Auburn University
Department of Economics
Working Paper Series

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AUWP 2025-05

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August 2025

Abstract

Donald Trump argued that the Korea–U.S. Free Trade Agreement (KORUS FTA) was a "horrible deal," pointing to a substantial increase in the U.S. trade deficit with Korea following the agreement's implementation in March 2012. Notably, during the same period, the U.S. trade balance with numerous other major trading partners, none of which maintained an FTA with the United States, also deteriorated, raising doubts as to whether the KORUS FTA was the primary cause of the observed imbalance. This study evaluates the causal effect of the KORUS FTA on the U.S.–Korea trade balance using a difference-in-differences framework, complemented by event-study and synthetic control analyses as robustness checks. The empirical findings, after accounting for business cycle fluctuations, provide overall support for Trump's assertion.

Keywords: KORUS FTA; Trade Deficit; Difference-in-Differences; Causal Effect; Event Study; Synthetic Control Analysis

JEL Classification: F13; F14

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I Introduction

During his 2016 presidential campaign, Mr. Donald Trump frequently criticized the Korea–U.S. Free Trade Agreement (KORUS FTA) as a "horrible deal," even threatening to terminate it.[1] His criticisms were largely based on the claim that the U.S. trade deficit in goods with Korea increased following the agreement's enactment in March 2012. While data confirms that the U.S. trade deficit with Korea did grow after the FTA, this trend was not unique to Korea.[2] Over the same period, the U.S. trade deficit also increased with seven of its eleven major trading partners, none of which had FTAs with the U.S. This raises the question of whether the KORUS FTA itself *causally* contributed to the post-2012 increase in the U.S. trade deficit with Korea.

The impact of free trade agreements (FTAs) on trade flows has been a central topic in international economics, attracting both theoretical and empirical attention. FTAs are intended to reduce or eliminate tariffs and other trade barriers between member countries, theoretically promoting trade and economic welfare. However, empirical assessments often produce mixed findings, with effects conditioned by agreement design, economic size, geography, and political context.

The gravity model of trade, pioneered by Isard (1954) and Tinbergen (1962), has been widely used for analyzing trade patterns. Anderson and van Wincoop (2003) later provided a structural foundation for the model, and Egger and Larch (2008) employed panel gravity models to capture dynamic trade responses to FTAs over time. Baier and Bergstrand (2004, 2007) modeled the FTA formation process, finding significant selection effects that bias naive OLS estimates. More recently, Lee, Mulabdic, and Ruta (2023) used firm-level data to show that regional trade agreements can have positive spillover effects, including third-country effects. Yang and Liu (2024) estimated the causal impact of FTA network depth on domestic value added (DVA) in exports, applying a structural gravity model.

[1] In an interview with *Reuters* at the White House on April 27, 2017, then-President Trump stated, "It is a horrible deal, and we are going to renegotiate that deal or terminate it."
[2] Russ and Swenson (2019) claim that the increase in the U.S. trade deficit with Korea reflects a diversion of U.S. import demand away from other trading partners.

The empirical literature increasingly emphasizes the heterogeneous effects of FTAs. Magee (2008) found that larger and more economically integrated FTAs generally have greater trade-promoting effects. Dutt, Mihov, and Van Zandt (2013) showed that the WTO's impact is concentrated almost entirely on the extensive margin of trade, while negatively affecting the intensive margin. Baccini, Dür, and Elsig (2015) further demonstrated that political and institutional factors influence both the design and effectiveness of FTAs.

Although Mr. Trump's criticism of the KORUS FTA may have been politically motivated, an empirical evaluation of his claim can yield valuable insights for policymakers. This is especially relevant in light of Baier, Yotov, and Zylkin's (2019) finding that trade agreements can produce substantial but highly variable trade gains. A key challenge in this evaluation is addressing endogeneity bias in estimating the treatment effects of FTAs. Baier and Bergstrand (2007, 2009) recommend panel approaches with country-pair fixed effects to address this issue, while Anderson and Yotov (2016) advocate structural gravity models to capture the general equilibrium effects of FTAs.[3] Cho, Choi, and Díaz (2022) apply a generalized difference-in-differences approach using highly disaggregated product-level data.

The effects of the North American Free Trade Agreement (NAFTA) on trade flows have been extensively studied. Early analyses include Krueger (1999, 2000), Burfisher, Robinson, and Thierfelder (2001), and Anderson and van Wincoop (2001). Longer-term assessments include Romalis (2007), Kehoe and Ruhl (2013), Caliendo and Parro (2015), and Khan (2020). For insights into the consequences of NAFTA's termination, see Steinberg (2020). In contrast, the KORUS FTA has received comparatively limited scholarly attention.

This paper seeks to fill that gap by estimating the causal effects of the KORUS FTA on the U.S. trade balance with Korea, employing rigorous econometric methods. Our primary strategy is a difference-in-differences approach, using the U.S.'s other major trading partners as a control group. In addition to country

[3] Baier and Bergstrand (2007) report substantially positive effects of FTAs on trade flows using a panel approach that controls endogeneity bias. Baier and Bergstrand (2009) confirmed this claim via nonparametric cross-section estimates.

and time fixed effects, we control for income (absorption) effects and expenditure-switching effects by including the real industrial production ratio and the real exchange rate.

