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ABSTRACT

We study whether tariff preferences conferred on South Korean goods through the implementation of the Korea-U.S. Free Trade Agreement (KORUS) drew U.S. import demand away from other U.S. trading partners through the phenomenon known as trade diversion. In the two years following the implementation of KORUS, trade diversion was particularly strong for U.S. imports of consumption goods and for trade partners who already had free trade agreements with the U.S. Our estimates of trade diversion sum to $13.1 billion in 2013 and $13.8 billion in 2014. Notably, these estimates of trade diversion are roughly of the same magnitude as the increase in the U.S. bilateral goods trade deficit with South Korea. Thus, while increased U.S. imports from South Korea may have increased the U.S.-South Korea bilateral trade deficit, the fact that KORUS diverted U.S. import demand away from other trading partners implies new U.S. imports from Korea stimulated by the KORUS did not expand the overall U.S. trade deficit.

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1. Introduction

The Korea-U.S. Free Trade Agreement (KORUS) received intense criticism from many quarters after it went into force in March 2012: President Trump has argued that the agreement allows South Korea to exploit the United States. More broadly, a number of critics have pointed to the U.S.- South Korea bilateral trade deficit which grew rapidly following the implementation of the agreement. However, whether and how regional free trade agreements affect trade imbalances remains an open question. The 2018 Economic Report of the President (Council of Economic Advisers, 2018, p.230) sums up the issue:

> Although trade agreements are associated with about twice as much overall trade, the causal impact on the trade balance is unclear, in part because agreements are more likely with countries that would otherwise have higher trade volumes. Nor does the presence of an agreement predict the balance of trade. The United States has free trade agreements (FTAs) with a number of countries—some of which represent net trade surpluses for the United States (Canada and Singapore), and some of which represent deficits (Mexico and South Korea).

Nonetheless, due to the temporal coincidence of the deterioration in the U.S.-South Korea trade balance immediately following implementation of KORUS, and in light of the importance of trade balances as political fodder in public discussions of trade agreements, it is worth evaluating dimensions on which FTAs may potentially affect bilateral trade balances. To this end, the goal of this paper is to estimate the degree and facets of trade diversion that were generated by the provision of KORUS tariff preferences, and to examine how the overall magnitude of these trade diversion effects compares with the actual change in the U.S.-South Korea trade balance. The question is important because trade diversion may increase the U.S. bilateral trade imbalance with an FTA partner, but cannot affect the overall U.S. trade balance since it simply transfers U.S. import demand from one trading partner to another.

To tackle these questions, we estimate the magnitude of trade diversion which can be attributed to U.S. KORUS policies. First, we use a method of estimating trade diversion pioneered by Romalis (2007) in his assessment of the North American Free Trade Agreement (NAFTA) and the Canadian-U.S. Free Trade Agreement. This involves measuring whether U.S. imports from third countries were sensitive to the U.S. tariff preferences extended to South Korean goods. This approach compares U.S. imports from South Korea versus other countries based on the goods-level tariff preferences. To control for external factors which also shaped the export capability of South Korea relative to other countries, the relative comparison for Australia and Canada's imports is used as a reference point. We find that a 1 percent decline in the U.S. tariff on a South Korean (HS-6) product was associated with between a 0.7 percent and a 1.4 percent decline in U.S. imports from third countries as a share of Australian or Canadian imports of the same product lines from the same third countries each year between 2010 and 2014.

In aggregate, we find that trade diversion may have redirected $13.1 billion and $13.8 billion worth of U.S. imports away from third countries in 2013 and 2014, amounts roughly comparable in size to the growth in the U.S. bilateral goods trade deficit from its level in 2011. Aggregating across all trading partners, we find that the redirection of imports to South Korea was largest for apparel and textile products, followed next by imports in the electronics and footwear sectors. Reduced U.S. imports from China, particularly in footwear, apparel, textiles, and electronics, accounts for roughly half of the gross implied trade diversion. Reduced imports from Mexico account for about one-seventh, concentrated in electronics and vehicle parts.

By definition, because trade diversion occurs when buyers reduce imports from some trading partners by shifting their import purchases towards the country facing newly lowered tariffs, trade diversion affects bilateral trade balances, but leaves the overall trade balance (across all trading partners) unchanged. Therefore, our empirical findings are consistent with the common assumption in structural models that trade agreements may affect bilateral trade balances without directly affecting the overall trade balance. The new trade agreement will not affect the overall national trade balance unless it changes macroeconomic conditions, as it might in the longer term if freer trade has an effect on national macroeconomic conditions or growth rates of the partner and third countries.

