' trade deficits with China through the use of tariffs relative to President Clinton. The important lesson drawn from these findings is that tariffs are counterproductive and ineffective policy strategy.

Keywords: Tariffs-restricted trade; United States; China; trade deficits; difference-in-differences.

JEL Classification: F13, F51, F53, N70, O34, O38, O57.

1. INTRODUCTION

The United States' trade deficits with China was not a major topic for discussion in the 1970s, 1980s, and 1990s among economists and policymakers because China did not account for a significant fraction of the total imports of goods and services to the United States. International trade data from the United States Census Bureau [1] showed that the United States' trade deficit in goods with China was merely –$6.0 million in 1985, and gradually increased to –$68,677.1 million in 1999 – all before China became a member of the World Trade Organization (WTO) in 2001. The perceived gains from free trade with China motivated the Clinton administration to pressure Congress to approve the United States-China trade agreement, which ultimately paved the way for China's membership in the WTO in 2001. By 2020, the United States' trade deficit in goods with China was –$310,800.5 million, which almost quintupled its 1999 level.

According to Breuninger and Wilkie [2], President Trump's views on free trade, tariffs-restricted trade, and multinational trade agreements or deals were set in stone long before he ran and became the 45th President of the United States on January 20, 2017. President Trump's desire for the United States to launch trade wars with its trading partners, such as Japan and China, began in the 1980s based on the premise that these trading partners took advantage of the United States and that it was time for the United States to end its vast trade deficits by making Japan, China, and others pay "to the American people." Essentially, President Trump capitalized on the United States' trade deficits of the 1980s and 1990s, and in the process, he was able to sow and ferment the seeds of a fiercely competitive view of international relations, which later reverberated among millions of working-class citizens who saw their businesses, industries, and jobs dwindle in the midst of globalization.

This paper complements and extends the plethora of extant studies on trade, trade wars and tariffs by focusing squarely on the United States' trade deficits with China under the recent past four presidents of the United States. Three of these presidents – Trump, Obama, and Bush – engaged in tariffs-restricted trade wars with China, while Clinton did not, but was instrumental in China's membership in the World Trade Organization in 2001. The overarching objective of the Trump, Obama, and Bush administrations' engagement in trade wars with China was to reduce the United States' trade deficits with China. This raises some policy laden research questions: Did the Trump, Obama, and Bush administrations achieve their objectives of reducing the trade deficits with China? If so, which of these administrations most effectively used the tariffs-restricted trade wars to reduce the United States' trade deficits with China in comparison to their immediate predecessor? What lessons can the Biden administration, other future administrations in the United States (US), and other governments around the world, learn from the outcomes of the tariffs-restricted trade wars which the past US administrations engaged in with China?

To answer these questions, we use the difference-in-difference (DID) estimator method, which is commonly used in economics and other social sciences to measure outcomes in treatment and control groups or to assess the effects of policies. In using DID, we divide the recent past four Presidents of the United States into two groups. We label the first group as the treatment or trade intervention group, and this

includes Presidents Trump, Obama, and Bush who engaged in and/or experimented with tariffs-restricted trade wars with China. The second group, we consider as the control group, consists of only President Clinton. For each group, we tested three different sets of null (H_0) and alternative (H_A) hypotheses. For the treatment group, we initially tested the null and alternative hypotheses in which we compared the 48 months of the United States' trade deficits with China under Presidents Trump and Obama, and then under Presidents Trump and Bush. We then tested the null and alternative hypotheses by comparing the 96 months of the United States' trade deficits with China under Presidents Obama and Bush since both served 96 months in office. Using the same format of the null and alternative hypotheses described earlier for the treatment group, we compared each president in the treatment group to President Clinton, the only president in the control group, who did not engage in any documented tariff-restricted trade wars with China.