To ensure robustness, we also implement an event study to test the parallel trends assumption, an essential condition for the validity of the diff-in-diff estimator. Furthermore, we apply the synthetic control (SC) method of Abadie and Gardeazabal (2003), which does not rely on the parallel trends assumption. As Arkhangelsky, Athey, Hirshberg, Imbens, and Wager (2021) note, the SC method is well-suited to cases involving a single (e.g., Korea) or a small number of treated units, making it an ideal robustness check.

Our findings suggest that the increase in U.S. trade deficits with the control group countries can largely be attributed to stronger U.S. economic performance relative to theirs and the real appreciation of the dollar against their currencies during the post-FTA period. In contrast, for Korea, the KORUS FTA appears to have directly contributed to the widening of the U.S. trade deficit, despite Korea's stronger relative economic performance and the real depreciation of the dollar against the Korean won—factors that would normally boost U.S. exports to Korea. In short, our results provide strong empirical support for Trump's claim that the KORUS FTA contributed to the post-enactment rise in the U.S. trade deficit with Korea.

The remainder of the paper proceeds as follows. Section II describes the data and offers preliminary insights. Section III presents and interprets the main results. Section IV concludes.

II Data Description and Some Insights from the Data

1. Data Description

The United States and the Republic of Korea signed the KORUS FTA on June 30, 2007, and it came into effect on March 15, 2012. Following his inauguration as the 45th President of the United States on January 20, 2017, Mr. Trump began renegotiating the agreement. Based on this timeline, the post-treatment (KORUS FTA) period spans the 58 months from March 2012, when the agreement first went into effect, to December 2016, the last month before Trump's presidency began. Consequently, the pre-treatment sample period consists of the 58 months prior to the KORUS FTA, from May 2007 to February 2012.

We obtained U.S. trade data for goods with the top 15 trading partner countries, covering the period from May 2007 to December 2016, from the United States Census Bureau. The data were seasonally adjusted using the X12-ARIMA procedure. Vietnam was excluded due to a lack of available control variable data. Additionally, Canada and Mexico were excluded because of their participation in the North American Free Trade Agreement (NAFTA) with the U.S., which was enacted in 1994, prior to the KORUS FTA, and later replaced by the U.S.-Mexico-Canada Agreement (USMCA) on July 1, 2020.[4] Consequently, South Korea is the treatment country, while the remaining 11 countries serve as the control group countries.[5]

We define the deficit ratio as the U.S. trade deficit (imports minus exports) divided by the trade volume (imports plus exports) with the partner country. To measure the income/absorption effect on the trade deficit, we employ the industrial production (IP) ratio, calculated as U.S. real IP divided by the real IP of the partner country. Real IP is derived by deflating nominal IP (2015=100) with the respective consumer price index (CPI). All IP and CPI data are seasonally adjusted and were obtained from the Federal Reserve Economic Data (FRED), except for Taiwan's data, which was acquired from Taiwan's National Statistics. Nominal bilateral foreign exchange rates (FXR) relative to the U.S. dollar, also obtained from the FRED, were converted into CPI-based real exchange rates and log-transformed.

2. Useful Insights from Key Trade-Related Data

Table 1 reports the average values of the key variables of interest: deficit ratios, IP ratios, and real exchange rates during the pre-FTA period (May 2007 to February 2012) and the post-FTA period (March 2012 to December 2016, Treatment). The control group countries are divided into two categories: Euro Zone and

[4] The USMCA was initially signed on November 30, 2018. A revised version of the agreement was signed on December 10, 2019.
[5] These countries include China, Japan, Germany, the U.K., France, India, Taiwan, the Netherlands, Brazil, Ireland, and Italy.

Non-Euro Zone.[6] Bold numbers indicate that the post-FTA average exceeds the corresponding pre-FTA average.

The results show that South Korea was not the only U.S. trading partner to exhibit an increased deficit ratio after the KORUS FTA came into effect. Seven out of eleven other major trading partners also recorded larger trade surpluses (bold numbers) with the United States during the same period, despite having no FTA with the U.S. As shown in Figure 1, the U.S. experienced similar deficit dynamics with Germany, India, and Italy as it did with Korea.

Moreover, each of these seven countries with higher deficits also experienced either a higher average IP ratio, a higher average real FXR, or both, in the post-FTA period. Since the IP ratio is defined as $IP_{US,t}/IP_{j,t}$, a higher value indicates stronger U.S. economic performance relative to the partner country, which is consistent with greater U.S. imports and hence a larger trade deficit. Similarly, a higher real FXR for the U.S. dollar implies real appreciation, which, through the expenditure-switching effect, would also tend to increase the trade deficit. That is, the rising U.S. trade deficits with these control group countries during the post-FTA period may have been driven by either stronger U.S. economic performance or the real appreciation of the U.S. dollar.

By contrast, Korea experienced neither a higher IP ratio nor a higher real FXR in the post-FTA period, indicating that business cycle conditions should have favored a lower U.S. trade deficit with Korea. The fact that the deficit nonetheless increased strengthens the likelihood that the KORUS FTA itself contributed to the observed rise in the U.S.–Korea trade imbalance.