Although the majority of trade diversion that we observe is with respect to non-U.S.-FTA partners, we also observe that trade diversion is strongest with respect to earlier U.S. FTA partners, who bear more than one-fifth of our measured trade diversion. This has important policy implications, suggesting that a substantial component of trade diversion under KORUS corrected earlier distortions that had previously suppressed imports from South Korea or other countries, in favor of competing suppliers in pre-KORUS U.S. FTA partners. Consequently, the trade diversion reported here with respect to existing FTA partners does not imply the more unequivocally negative welfare effects generally associated with the trade diversion when all partners start from a position of identical tariff treatment by the importing country.

2. Trade between South Korea and the United States

The United States imported $82.6 billion dollars in goods and services from and exported $72.3 billion dollars in goods and services to South Korea in 2017 according to the U.S. Bureau of Economic Analysis (BEA). To put this in context, although the U.S. gross domestic product is more than 10 times larger, South Korea is the 7th largest U.S. trading partner in terms of total trade in goods and services and has accounted for roughly 3 percent of all U.S. imports and exports for the past several decades. Bilateral trade between the U.S. and South Korea constitutes 13 percent of South Korea's total trade according to United Nations Comtrade.

2.1 The trade balance

Similar to its relationship with many other trade partners, the U.S. runs a services trade surplus with South Korea and a large deficit in goods trade. The bilateral goods deficit increased between 2012 and 2016 as KORUS went into force. U.S. imports from South Korea expanded considerably after 2012, with 1,988 new HS10 categories imported in either 2016 or 2017 that did not appear in the 5 years prior to the agreement, according to data from the U.S. Census USATrade. The chart below shows the ten HS2 categories (other than HS 98, which includes re-imported goods) with the largest increase in U.S. imports from South Korea between 2012 and 2016. Vehicles are at the top, having increased by $6.3 billion, followed by electrical machinery and equipment ($3.2) and pharmaceutical products ($2.4). Most of these categories—particularly chemicals, iron and steel; glass, lead, fertilizers, plastics, and electrical machinery and equipment—include intermediate inputs. Four of the top-ten categories rely heavily on metals—vehicles; electrical machinery and equipment; ships, boats, and floating structures; and iron and steel.

Yet, looking at import shares as a way to control for domestic factors influencing the overall import demand, imports from Korea as a fraction of US goods imports overall and US services imports overall changed little between 2012 and 2016 according to statistics from BEA. South Korea's imports of goods from the United States as a fraction of all goods imported by South Korea ticked up from 8 percent to more than 10 percent. Using statistics from the United Nations