For the treatment group, we rejected the null hypotheses in favor of the alternative hypotheses, which suggest that President Trump's series of aggressive tariffs-restricted trade wars with China was less successful at reducing the United States' trade deficits with China than President Obama's tire tariffs. The alternative hypothesis is that President Trump's series of tariffs-restricted trade wars worsened the United States' trade deficits with China when compared to President Obama's tire tariffs. The results of the null and alternative hypotheses also hold true when we compared President Trump's 48 months in office to President Bush's first term. Our results, based on 96 months of data on trade deficits with China under Obama and Bush presidencies, showed that President Obama's tire tariffs-restricted trade with China was less successful at reducing the United States' trade deficits with China than President Bush's steel tariffs. Similarly, we rejected the null hypotheses in favor of the alternative hypotheses when we compared each president – Trump, Obama, and Bush – in the treatment group to President Clinton – the lone president in the control group. Based upon these findings, we conclude that the United States' trade deficits with China worsened under President Trump when compared to President Obama. The trade deficits also loomed larger under the two terms of Presidents Obama and Bush when compared to the two terms under President Clinton.

The rejection of the null hypotheses in favor of the alternative hypotheses for the treatment group demonstrates that tariffs-restricted trade wars may not be the best strategic trade policy with which to reduce trade deficits. These outcomes are of significance to the Biden administration and future US presidential administrations. They are also consequential for other governments around the world who may want to engage in tariffs-restrictive trade wars to reduce trade deficits.

We organize the rest of this paper as follows. Section 2 reviews the recent literature on tariffs-restricted trade wars between the United States and China. Section 3 discusses the various episodes of tariffs-restricted trade wars initiated under Presidents Clinton, Bush, Obama, and Trump during their first and/or second terms in office. Section 4 discusses the methodology and the empirical results. Section 5 concludes with some policy implications and recommendations.

2. LITERATURE REVIEW

Whenever the United States engages in tariffs-restricted trade wars with its trading partners, international trade theorists consider it as a revisit of the Smoot-Hawley Tariff Act of 1930, which had dire consequences on the economy of the United States. Trade experts at the Peterson Institute for International Economics (PIIE) have provided a plethora of detailed studies of trade wars that involved China and the United States and its allies over the past decade, especially in the past five years [Bown and Irwin [3], Bown and Joseph [4], Bown et al. [5-11], Bown et al. [12,46-47], Bown and Zhang [13,14-16], Gonzalez [17], Hufbauer [18], Hufbauer and Jung [19], Lovely and Liang [20], Lu and Schott [21], Schott and Lu [22], Schott [23]. According to Hufbauer and Woollacott [24], the desire to engage in trade war with China[1] did not go well under President George W. Bush despite the fact that the United States International Trade Commission (USITC) found affirmative market disruptions covering imported goods from China that called for trade sanctions. They further pointed out that President Obama, in his first year in office, approved the relief for domestic producers of tires by imposing "additional 35 percent ad valorem tariff duty in the first year, 30 percent ad valorem in the second year, and 25

[1] *China joined WTO in 2001 during the first year of George W. Bush's presidency, and this may explain why he was forced to backtrack the steel tariffs on China after 18 months instead of the intended three years.*

percent ad valorem in the third year" on imported tires from China. In its quest to resolve the trade tariffs, China got the World Trade Organization (WTO) involved after their consultation with the United States failed. The ruling from the WTO did not change the three-year tire tariffs implementations. In early 2010, China retaliated by "imposing antidumping tariffs ranging from 50.3 to 105.4 percent and countervailing duties of between 4.0 and 30.3 percent on US and other foreign chicken part exports to China."

According to Breuninger and Wilkie [2], President Trump's radical views on trade were developed long before he targeted China with tariffs. During the 2016 presidential election, trade experts and legal scholars assessed how the trade agendas of both candidates (Donald Trump and Hillary Clinton) would affect different parts of the US economy. For example, extending a macroeconomic model from Moody's Analytics, Noland et al. [25,50] found that if Trump raises tariffs sharply on China, Mexico, and other trading partners, export-dependent industries in the United States that manufacture machinery used to create capital goods in the information technology, aerospace, and engineering sectors would be the most severely affected. The authors noted that the shock resulting from Trump's proposed trade sanctions would also damage sectors not engaged directly in trade, such as wholesale and retail distribution, restaurants, and temporary employment agencies, particularly in regions where the most heavily affected goods are produced. In addition, millions of American jobs that appear unconnected to international trade—disproportionately lower-skilled and lower-wage jobs—would be at risk. In a related study, which addressed the losses to both countries due to tariffs, Nicita [26] pointed out that the United States tariffs on China hurt both countries economically, largely through higher prices on American consumers and significant export losses by Chinese exporters. According to Nicita [26], "China's export losses in the United States have resulted in trade diversion effects to the advantages of Taiwan Province of China, Mexico, the European Union and Viet Nam, among others."