Building on these descriptive patterns, the following sections formally assess the causal effect of the KORUS FTA on the U.S.–Korea trade balance using a diff-in-diff framework, supplemented by event-study and synthetic control methods as robustness checks.

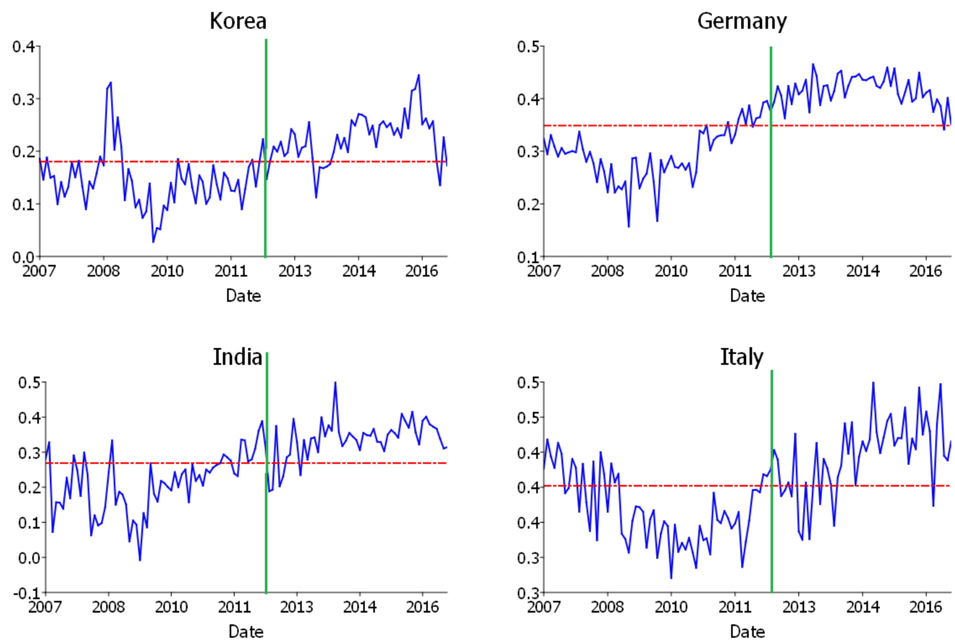
[6] The Euro-Zone group comprises France, Germany, Ireland, Italy, and the Netherlands, while the Non-Euro Zone group includes Brazil, China, India, Japan, Taiwan and the UK.

Table 1. Summary Statistics of Major Trading Partners

	Deficit Ratio		*IP Ratio*		*Real FXR*	
Countries	Pre-FTA	Post-FTA	Pre-FTA	Post-FTA	Pre-FTA	Post-FTA
			Treatment Country			
Korea	0.142	**0.219**	0.464	0.431	7.910	7.879
			Control Group I: Euro-Zone Countries			
France	0.179	**0.193**	0.406	**0.436**	0.507	**0.657**
Germany	0.286	**0.411**	0.449	0.438	0.520	**0.661**
Ireland	0.621	**0.637**	0.699	0.580	0.469	**0.653**
Italy	0.372	**0.431**	0.367	**0.434**	0.526	**0.657**
Netherlands	-0.296	-0.373	0.391	**0.423**	0.542	**0.664**
			Control Group II: Non-Euro-Zone Countries			
Brazil	-0.105	-0.143	0.286	**0.396**	1.729	**1.882**
China	0.622	0.591	0.338	**0.398**	2.844	2.714
India	0.202	**0.336**	0.328	**0.420**	5.069	5.031
Japan	0.341	**0.351**	0.421	**0.429**	5.341	**5.502**
Taiwan	0.199	**0.213**	0.532	0.448	4.291	**4.296**
UK	0.016	0.016	0.380	**0.435**	0.369	**0.429**

Note: *Deficit Ratio* denotes the difference between U.S. imports and exports, divided by the total trade volume (imports plus exports) with a partner country. *IP Ratio* is defined as U.S. real industrial production divided by the real industrial production of the partner country. Real IP is derived by deflating nominal IP (2015=100) with the respective consumer price index (CPI). All IP and CPI data are seasonally adjusted using the X12-ARIMA procedure. *Real FXR* refers to the natural logarithm of the nominal foreign exchange rate, adjusted by the consumer price index ratio. The pre-FTA denotes the sample period from May 2007 to February 2012, while the post-FTA is the period from March 2012 to December 2016, covering the time when the KORUS FTA was in effect. Bold numbers indicate cases where the average value in the post-FTA period exceeds that of the pre-FTA, suggesting the potential for increasing U.S. deficits through income/absorption effects and expenditure-switching effects.

Figure 1. U.S. Trade Deficit Ratios: Selective Trading Partners



Note: We report the deficit ratio, calculated as the difference between U.S. imports and exports, divided by the total trade volume (U.S. imports plus exports) with a partner country. The data spans the periods before and after the KORUS FTA. The vertical line indicates March 2012, when the KORUS FTA became effective, while the horizontal line shows the average deficit ratio for the entire sample period.