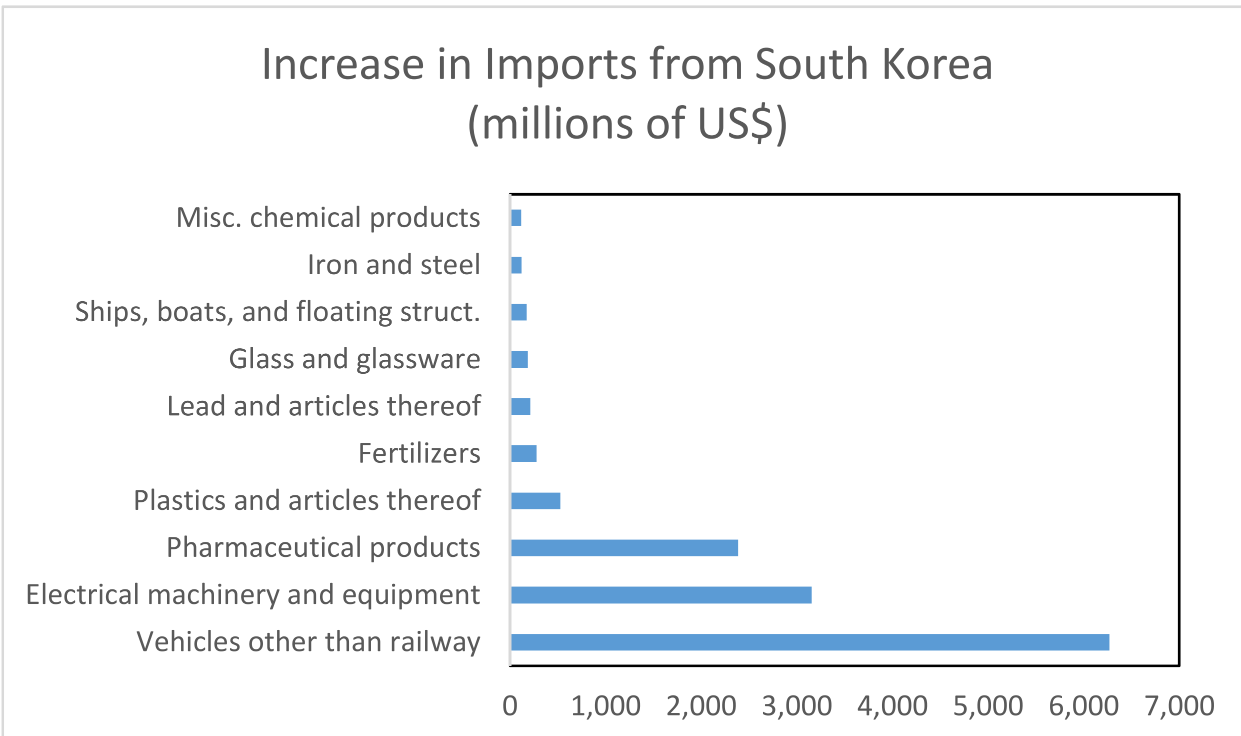


Figure 1: Commodity categories with greatest increase in U.S. imports, 2012-2016

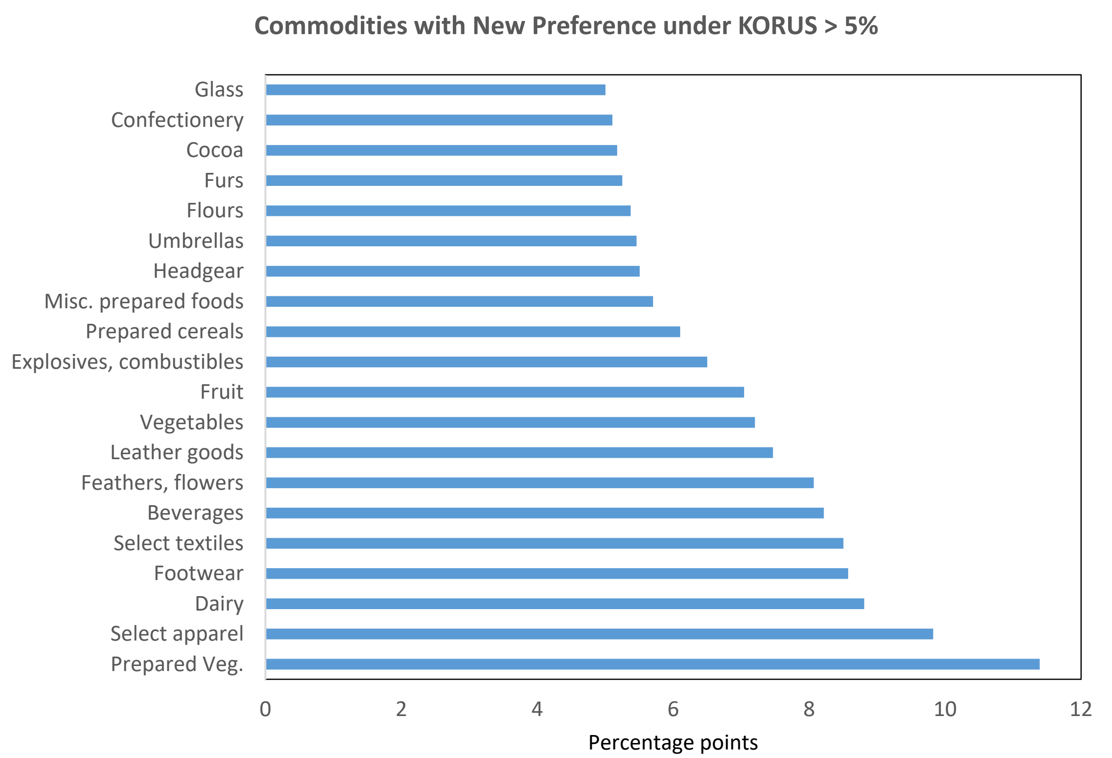
Comtrade database, South Korean imports of services from the US as a fraction of all services imported by South Korea increased as well, from 18 percent to nearly 20 percent. Thus, the increasing U.S. trade deficit with South Korea after KORUS took effect corresponds with an overall decline in the demand for imports in South Korea at the time, but a strengthening of Korean demand for U.S. goods and services as a share of overall imports. These macroeconomic factors show up in large year and country-year fixed effects in the baseline specification of our estimation below.