Section 232 of the Trade Expansion Act of 1962 allows the United States President to impose tariffs based on a recommendation from the US Secretary of Commerce if imports into the United States threaten the national security. Given President Trump's radical views on United States-China trade deficit relations, experts worry about the ramifications with respect to the global economy if President Trump imposed tariffs on China and other trading partners. Hufbauer [18] argued that there is ample precedent and scope for a United States president to unilaterally raise tariffs that Trump vowed to do as a centerpiece of his trade policy and that efforts to block Trump's actions through the courts, or amend the authorizing statutes in Congress, would be difficult and time-consuming. Noland [25] analyzed what the impact of the trade policies advocated by both Trump and Clinton would have on the United States' foreign policy interests and its global leadership. According to Noland [25], if both candidates pull out of the Trans Pacific Partnership, which both promised to do, this would weaken United States alliances in Asia and embolden its rivals, thus eroding the national security of the United States. The study also cautioned that the abrogation of the North America Free Trade Association, which Trump threatened, would deliver a severe blow to Mexico's economic and political development that could increase, not decrease, the flow of illegal migrants and drugs into the United States.

As the largest importer, the consequences of the United States' engagements in tariffs trade wars with China and other allies had prompted a plethora of studies. For example, Bown (2018) provided reasons why President Trump's steel and aluminum tariffs are counterproductive. First, Bown (2018) pointed out that steel has been the largest beneficiary of special protection for decades and that "As of the end of 2017, more than 60 percent of US imports of steel were already covered by previously imposed special protections." Second, the study noted that since nearly 94 percent of US steel imports from China was already subject to special tariffs, the new 25 percent tariff on steel imports advocated by President Trump would have little impact on imports from China but would adversely affect the allies of the United States like Canada, Germany, and Japan.

Third, the US aluminum industry is also a beneficiary covered by the special protection arising under the US antidumping and countervailing duties. Fourth, Canada is the largest source of US aluminum imports followed by China, and the established trade restrictions already covered 96 percent of US imports of aluminum products from China. This means that like the 25 percent tariff on steel imports, the 10 percent tariff on aluminum would have less impact on imports from China but would

significantly negatively impact Canada and the other aluminum trading partners of the United States.

Robinson et al. [27] also pointed out that Trump's tariffs on steel and aluminum will cause production in automobile industries to fall by 1.5 percent and further cause between 195,000 and 624,000 US workers to lose their jobs over a one-to-three-year period or possibly longer [see Cavallo et al. [28], Flaaen et al. [29], Fajgelbaum et al. [30]. Amiti et al. [31] argued that the end result of U.S. import tariffs followed by other countries' retaliatory tariffs on US exports will "lower imports and lower exports, with little or no improvement in the trade deficits." In addition, Amiti et al. [32] showed graphically the impact of Trump's tariffs on prices and the welfare losses due to higher import tariffs. Their study concluded that the deadweight welfare costs of Trump's tariffs reached $1.4 billion per month by December 2018, which is consistent with the findings of a growing number of studies with respect to the 2018 tariffs.

In a recent study, Owoye and Onafowora [33] indicated that the tariffs-restricted trade wars with China under President Trump was accompanied by many interactive actions with the dates on which these actions occurred. Further, they suggested that the intensity of the tariffs-restricted trade wars with China may have fractured [34] the diplomatic relationships between both countries, thus their inability to share the pertinent information necessary for collaboration and coordination in preparation for the global COVID-19 coronavirus pandemic.

3. TRENDS IN THE UNITED STATES-CHINA TRADE RELATIONSHIPS UNDER THE PAST FOUR PRESIDENTS

In analyzing the trends in the United States-China trade relationships under the recent past four presidents of the United States, three of whom engaged in and experimented with tariffs-restricted trade wars with China, it is important to point out that tariffs at the very low rates, allowed by members of the World Trade Organization (WTO), were imposed on goods from China prior to its membership in the WTO in 2001. In addition, for many years, China was one of the most important countries among the group that required an annual waiver to maintain free trade status with the United States.