III Econometric Test Results

1. Difference-in-Differences Estimation and Interpretation of the Results

This section assesses the causal effect of the KORUS FTA on the U.S. trade deficit with South Korea using the difference-in-differences (diff-in-diff) estimator (Card and Krueger, 1994). We prefer the diff-in-diff approach because it allows for a rigorous comparison of U.S. trade with Korea (the treated group) to trade with similar countries not covered by the agreement (the control group) before and after the implementation of the KORUS FTA. This quasi-experimental approach is particularly well-suited for identifying the causal impact of specific policy interventions.[7]

We propose the following regression equation.

$$USDef_{i,t} = \alpha + \beta_1 treated_{i,t} + \beta_2 post_{i,t} + \beta_3 treated_{i,t} \times post_{i,t} \quad (1)$$
$$+\beta_4 ipratio_{i,t} + \beta_5 rfxr_{i,t} + \alpha_t + \gamma_i + \varepsilon_{i,t},$$

where $USDef_{i,t}$ is the US deficit ratio with country i at time t, $treated_{i,t}$ is a dummy variable that takes the value of 1 for Korea (treatment) and 0 for control group countries. $post_{i,t}$ is a dummy variable that takes the value of 1 for the post-KORUS FTA period (treatment period, March 2012 to December 2016) and 0 for the pre-KORUS FTA period. β_3 is the diff-in-diff coefficient, which is crucial for our study.

Two control variables, $ipratio_{i,t}$ and $rfxr_{i,t}$, are added to the regression equation to control for possible business cycle effects: income/absorption effects and expenditure-switching effects, respectively. In addition to the time fixed effects (α_t), we also include the country fixed effects (γ_i) when there are multiple control countries. Since our regression equation utilizes time series variables with 116 monthly observations, we employ the Newey-West HAC (Heteroskedasticity and Autocorrelation Consistent) standard error to address serial correlations in the data.[8,9]

Table 2 reports estimation results with all 11 control group countries among major trading partners. In all four specifications, we obtained significantly positive estimates $\hat{\beta}_3$ at the 1% level, indicating a positive causal effect of the KORUS FTA on the U.S. trade deficit with South Korea. The coefficient estimates for control variables have correct signs, that is, positive $\hat{\beta}_4$ and $\hat{\beta}_5$, although they may not be always significant.

[7] Alternatively, one could employ panel data approaches or structural gravity models. Panel data models are widely used in the literature and are useful for analyzing trade flows, but they often lack the quasi-experimental framework needed to clearly establish causality. Structural gravity models offer valuable insights into trade patterns. However, they rely on strong parametric assumptions, which can make it difficult to isolate the impact of a specific policy change.

[8] We implemented the regression with 3-month bandwidth selections for the Bartlett kernel for the NW estimator. Results with 6- and 9-month bandwidths are qualitatively similar and available upon request.

[9] See Bertrand, Duflo, and Mullainathan (2004) for the implication of the bias of diff-in-diff estimation for serially correlated variables.

Table 2. Diff-in-Diff Estimation: U.S. Deficit with all Control Group Countries

	US Deficit Ratio			
	(1)	(2)	(3)	(4)
$treated_{i,t}$ (β_1)	0.276‡	0.269‡	-0.051	-0.093
	(0.017)	(0.017)	(0.205)	(0.200)
$post_{i,t}$ (β_2)	-0.034	-0.033	-0.043*	-0.043*
	(0.024)	(0.025)	(0.025)	(0.025)
$\boldsymbol{treated_{i,t} \times post_{i,t}}$ **($\boldsymbol{\beta_3}$)**	**0.056**‡	**0.059**‡	**0.062**‡	**0.067**‡
	(0.014)	(0.014)	(0.014)	(0.014)
$ipratio_{i,t}$ (β_4)		0.054		0.066
		(0.059)		(0.057)
$rfxr_{i,t}$ (β_5)			0.053	0.059*
			(0.033)	(0.033)
Country FEs	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes	Yes
Observations	1392	1392	1392	1392

Note: β_3 is the diff-in-diff coefficient. Superscripts *, †, and ‡ and denote statistical significance at the 10%, 5%, and 1% level, respectively. Newey-West HAC standard errors are in parenthesis.

To further investigate our findings, we conducted similar estimations using more disaggregated data. Table 3 presents the estimation results using two different control groups: Euro-Zone countries in Panel A and non-Euro-Zone countries in Panel B. The former includes France, Germany, Ireland, Italy, and the Netherlands, while the latter includes the remaining six partner countries. We also report the results for each individual country.

Again, we obtained significantly positive diff-in-diff estimates, $\hat{\beta}_3$, in all cases at the 5% level, with the exceptions of Germany and Italy. The coefficients of $ipratio_t$ and $rfxr_t$ have the correct signs whenever they are statistically significant, except for Taiwan for $rfxr_t$.

It is noteworthy that $\hat{\beta}_3$ is not statistically significant for Germany and Italy. Recall that these countries exhibited strikingly similar dynamics of the U.S. trade surplus as Korea as shown in Figure 1. Therefore, the insignificant $\hat{\beta}_3$ estimates for these two countries seem to result from a lack of sufficient variations in the data.