2.2 *Tariff preferences under KORUS*

South Korean exporters of manufactured goods were given new tariff preferences by the U.S. through the KORUS agreement relative to the standard tariffs charged on other exporters who instead faced the U.S.'s tariffs as given by the most favored nation (MFN) tariff schedule. Figure 2 below shows the HS-2 categories with the greatest new preferences for South Korean producers exporting to the United States using a simple average across HS6 categories within each HS2 heading.

Many of the industries with the greatest new preference are finished or consumer goods, such as apparel, footwear, and processed foods. In the chart below (Figure 3), we show U.S. import shares from South Korea broken down by new preferential access under KORUS. Categorizing goods by the level of new preference, import shares increased most for South Korean goods where new preference was the largest. Passenger vehicles are excluded from this figure since we believe trends in passenger vehicle trade at this time were strongly affected by the recovery from the global financial crisis. In addition, U.S. imports of South Korean automobiles did not receive any tariff preferences until the fifth year of implementation. However, we discuss the automotive sector at greater length in Section 4 when considering industry breakdowns of estimated trade diversion.

Next, we break down end-use categories within goods that received new tariff preference under KORUS of 5 percentage points or more in Figure 4. Intermediate goods appear to have been the most responsive, suggesting that new tariff preferences under a regional free trade agreement may have an effect on supply chains. In the case here, the effect is somewhat lagged,



Notes: New tariff preference defined as the difference between the most favored nation (MFN) tariff and the KORUS tariff as reported in the WTO tariff database in 2017 by the United States. Values reflect means across HS6 categories within HS2 headings. Select Apparel includes HS 60-63,Select Textiles include HS51-56 and 58.