3.1 President Clinton's United States-China Trade Deal

Before President Clinton called on Congress to change China's normal trade relations with the United States to permanent status, which also culminated in China's admission into the WTO in 2001, China was not the major source of total imports of goods and services to the United States. President Clinton considered the United States–China Relations Act of 2000 as the equivalent of a one-way street required to open China's markets, the biggest markets in the world, potentially to the United States' products and services in unprecedented new ways. In retrospect, many international trade experts questioned whether or not this was a strategic mistake on the part of the United States for allowing China to join the WTO in 2001 [34,49].

3.2 President Bush's Steel Tariff

According to Palmer [35], as the United States-China trade relationship quickly veered off track after China joined the WTO, this compelled President George W. Bush to try and save the steel industry in 2002 by raising tariffs on selected steel products. Many experts believed that the Bush's tariffs on steel failed because it led automobile parts manufacturers to leave the United States "so that they could make their parts with cheaper steel and then ship them back to the U.S. – cutting jobs for American workers while also avoiding tariffs." President Bush back-pedaled on the tariffs in just 18 months instead of three years as planned because the WTO ruled that the Bush tariffs did not conform to the global rules; and at the same time, the European Union and other countries threatened the United States with retaliatory tariffs. According to a study conducted by the Peterson Institute for International Economics, the Bush's steel tariffs cost about 200,000 jobs in comparison to the roughly 187,000 jobs saved – at roughly about $400,000 per job saved [35].

3.3 President Obama's tire Tariffs

In 2009, President Obama used tire tariffs as the approach to relief domestic producers of tires by imposing ad valorem tariff duties covering three years, which started with 35 percent in the first year, 30 percent in the second year, and 25 percent in the third year on imported tires from China. In retaliatory response, China imposed antidumping tariffs ranging from 50.3 to 105.4 percent and countervailing duties of between 4.0 and 30.3 percent on the United States and other

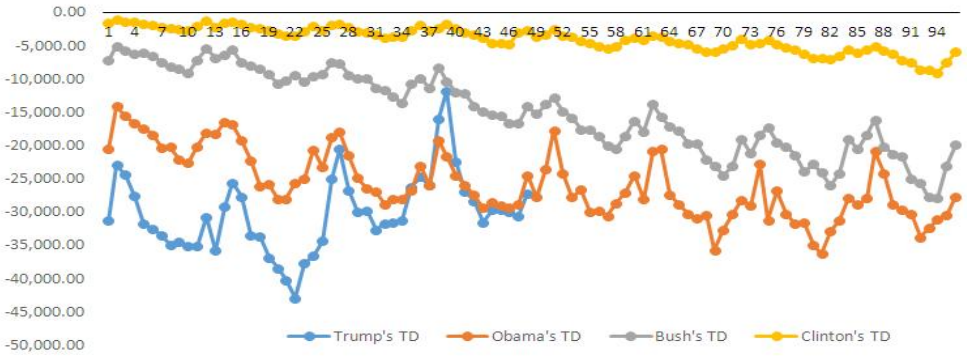

Fig. 1. Monthly trade deficits in goods with China under presidents Trump, Obama, Bush, and Clinton

Note: The numbers on the vertical axis are in millions of dollars, while the numbers on the horizontal axis cover 96 months. Data used to plot this diagram was obtained from https://www.census.gov/foreign-trade/balance/c5700.html.

foreign chicken part exports to China. According to Gillespie [36], these retaliatory tariffs cost American chicken producers about $1 billion in sales.

3.4 President Trump's Series of Aggressive Tariffs

The study by Bown and Kolb (2020) documents President Trump's trade war timeline, which they classified into five "Battles." The "Battle #1" category dealt with the solar panels and washing machines tariffs, and it laid out different actions taken by the United States as well as the responses and counteractions taken by China and South Korea. The "Battle #2" category addressed the 25 percent and 10 percent tariffs on steel and aluminum, respectively. The steel and aluminum tariffs spurred actions and counteractions not only from China but from other trading partners who are also major sources of steel and aluminum exports to the United States. The "Battle #3" category laid out the tariffs imposed on China premised on unfair trade practices for technology, and intellectual property thefts. This particular trade battle with China prompted more actions and counteractions than the previous two trade battles combined. While "Battle #4" addressed the automobile industry as national security threat [48], "Battle #5" involved the issue of illegal immigration from Mexico. The nature and focus of the last two battles suggest that President Trump's trade wars were multidirectional.