Putting it all together, we conclude that our analysis provides strong evidence of a positive causal effect of the KORUS FTA on Korea's trade account balance with the U.S.[10]

2. Validating Parallel Trends: An Event-Study Approach

The results of our diff-in-diff estimates rely on the assumption of *parallel trends*, meaning that we require the control group to satisfy this assumption in relation to the treated group.[11] The parallel trends assumption implies that, if the KORUS FTA had not occurred, the difference between the US deficit ratio with Korea (the treated group) and with control group countries would have remained constant in the post-KORUS FTA period, just as it was in the pre-KORUS FTA period.

To test the parallel trends assumption in diff-in-diff estimation, we conduct an event study analysis to test prior trends, using the following regression:

$$USDef_{i,t} = \alpha + \beta_1 treated_{i,t} + \beta_2 post_{i,t} + \sum_{t=0}^{116} \beta_3 \left(treated_{i,t} \times 1[time_{i,t} = t]\right) \quad (2)$$
$$+\beta_4 ipratio_{i,t} + \beta_5 rfxr_{i,t} + \alpha_t + \gamma_i + \varepsilon_{i,t},$$

where $1[time_{i,t} = t]$ are dummies for the 58 months before and after the KORUS FTA. To avoid perfect multicollinearity, we omit February 2012, the month prior to the month KORUS FTA went into effect.

For the parallel trends assumption to hold in this regression, the estimates of the main coefficient of interest, $\hat{\beta}_3$, should generally be insignificant for most months prior to the KORUS FTA event. This would indicate that before the event, both the treatment country (Korea) and the control countries followed the same trend. Statistically significant $\hat{\beta}_3$ for months during the post-FTA indicates causal effects of the KORUS FTA.

[10] Following a reviewer's suggestion, we conducted a robustness check using quarterly data. In this alternative specification, we replaced the monthly industrial production ratio with quarterly sovereign real GDP deviations from U.S. real GDP. Quarterly variables were constructed by taking end-of-period values from the corresponding monthly data. The results are largely consistent with our main findings. Although the diff-in-diff coefficient remains positive, it is statistically insignificant, which is likely due to the smaller number of observations. Nonetheless, we obtain the expected signs for both the real GDP deviation and the real exchange rate, lending further support to the robustness of our baseline results. These results are available upon request.
[11] See Abadie (2005) for a detailed discussion on the importance of parallel trends in diff-in-diff estimations.

Table 3. Diff-in-Diff Estimation: U.S. Deficit Ratio with Individual Trading Partners

Panel A	**Euro Zone**	France	Germany	Ireland	Italy	Netherlands
$treated_{i,t}$ (β_1)	-1.862†	-1.683†	-1.863†	-2.468‡	-1.445†	0.782
	(0.797)	(0.784)	(0.842)	(0.755)	(0.626)	(1.307)
$post_{i,t}$ (β_2)	-0.107†	-0.168‡	0.013	-0.006	-0.050	-0.098
	(0.043)	(0.051)	(0.036)	(0.085)	(0.040)	(0.066)
$\boldsymbol{treated_{i,t} \times post_{i,t}}$ **($\boldsymbol{\beta_3}$)**	**0.093**‡	**0.124**‡	0.008	**0.092**‡	0.037	**0.185**‡
	(0.022)	(0.028)	(0.023)	(0.027)	(0.025)	(0.045)
$ipratio_{i,t}$ (β_4)	0.010	0.343	0.744‡	0.338‡	-0.062	0.616
	(0.073)	(0.256)	(0.237)	(0.085)	(0.152)	(0.499)
$rfxr_{i,t}$ (β_5)	0.247†	0.220†	0.231†	0.278‡	0.165*	-0.053
	(0.108)	(0.106)	(0.114)	(0.102)	(0.085)	(0.178)
Country FEs	Yes	No	No	No	No	No
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	696	232	232	232	232	232