Figure 2: Commodities with greatest new U.S. tariff preference under KORUS

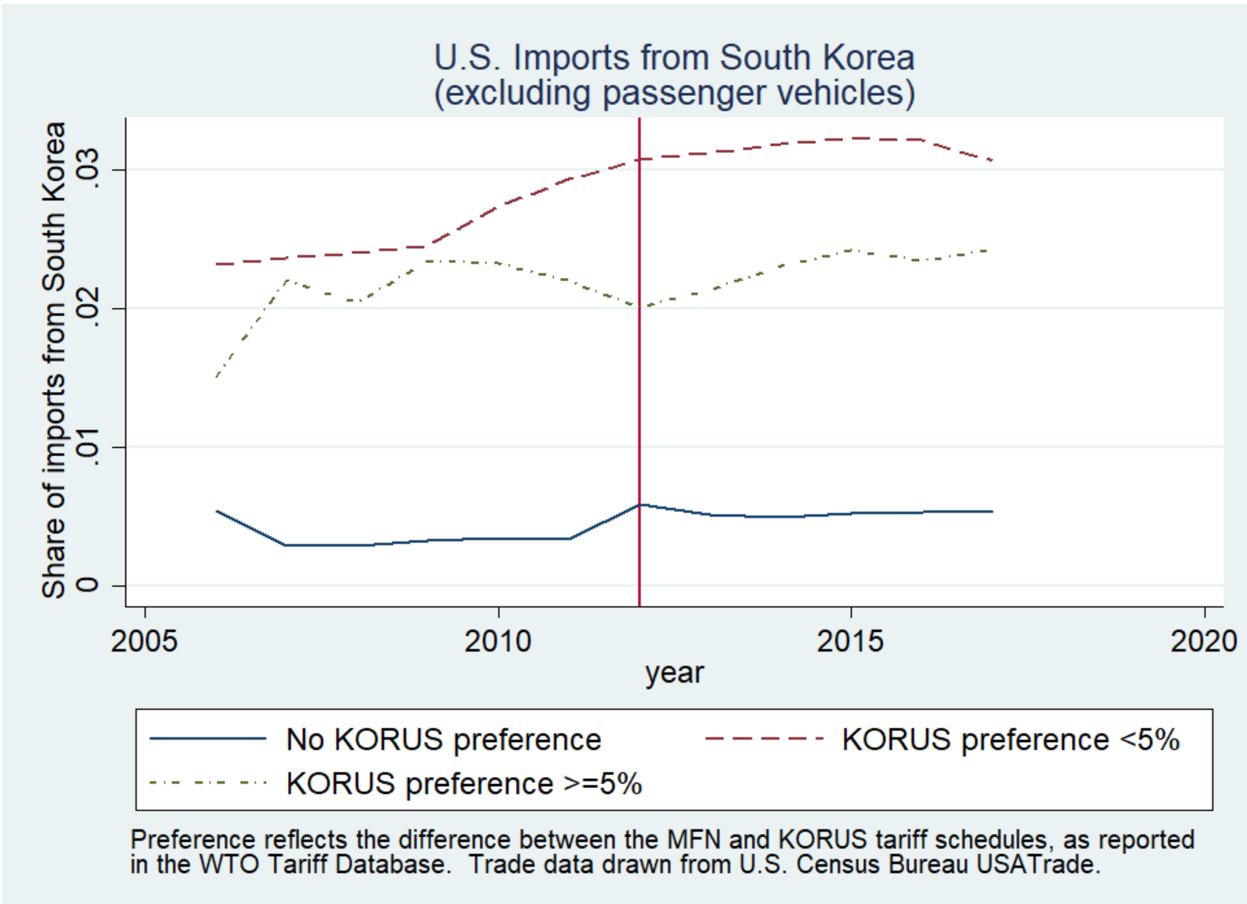


Figure 3: Imports by degree of new (U.S.) KORUS preference

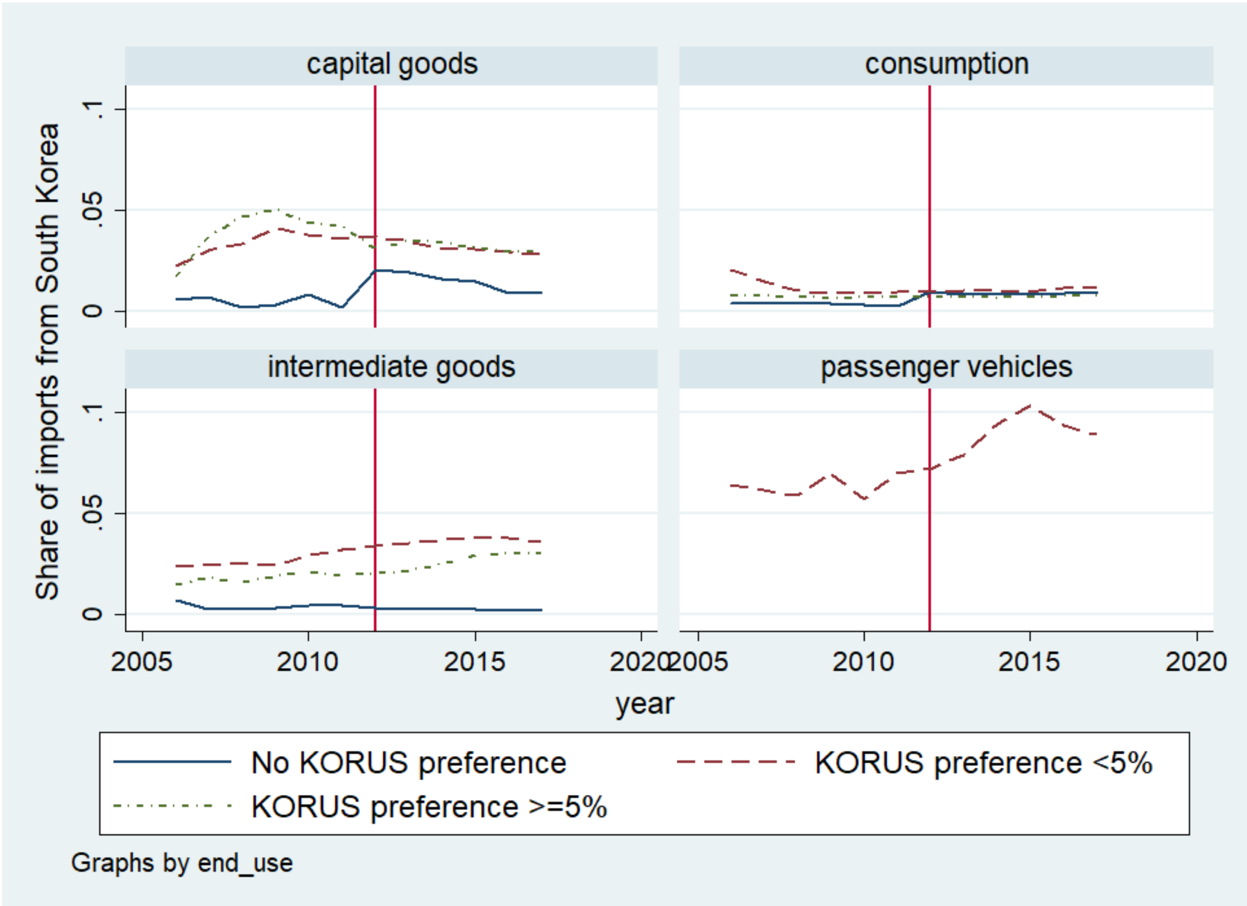


Figure 4: Imports of intermediate goods and passenger vehicles increase most under KORUS

most noticeable 2-4 years after the agreement goes into force in 2012. The lag suggests that adjustment costs or other impediments may be at work.

The bottom left panel in Figure 4 demonstrates that import shares for intermediate goods with no new tariff preference under KORUS or new tariff preference of less than 5 percentage points (but above zero) do not increase at the same rate as for this higher preference class. The greater degree and persistence of the increase in import shares for intermediate goods subject to the highest levels of new preference under KORUS again suggests the presence of adjustment costs and other frictions or persistent cost differentials between source countries that outweigh tariff cuts between 0 and 5 percent.

3. Trade Diversion

The literature on trade diversion is vast. Viner (1950) pioneered the theoretical treatment of preferential (regional) trade agreements like KORUS. This work demonstrated how the preferential lowering of tariffs could lead to trade creation and/or trade diversion by which preferential tariffs redirect trade from lower-cost suppliers to higher-cost FTA partners. The mechanism for this diversion becomes relevant when the export prices of current trade partners inclusive of tariffs exceeds the export prices of higher-cost FTA suppliers who benefit from lower or zero tariffs. Over the last two decades, authors including Frankel (1997), Haveman and Hummels (1998), Baier and Bergstrand (2007), and Anderson and Yotov (2016) have used gravity-based frameworks to examine the effect of FTAs on trade flows, while others including Clausing (2001) have attempted to estimate counterfactuals using demand-based methods. Magee (2008) draws on varying approaches and incorporates exporter-year fixed effects from the gravity literature. We also introduce this use of fixed effects into the Romalis (2007) approach to mitigate measurement error as we estimate the degree of trade diversion.

Some economists question whether in the age of proliferating preferential trade agreements, trade diversion remains quantitatively important (Magee, 2017). Our findings suggest that this may be true with respect to aggregate trade balances, but that diversion of U.S. import purchases away from earlier U.S. FTA partners and toward South Korean suppliers may illustrate the "defensive" or "contagious" nature of FTA proliferation, in the spirit of Baldwin and Jaimovich (2012) and Missios, Saggi, and Yildiz (2016), and is also apparent in Dai, Yotov, and Zylkin (2014).