Fig. 1 provides a visual representation of the trends in monthly trade deficits during the tenure of each president. The figure shows that in the first 26 months under President Trump, United States' trade deficits with China worsened; and between the 27th and 48th months, there appeared to be no difference in the trade deficits under Presidents Trump and Obama. President Trump achieved a sizeable reduction in trade deficit to –$11,833.50 million in the 39th month when compared to President Obama's 39th month trade deficit of –$21,619.80 million. In addition, President Trump's reduction in trade deficits to –$11,833.50 million in his 39th month in office falls midway between President Bush's trade deficits of –$10,438.20 million in the 39th month and –$12,010.20 million in the 40th month. There appeared to be parity in the United States' trade deficits with China during the 39th and 48th months under Presidents Trump and Obama, but the deficits were farther apart from those experienced under Presidents Bush and Clinton.

4. METHODOLOGY AND ESTIMATED RESULTS

In this section, we use the difference-in-differences (DID) [2] statistical technique widely used in econometric and quantitative research in economics and other social sciences to quantify the outcomes of the import tariff interventions, which three of the four presidential administrations used. We compare the changes in trade deficits over time between the three presidents that engaged in tariff-restricted trade wars with China, and then, to the lone president who did not. Importantly, the DID methodology

[2] *For more discussion on difference-in-differences or the difference-in-means method, see Fredriksson and de Oliveira [38], Athey and Imbens [39,40], Stock and Watson [41], Wooldridge [42], Lechner [43], and Bertrand et al. [44].*

facilitates the assessment of which of these presidents was more successful in reducing the United States' trade deficits with China relative to their immediate predecessor.

We proceed by dividing the recent past four presidents into two groups. The first (treatment or trade intervention) group consists of Presidents Trump, Obama, and Bush who engaged in and experimented with tariffs-restricted trade wars in their attempts to protect jobs and reduce the United States' trade deficits with China. The second (control) group consists only of President Clinton who did not engage in tariffs-restricted trade wars with China but was instrumental in China's membership in the WTO. Given that the United States-China trade relationship quickly veered off track after China joined the WTO and the United States' trade deficits with China skyrocketed thereafter, one can presume that each subsequent administration used tariffs-restricted trade wars as the strategic policy instrument with which to improve or to reduce the trade deficits better than its predecessor. Since the presidents in the treatment group (TG) engaged in tariffs-restricted trade wars with China and the lone president in the control group (CG) did not, the DID estimator of the tariffs-restricted trade war outcomes can be expressed as:

$$DID = \left(\overline{TD}_i - \overline{TD}_j\right)_{TG} - \left(\overline{TD}_i - \overline{TD}_j\right)_{CG} = \Delta\overline{TD}_{TG} - \Delta\overline{TD}_{CG} \quad (1)$$

where $\overline{TD}$ represents the average monthly trade deficits under each of the four presidents in the sample while *i* and *j* represent the successors and the predecessors, respectively (Trump v. Obama, Trump v. Bush, and Obama v. Bush).

For the lone president in the control group, $\overline{TD}_{i,CG} = \overline{TD}_{j,CG}$, that is, $\Delta\overline{TD}_{CG} = 0$; therefore, the *DID* for comparing average outcomes of the import tariffs interventions by the three presidents in the treatment group can be expressed as:

$$DID = \left(\overline{TD}_i - \overline{TD}_j\right)_{TG} \gtrless 0 \quad \text{or} \quad DID = \left(\overline{TD}_i - \overline{TD}_j\right)_{TG} \lessgtr 0$$
$$= \Delta\overline{TD}_{i,j;TG} \gtrless 0 \quad \text{or} \quad \Delta\overline{TD}_{i,j;TG} \lessgtr 0 \quad (2)$$

Furthermore, the *DID* for comparing the $\overline{TD}$ between the *TG* and *CG* can be expressed as:

$$DID = \overline{TD}_{i,TG} - \overline{TD}_{j,CG} \gtrless 0 \text{ or } DID = \overline{TD}_{i,TG} - \overline{TD}_{j,CG} \lessgtr 0 \quad (3)$$

While the Bush administration was considered tough on China, the Obama administration was deemed tougher, and the Trump administration was acclaimed the toughest on China in comparison to the Clinton administration [37,36]. The Trump administration's policy strategy of imposing stiff and aggressive import tariffs on China was meant to fulfil his campaign promise that "trade wars are good, and easy to win," but more importantly, President Trump wanted to prove that he could reduce the United States' trade deficits with China better than Presidents Obama, Bush, and Clinton.