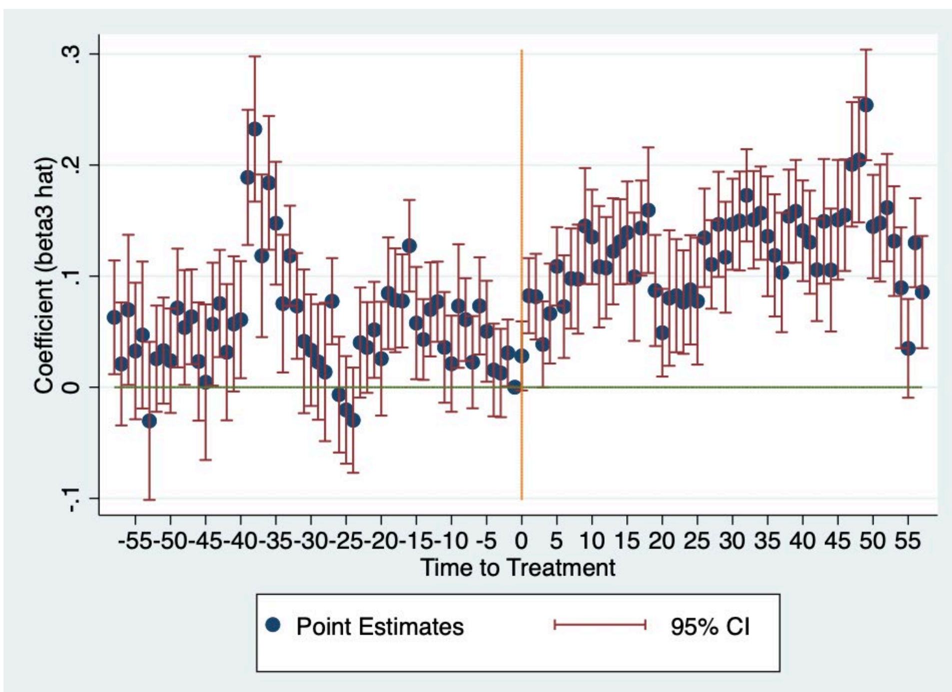
Panel B	**Non-EZ**	Brazil	China	Japan	India	Taiwan	UK
$treated_{i,t}$ (β_1)	0.147	-1.524‡	-1.297‡	-0.334	-0.930†	0.801†	-1.639†
	(0.215)	(0.560)	(0.223)	(0.277)	(0.361)	(0.313)	(0.808)
$post_{i,t}$ (β_2)	-0.047	-0.190†	-0.095‡	-0.080†	-0.019	-0.040	-0.121†
	(0.030)	(0.078)	(0.030)	(0.040)	(0.037)	(0.035)	(0.050)
$\boldsymbol{treated_{i,t} \times post_{i,t}}$ **($\boldsymbol{\beta_3}$)**	**0.075**‡	**0.170**‡	**0.091**‡	**0.068**†	**0.081**‡	**0.058**‡	**0.076**†
	(0.015)	(0.037)	(0.016)	(0.033)	(0.030)	(0.018)	(0.031)
$ipratio_{i,t}$ (β_4)	0.170*	0.020	-0.006	-0.228	1.123‡	-0.083	-0.253
	(0.094)	(0.198)	(0.152)	(0.392)	(0.235)	(0.193)	(0.263)
$rfxr_{i,t}$ (β_5)	0.017	0.286‡	0.161‡	0.056	0.253†	-0.239‡	0.237†
	(0.036)	(0.091)	(0.042)	(0.106)	(0.119)	(0.089)	(0.108)
Country FEs	Yes	No	No	No	No	No	No
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	812	232	232	232	232	232	232

Note: We report the results using two sets of control group countries: Eurozone and non-Eurozone groups, along with individual trading partner countries. β_3 is the diff-in-diff coefficient. Superscripts ‡, †, and * denote statistical significance at the 1%, 5%, and 10% level, respectively. Newey-West HAC standard errors are in parenthesis.

Figure 2 reports the estimate for β_3 in equation (2). The horizontal axis reports the number of months relative to the implementation of the KORUS FTA in March 2012, where "0" denotes March 2012 and "−30" corresponds to 30 months earlier (September 2009). The vertical axis plots $\hat{\beta}_3$, the estimated coefficients for the interaction term between the treatment dummy and the month-year indicators together with their associated 95% confidence intervals. The vertical bars around the point estimates depict the confidence interval for each month before and after the agreement's implementation.

We observe mostly statistically insignificant estimates (confidence bands change signs) prior to the event, which indicates no meaningful difference in the U.S. deficit ratio between Korea and the control group countries, thereby supporting the parallel trends assumption. In contrast, following implementation (time "0"), the estimates become strongly positive and statistically significant, indicating a substantial increase in the U.S. deficit ratio with Korea relative to the control group, consistent with an expansion of the U.S. trade deficit after the KORUS FTA.

Figure 2. Event Study Analysis for U.S. Deficit Ratio



Note: We report the point estimates for $\hat{\beta}_3$ in equation (2), along with their 95% confidence intervals. The horizontal axis indicates the number of months before (negative numbers) or after (positive numbers) the event. For example, -30 refers to 30 months (Sept. 2009) before the KORUS FTA went into effect (March 2012).

3. Further Validation: A Synthetic Control Approach

In this section, we present a synthetic control analysis, see among others Abadie, Diamond, and Hainmueller (2010, 2015), and Abadie and L'Hour (2016), as an additional robustness check. This method complements the diff-in-diff estimates reported in earlier sections by providing estimates of dynamic treatment effects. A key advantage of the synthetic control approach is that it does not rely on the parallel trends assumption, making it particularly robust in cases where parallel trends hold in the pre-treatment period but may not persist afterward.[12]

We also examine the quality of the match between Korea and its synthetic counterpart during the pre-treatment period. A close match suggests that the synthetic control effectively captures unobserved heterogeneity and accounts for potential confounders that may be omitted from the diff-in-diff regressions. Furthermore, as emphasized by Abadie (2021), the synthetic control method leverages time-series variation more heavily than cross-sectional variation, making it especially appropriate in our setting with a single treated unit.

Denote $post_{KR,t}$ be a dummy variable that is equal to 1 for Korea in the post-treatment period and 0 otherwise. Then, we write the U.S. trade deficit with Korea as follows.

$$USDef_{KR,t} = \beta_3 post_{KR,t} + USDef_{KR,t}^{SC} + \varepsilon_{KR,t} \tag{3}$$

where $USDef_{KR,t}^{SC}$ denotes the synthetic control component and $\varepsilon_{KR,t}$ is a mean-zero error term. The term $USDef_{KR,t}^{SC}$ represents the expected U.S. trade deficit with Korea in the absence of the KORUS FTA during the pre-treatment period ($t < t_{FTA}$). During the post-treatment period ($t \geq t_{FTA}$), the observed trade deficit becomes,

[12] The SC approach has not yet been actively applied in the current FTA literature, even though it has gained significant attention in the causal inference literature, particularly in cases where the treatment group consists of a single unit. A recent addition to this line of research is Cho and Choi (2025).

$$USDef_{KR,t} = \beta_3 + USDef_{KR,t}^{SC} + \varepsilon_{KR,t},$$

where β_3 captures the treatment effect of the KORUS FTA, consistent with the diff-in-diff estimate presented in earlier sections.