To the best of our knowledge, the previous literature has not yet framed its results in a way that sheds light on recent questions about the connections, if any, between trade agreements and trade balances. In part, the absence of such work may be explained by the fact that public concern with bilatral trade deficits remains puzzling to economists, who note that overall national deficits are pinned down by a macroeconomic accounting identity. Namely, if a country's expenditures exceed its income, the country will run a current account deficit with the rest of the world. Bilateral trade agreements do not have any direct effect on this accounting relationship. Therefore, it is perhaps a matter of course that standard quantitative models assessing the impacts of trade policy either feed in past values of the trade balance as an exogenous variable (Dekle, Eaton, and Kortum, 2007), or extrapolate its value based on past and forecasted macroeconomic growth

(United States International Trade Commission, 2016). This same approach has been taken to develop predictions about trade patterns as in the recent model by Caliendo and Parro (2015) and in earlier work with CGE models. These too treat national aggregate trade balances as exogenously determined outside the model.

Yet, bilateral trade balances are the force at least nominally driving the new tack in U.S. trade policy and some applications of these approaches have come under fire for not addressing them fully. Baker and Rosnick (2016), for example, compare the observed U.S.-South Korea bilateral trade deficit with forecasts based on the ITC's CGE model predictions. This work shows the poor performance of the CGE model in predicting changes in bilateral trade balances, as it contains the assumption that the bilateral trade deficit would continue to grow at the same rate as it had prior to the KORUS conditional on macroeconomic growth. As a result, effects attributable to tariff changes were overwhelmed in practice by other factors which also influenced the trade deficit. One benefit of our approach is the use of year fixed effects, which should capture the aggregate influence of differential growth rates, and fluctuations in exchange rates which may have had an influence on relative U.S. import demand. Due to the political salience of this question, the purpose of our study is to identify the degree of trade diversion under KORUS, recognizing it as a phenomenon which can widen a bilateral trade deficit with no effect on the aggregate trade deficit and therefore consistent with the assumption that the overall aggregate trade deficit is driven by macroeconomic fundamentals.