To ascertain statistically which administration in the treatment group was relatively more successful in reducing the United States' trade deficits with China, we rely on the reduced *DID* in equation (2) and conduct tests of the following three sets of null hypotheses (H_0) and alternative hypotheses (H_A):

$$H_0: \overline{TD}_{Trump,i} \leq \overline{TD}_{Obama,j} \quad \text{versus} \quad H_A: \overline{TD}_{Trump,i} > \overline{TD}_{Obama,j} \quad (4)$$

$$H_0: \overline{TD}_{Trump,i} \leq \overline{TD}_{Bush,j} \quad \text{versus} \quad H_A: \overline{TD}_{Trump,i} > \overline{TD}_{Bush,j} \quad (5)$$

and

$$H_0: \overline{TD}_{Obama,i} \leq \overline{TD}_{Bush,j} \quad \text{versus} \quad H_A: \overline{TD}_{Obama,i} > \overline{TD}_{Bush,j} \quad (6)$$

where $\overline{TD}_{Trump}$, $\overline{TD}_{Obama}$, and $\overline{TD}_{Bush}$ represent the average monthly trade deficits under Presidents Trump, Obama, and Bush. For hypotheses (4) and (5), the average monthly trade deficits covered the first 48 months of each president's tenure in office to ensure fair and accurate comparison between the presidents; and for hypotheses (6), the average trade deficits covered 96 months since both Presidents Obama and Bush spent two terms in office.

As noted earlier, the *DID* in equation (3) can be used as the assessment tool to determine whether Presidents Trump, Obama, and Bush managed the United States' trade deficits with China better than President Clinton, thus we express the H_0 and H_A hypotheses as:

$$H_0: \ \overline{TD}_{Trump,i} \leq \overline{TD}_{Clinton,j} \text{ versus } H_A: \overline{TD}_{Trump,i} > \overline{TD}_{Clinton,j} \tag{7}$$

$$H_0: \ \overline{TD}_{Obama,i} \leq \overline{TD}_{Clinton,j} \text{ versus } H_A: \overline{TD}_{Obama,i} > \overline{TD}_{Clinton,j} \tag{8}$$

and

$$H_0: \ \overline{TD}_{Bush,i} \leq \overline{TD}_{Clinton,j} \text{ versus } H_A: \overline{TD}_{Bush,i} > \overline{TD}_{Clinton,j} \tag{9}$$

For the H_0 and H_A hypotheses (7), the $\overline{TD}_{Clinton}$ represents the average monthly trade deficits for the first 48 months of President Clinton's two-term tenure in order to conduct a fair and accurate comparison to President Trump who spent only one term or 48 months in office. For hypotheses (8) and (9), $\overline{TD}_{Obama}$, $\overline{TD}_{Bush}$, and $\overline{TD}_{Clinton}$ represent the average trade deficits over the 96 months or the two terms each of the three presidents spent in office. While the three sets of H_0 and H_A hypotheses (4)-(6) for the treatment group are intended to answer the question with respect to which administration was relatively more successful at reducing the United States' trade deficits by engaging in tariffs-restricted trade wars with China, the three sets of H_0 and H_A hypotheses (7)-(9) paired off each president in the treatment group with the lone president in the control group to highlight the effectiveness or ineffectiveness of import tariffs aimed at reducing the trade deficits.