We model $USDef_{KR,t}^{SC}$ in (3) as a weighted average of the U.S. trade deficits with other major trading partners in the control group as follows.

$$USDef_{KR,t}^{SC} = \sum_{j \in Control} w_j USDef_{j,t}, \tag{4}$$

$$s.t. \sum_{j \in Control} w_j = 1 \text{ and } w_j \geq 0, \forall j$$

The weights w_j are estimated by solving the following minimization problem.

$$\text{Min}_{\boldsymbol{w}} \sum_{t < t_{FTA}} \left(USDef_{KR,t} - \sum_{j \in Control} w_j USDef_{j,t} \right)^2, \tag{5}$$

$$s.t. \sum_{j \in Control} w_j = 1 \text{ and } w_j \geq 0, \forall j,$$

where $\boldsymbol{w}$ is a $k \times 1$ vector of weights for the control group countries. As in LASSO (Least Absolute Shrinkage and Selection Operator) estimation, the optimization procedure can assign zero weights to some control units, effectively selecting a subset of countries that best match Korea's trade deficit dynamics in the pre-treatment period.[13]

Among all countries in the control group, six received zero weights, while five donor countries were assigned non-zero weights. Notably, the weights for Taiwan and the United Kingdom were particularly large and statistically significant.[14] Furthermore, the estimated synthetic control places nearly 70% of the total weight on Korea's Asian neighbors, suggesting that geographic proximity is a strong predictor of U.S.–Korea trade flows. This finding aligns with the intuition from the gravity model, which

[13] This so-called feature selection property arises from the L_1 regularization, which leads to corner solutions analogous to those in the LASSO framework.
[14] Detailed estimation results are available upon request.

emphasizes distance as a key determinant of bilateral trade. Substituting these estimated weights, we construct the synthetic control estimate $USDef_{KR,t}^{SC}$ as follows.

$$\widehat{USDef_{KR,t}^{SC}} = 0.079USDef_{JP,t} + 0.24USDef_{UK,t} + 0.04USDef_{India,t} + 0.57USDef_{TW,t} + 0.071USDef_{Brazil,t}$$

Figure 3 shows that the estimated synthetic control $\widehat{USDef_{KR,t}^{SC}}$ closely tracks the actual U.S. trade deficit with Korea during the pre-treatment period. The root mean squared error (RMSE) to mean ratio is 0.28, indicating that the fitted values deviate by approximately 28% from the actual values on average. This provides strong evidence of a good pre-treatment match.

It is important to note that $\widehat{USDef_{KR,t}^{SC}}$ can be interpreted as the counterfactual trade deficit that Korea would have experienced in the post-FTA period in the absence of the KORUS FTA. Accordingly, the treatment effect of the KORUS FTA, denoted $\hat{\beta}_{3,t}$ in the previous sections, can be estimated as follows.

$$\hat{\beta}_{3,t} = USDef_{KR,t} - \widehat{USDef_{KR,t}^{SC}},\ t \geq t_{FTA} \tag{6}$$

Here, the subscript t on $\hat{\beta}_{3,t}$ indicates that the treatment effect is allowed to vary over time. In this framework, $\hat{\beta}_{3,t}$ represents the dynamic treatment effect of the KORUS FTA estimate, estimated using the synthetic control method.

To assess the statistical significance of our estimated average treatment effect, we further apply the Placebo test procedure proposed by Abadie, Diamond, and Hainmueller (2010). This method relies on the distribution of synthetic control estimates for units that did not receive the treatment, in our case, the control group countries. Specifically, we simulate a *false* treatment for each country in the control group, assuming that it received the treatment at time t_{FTA}, and then estimate the corresponding treatment effects using equation (6). By pooling these Placebo treatment effects across all control units, we construct a reference distribution and compute relevant percentile cutoffs (e.g., 90th and 95th percentiles), which serve as thresholds for evaluating whether the observed treatment effect for Korea is statistically significant.