It is worth noting that when Caliendo and Parro (2015) evaluate the effects of the North American Free Trade Agreement (NAFTA) through a model which recognizes sectoral input-output linkages their work demonstrates how the adoption of free trade agreements endogenously affects sector-level trade balances. Since the treatment of sectoral linkages naturally provides information on the value-added by different sectors in different countries, in the longer-run, it will be interesting to apply their methods to study tariff preferences under other agreements. However, two features prompt us to leave this type of approach for further research. First, sectoral trade involves trade in intermediate inputs. While intermediate inputs are a large share of U.S.-Mexico trade due to the fact that global supply chains benefit from lower trade costs both in terms of actual transportation costs, but also in the cost of time, intermediates trade is a much smaller share of U.S. import from Korea. Second, since KORUS is a new agreement, its provisions are still being phased-in, and the full effects have not had time to emerge. If KORUS leads to the relocation of activities within supply chains, the need to plan, and to undertake investments that support the relocation place these impacts outside our interval of estimation. Although we anticipate that the effects of KORUS on intermediates trade will increase over time, these changes are not revealed in the short-run data analysis that follows, where we see the most dramatic impact on consumer goods.

3.1 Detecting trade diversion

We use the measure of trade diversion constructed by Romalis (2007) as a tool to analyze the effects of NAFTA. Through this approach we are able to show that even for a bilateral free trade agreement with a country that accounts for only 3 percent of U.S. trade, trade diversion exists and is nontrivial in size. Based on an economy with constant elasticity of demand (CES) preferences, Romalis (2007) derives a relative import demand equation for the FTA partner, in our case the United States, and a reference country, R, for good i purchased from a control or third country j. Simplifying the notation, we relate U.S. imports relative reference country R imports through the following equation,

$$\ln \frac{M_{ijt}^{US}}{M_{ijt}^{R}} = \sigma \ln \frac{1+\tau_{ijt}^{US}}{1+\tau_{ijt}^{R}} - (\sigma-1)\ln \frac{g_{ijt}^{US}}{g_{ijt}^{R}} + (\sigma-1)\ln \frac{P_{it}^{US}}{P_{it}^{R}} + \ln \frac{b_{it}^{US}Y_t^{US}}{b_{it}^{R}Y_t^{R}}, \tag{1}$$

where σ is the elasticity of substitution between goods, τ the relevant tariff in percentage points, g an iceberg trade cost representing other trade costs, P the aggregate price index of all sellers of product i in the United States or reference country, b a demand shifter, and Y aggregate domestic production, with the product bY equal to aggregate domestic demand in the United States or reference country. Note that the relative price level in this equation captures real exchange rate effects and relative demand captures GDP ratios generally modeled in macro approaches to current account imbalances.

We obtain all import data at the HS-6-digit level from UN Comtrade for the countries listed in the appendix. We obtain tariff data for U.S. most-favored-nation (MFN) and KORUS schedules from the World Trade Organization (WTO) tariff database. We use Australia and Canada as control countries instead of the European Union because the EU enacted a free trade agreement with South Korea the year before KORUS went into effect, precluding its usefulness as a reference area. However, both Australia and Canada also put into force free trade agreements with South Korea in December 2014 and January 2015, respectively, so we cut off the sample at 2014. We use Australia and Canada despite their truncated years of eligibility instead of Japan because Japan put into force agreements with many countries in the control-country sample during or shortly before our period of interest, particularly in Asia. We begin the sample in 2010 to avoid confounding factors related to the trade collapse and rebound between 2007 and 2009.