To test the H_0 and H_A hypotheses (4)-(6) and (7)-(9) under the treatment and control groups, respectively we obtained monthly international trade data on goods between the United States and all countries including China for the period 1993-2020 from the United States Census Bureau [1]. The estimated results for the six hypotheses, (4)-(6) and (7)-(9), are presented in Tables 1 and 2, respectively. Based on the results reported in Table 1 for the treatment group, which experimented with tariffs-restricted trade wars with China, we rejected the three null hypotheses (H_0) in favor of the three alternative hypotheses (H_A). The results for hypotheses (4) and (5) are particularly revealing because they indicate that the United States' trade deficits (*TDs*) with China under President Trump were much higher in comparison to Presidents Obama and Bush (that is, $\overline{TD}_{Trump,i} > \overline{TD}_{Obama,j}$ and $\overline{TD}_{Trump,i} > \overline{TD}_{Bush,j}$) thereby contradicting President Trump's constantly repeated mantra that "trade wars are good, and easy to win." Based on the available data, President Trump's –$30,210.96 million average monthly trade deficit with China exceeded President Obama's –$23,130.63 million and President Bush's –$9,843.40 million average monthly trade deficits. Similarly, since $\overline{TD}_{Obama,i} > \overline{TD}_{Bush,j}$, this suggests that President Obama's ad valorem tariffs were less successful in reducing the trade deficits with China than President Bush's steel tariffs, which lasted for 18 months instead of the intended 36 months.

Based on the estimated results reported in Table 2 where we paired-off and compared the three presidents in the treatment group individually with the lone president in the control group, we also rejected the three null (H_0) hypotheses in favor of

Table 1. *TDs* with China: Comparison among the Experimenters of Tariffs

	4. Trump		**versus**	**Obama**		
N_{Trump}	$\overline{TD}_{Trump}$	S^2_{Trump}		N_{Obama}	$\overline{TD}_{Obama}$	S^2_{Obama}
48	– 30,210. 96	34,278,683.51		48	– 23,130.63	19,137,096.47
Difference in $\overline{TD}_S$ = – 7,080.33, t-*statistics* = –7.92, α = 0.01, and *df* = 94						
	5. Trump		**versus**	**Bush**		
N_{Trump}	$\overline{TD}_{Trump}$	S^2_{Trump}		N_{Bush}	$\overline{TD}_{Bush}$	S^2_{Bush}
48	– 30,210. 96	34,278,683.51		48	– 9,843.40	9,525,004.52
Difference in $\overline{TD}_S$ = – 20,367.56, t-*statistics* = –21.55, α = 0.01, and *df* = 94						
	6. Obama		**versus**	**Bush**		
N_{Obama}	$\overline{TD}_{Obama}$	S^2_{Obama}		N_{Bush}	$\overline{TD}_{Bush}$	S^2_{Bush}
96	– 25,915.88	25,041,063.55		96	– 14,952.16	37,650,049.66
Difference in $\overline{TD}_S$ = –10,963.72, t-*statistics* = –32.20, α = 0.01, and *df* = 190						

Note: The $\overline{TD}_S$ are in millions of dollars while S^2_{Trump}, S^2_{Obama}, and S^2_{Bush} are the mean TDs variances under each president. Variance is $S^2 = \frac{\sum(TD-\overline{TD})^2}{N}$, standard deviation is $S_{\overline{TD}_1-\overline{TD}_2} = \sqrt{\left(\frac{N_1S_1^2+N_2S_2^2}{N_1+N_2-2}\right)\left(\frac{N_1+N_2}{N_1N_2}\right)}$, $df = N_1 + N_2 – 2$, and the statistical significance is at $\alpha = 0.01$.

Table 2. *TDs* with China: The Experimenters of Tariffs Compared to the Non-Experimenter

	7. Trump		**versus**	**Clinton**		
N_{Trump}	$\overline{TD}_{Trump}$	S^2_{Trump}		N_{Clinton}	$\overline{TD}_{Clinton}$	$S^2_{Clinton}$
48	– 30,210. 96	34,278,683.51		48	– 2,616.49	810,552.75
Difference in $\overline{TD}_S$ = –27,594.47, t-*statistics* = –33.89, α = 0.01, and *df* = 94						
	8. Obama		**versus**	**Clinton**		
N_{Obama}	$\overline{TD}_{Obama}$	S^2_{Obama}		N_{Clinton}	$\overline{TD}_{Clinton}$	$S^2_{Clinton}$
96	– 25,915. 88	25,041,064.55		96	– 4,007.55	3,436,560.12
Difference in $\overline{TD}_S$ = – 21,908.33, t-*statistics* = –58.67, α = 0.01, and *df* =190						
	9. Bush		**versus**	**Clinton**		
N_{Bush}	$\overline{TD}_{Bush}$	S^2_{Bush}		N_{Clinton}	$\overline{TD}_{Clinton}$	$S^2_{Clinton}$
96	– 14,952.16	37,650,049.66		96	– 4,007.55	3,436,560.12
Difference in $\overline{TD}_S$ = –10,944.61, t-*statistics* = –24.25, α = 0.01, and *df* = 190						