Figure 3. In-Sample Fit of the Estimated Synthetic Control

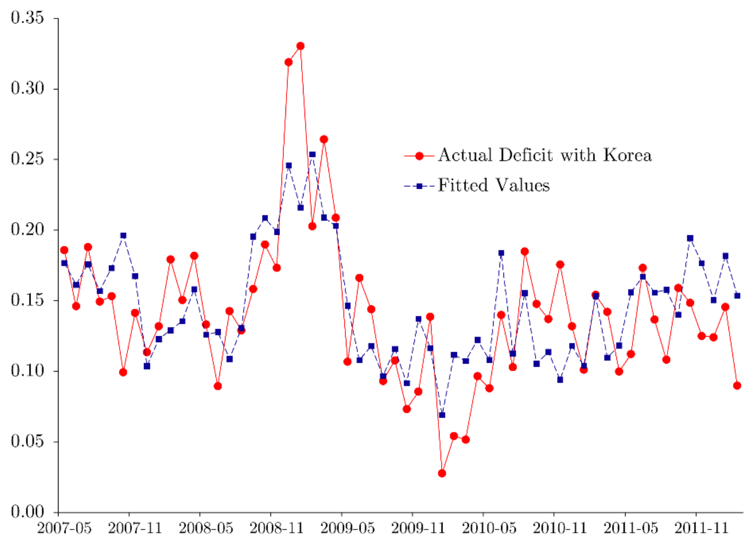
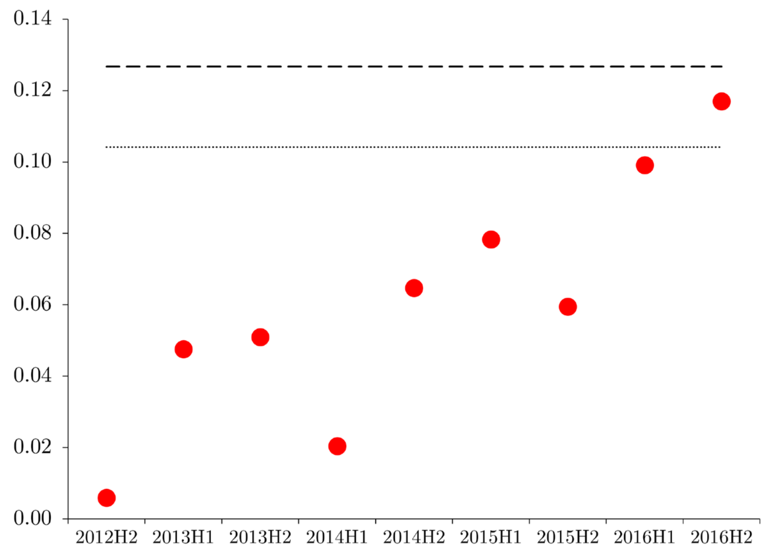


Figure 4 presents the six-month average treatment effects for Korea, alongside the 90th and 95th percentile bounds of the Placebo distribution (shown as dotted and dashed lines, respectively). We find that the estimated treatment effect increases steadily over time, eventually exceeding the 90th percentile threshold. This pattern suggests that the post-FTA increase in the U.S. trade deficit with Korea is statistically significant and unlikely to be driven by random variation alone.

The synthetic control estimates indicate that the KORUS FTA contributed to a sustained increase in the U.S. trade deficit with Korea, with substantial positive effects materializing only in the long run, partially consistent with Mr. Trump's assertion. Over the full post-treatment period, the average dynamic treatment effect is estimated to be 0.06, which falls within the two-tailed 95% confidence interval of our earlier difference-in-differences estimate. These results suggest that the synthetic control analysis corroborates our diff-in-diff findings, reinforcing the robustness of our conclusions.

Figure 4. Treatment Effects vs. Placebo Effects



Note: We report six-month average treatment effects estimated using the synthetic control method. The dashed and dotted lines represent the 95% and 90% thresholds, respectively, derived nonparametrically from the distribution of Placebo effects. The final average treatment effect exceeds the 90% threshold, indicating a substantial and statistically significant positive impact of the KORUS FTA on the U.S. trade deficit with Korea.

IV Concluding Remarks

Mr. Trump criticized the KORUS FTA as a job-killing trade deal, citing the rising U.S. trade deficit with Korea after the agreement came into effect in March 2012. However, 7 out of 11 major U.S. trading partners also experienced similar increases in their trade surpluses with the U.S. during the same period, despite not having an FTA with the U.S. This complicates the evaluation of the causal effects of the KORUS FTA on the trade balance with Korea.

While rising U.S. trade deficits with other partner countries were largely driven by stronger U.S. economic performance or the real appreciation of the dollar, Korea's case is different. Relatively stronger Korean economic performance and a weaker won should have favored an improvement in the U.S. trade balance with Korea in the absence of other shocks. That this improvement did not occur underscores the likelihood that the KORUS FTA played a decisive role in the post-FTA deficit expansion.

Employing a difference-in-differences approach, we find strong empirical evidence that the KORUS FTA causally contributed to the widening of the U.S. trade deficit with Korea after taking the changing business cycle conditions in consideration. Our event study exercises justifies the use of diff-in-diff approach by confirming the parallel trend assumption. The synthetic control analysis further deepen our understanding of these results, demonstrating that the agreement's full trade-balance effects emerged gradually over several years. This time pattern suggests that structural adjustments, supply-chain reconfigurations, and firm-level responses may have amplified the agreement's impact in the medium term.

Future research could expand on several fronts. First, examining disaggregated sectoral and product-level trade flows would help identify which industries drove the post-FTA deficit expansion and whether these effects were concentrated in a few key sectors or spread broadly across the economy. Second, firm-level data could be employed to evaluate how the KORUS FTA influenced entry, exit, and productivity patterns among U.S. and Korean exporters and importers. Finally, integrating general equilibrium trade models with the empirical estimates here could provide a richer assessment of welfare effects, including consumer gains and distributional consequences within each country.

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