Note: Same as in Table 1

the three alternative (H_A) hypotheses. The estimated results supporting the H_A hypotheses ($\overline{TD}_{Trump,i} > \overline{TD}_{Clinton,j}$, $\overline{TD}_{Obama,i} > \overline{TD}_{Clinton,j}$, and $\overline{TD}_{Bush,i} > \overline{TD}_{Clinton,j}$) indicate that the three presidents that engaged in and/or experimented with tariff-restricted trade wars with China tariffs were not successful in reducing the United States' longstanding trade deficits with China. Specifically, when compared to President Clinton who did not engage in tariffs-restricted trade wars with China, one can infer that while the *TDs* with China was bad under President Bush, it grew worse under President Obama, and was worst under.

President Trump whose administration employed and imposed the stiffest and most aggressive import tariffs on China in recent memory. More importantly, these results provide the statistical verification of Fig. 1 and lend the statistical answer to the question as to whether import tariffs helped to reduce trade deficits (Amiti et al. [31]).

The observation that the United States' trade deficits with China worsened as the three presidents in the treatment group imposed stiffer tariffs on China could cause skeptics to raise question about what could possibly be responsible for the upsurge in the trade deficits during any tariff-restricted trade wars with China. According to Nicita [26], the United States' importers stockpiled non-tariffed goods due to the expectations or possibilities of additional tariffs on these non-tariffed goods; and this could be a plausible explanation for the increase in the trade deficits. Buehn and Eichler [45] earlier pointed out that Chinese exporters tend to increase their exports of non-tariffed goods during tariffs-restricted trade wars in order to maintain their profit margins. The drive to maintain profit margins caused or compelled the Chinese exporters to underinvoice or misinvoice their products in order to avoid the tariffs. In other words, Chinese exporters tend to increase their exports in non-tariffed goods to the United States through nefarious trade practices. Therefore, China's ability to increase its exports in non-tariffed goods when engaged in trade wars with the United States provides another possible explanation for the United States' inability to reduce its trade deficits with China even in the presence of the most aggressive tariffs that President Trump imposed during his four-year term.

5. CONCLUSIONS AND POLICY IMPLICATIONS

This paper complements and extends the plethora of extant studies on trade, trade deficits and the effects of tariffs by conducting a comparative analysis of the effectiveness or the ineffectiveness of the United States tariffs-restricted trade wars with China under the recent past four Presidents of the United States and using the difference-in-difference technique. We divided the four presidents into two groups – treatment and control groups, and tested three different sets of null and alternative hypotheses for each of the two groups. For the presidents in the treatment group, we rejected all the null hypotheses in favor of the alternative hypotheses, which indicated that President Trump's series of aggressive tariffs on China was less successful in reducing the United States' trade deficits with China than President Obama's tire tariffs. Similarly, President Obama's tire tariffs on China was less successful at reducing the United States' trade deficits than President Bush's steel tariffs. Furthermore, our analysis showed that the average monthly trade deficits with China was bad under President Bush, worse under President Obama, and worst under President Trump.

When we compared the three presidents (Trump, Obama, and Bush) in the treatment group to President Clinton in the control group, we also rejected the three null hypotheses in favor of the alternative hypotheses. These results suggested that when Presidents Trump, Obama, and Bush imposed tariffs on China in order to protect industries, businesses, and save jobs, they could not achieve the desired low levels of trade deficits with China, which the Clinton administration experienced in the absence of import tariffs on China. The implication is that tariffs are not the most effective mechanisms with which the United States can achieve trade deficits reductions with trading partners such as China.

Presidents Trump, Obama, and Bush's tariffs-restricted trade interventions aimed at reducing the United States' trade deficits did not yield the intended results. This should therefore signal to the current and future administrations to consider other strategic trade policies because the tariffs-restricted trade wars, which did not yield the expected outcomes under the past three presidents in the treatment group, could be construed as counterproductive and ineffective trade policy strategy if the objective is to reduce trade deficits with China. These findings can also be of significance to other governments around the world who may want to engage in tariff-restricted trade wars as the means of reducing trade deficits with their trading partners.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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