Equation 1 yields an econometric specification:

$$\ln \frac{M_{ijt}^{US}}{M_{ijt}^{R}} = \beta_1 \ln(1 + \tau_{it}^{US,Korea}) + \beta_2 \ln(1 + \tau_{it}^{US,MFN}) + +\beta_3 \ln(1 + \tau_{it}^{CAN,MFN}) + D_i + D_t + \varepsilon_{it}. \quad (2)$$

D_i and D_t are a full set of product and year fixed effects, with ε_{it} an error term orthogonal to the tariffs. Instead of year fixed effects (D_t), we include third-country-year fixed effects (D_{jt}) in most specifications to avoid overestimating the effect of the tariff change. The fixed effects as a group are meant to capture the relative non-tariff trade costs, $\frac{g_{ijt}^{US}}{g_{ijt}^{R}}$, factors affecting relative demand, $\frac{b_{it}^{US} Y_t^{US}}{b_{it}^{R} Y_t^{R}}$, as well as factors that may affect relative prices of Korean versus other goods, such as changes in the won-dollar rate and domestic factors affecting industry and aggregate price levels in the U.S. relative to the reference country.

Table 1 below shows summary statistics for our baseline regression using Canada as the reference country. The average U.S. tariff under KORUS is about half the size of the average U.S. tariff under MFN. The U.S. market is larger than Canada's, so the import share is naturally larger on average. Pooled across goods and partners, about half of U.S. imports are intermediate goods, a little over 1/3 are consumption goods, and about 11 percent are capital goods, with considerable variation across goods and partners.

We choose Canada as a natural reference country in our baseline regressions below because it is nearly equidistant from South Korea and has similar per capita income and thus a high level of similarity of customer demands compared with the United States. We rule out Japan as a reference country due to new FTA activity during our sample period; Singapore due to its prominence as a hub for entrepot trade as well the fact that Singapore and South Korea enacted a second FTA through the ASEAN-Korea FTA in 2007, which may have prompted changes through 2010; and China due to much lower per capita income and its close proximity to South Korea, making it a prime candidate as a country whose U.S. imports might be diverted by KORUS. Instead, we use Australia as an additional reference country as a robustness check, since it has similar per capita income as the United States, does not have FTA activity with the United States

Table 1: Summary Statistics for Baseline Regression Sample (Canada, 2010-2014)

Variable	Mean	Standard Deviation
$\tau_{it}^{US,Korea}$	0.025	0.051
$\tau_{it}^{US,MFN}$	0.049	0.060
$\ln \frac{M_{ijt}^{US}}{M_{ijt}^{CAN}}$	2.836	2.437
Fraction intermediate goods	0.482	0.500
Fraction consumption goods	0.376	0.484
Fraction capital goods	0.113	0.316
N	120,058	
No. Products	4,380	

or South Korea that rules it out during our sample, and is not an adjacent neighbor to South Korea.

3.2 *Estimates*

We view Canada as our baseline specification because it is geographically closest to the United States, with results for Australia showing very similar quantitative and qualitative patterns. Table 2 shows that a one-percent reduction in the U.S. tariff on South Korean goods is associated with a reduction in imports from control countries of between 0.78 and 1.17 percent relative to Canadian imports. These baseline estimates are all within the range of coefficient estimates (0.06-1.38) that Romalis reports for U.S. tariff changes under NAFTA toward imports from Canada and Mexico using a similar control-country sample and the EU as a reference area. Estimates using Australia as the reference country, 1.16 and 1.36, are also within the range of Romalis's coefficients.

As a side note, country-year fixed effects, not reported here, are often about 5 times the size of the coefficients on the tariffs, illustrating the large role that macroeconomic factors play in driving relative import shares.

Table 3 shows the sensitivity of the log U.S.-Canada ratio of imports from third countries by end-use category. We define intermediate goods as United Nations Broad Economic Categories (BEC) 111, 121, 21, 22, 31, 322, 42, and 53; consumption goods as BEC 112, 122, 522, 61, 62, and 63; and capital goods as BEC 41 and 521. The coefficient on the interaction term between intermediate

Table 2: Log of U.S.-reference country import ratio on U.S. tariff for South Korean goods

Reference Country	Canada		Australia	
	(1)	(2)	(3)	(4)
$\tau_{it}^{US,Korea}$	1.167***	0.778**	1.160**	1.364***
	(0.340)	(0.346)	(0.456)	(0.393)
Constant	3.078***	3.360***	2.220***	1.725
	(0.165)	(1.306)	(0.763)	(2.188)
MFN Tariffs	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	No
Partner Country-Year FE	No	Yes	No	Yes
HS-6 Product FE	Yes	Yes	Yes	Yes
Partner Countries	Ap. A	Ap. A	Ap. A	Ap. A
N	120,058	120,058	86,031	86,031
R^2	0.162	0.198	0.198	0.447
No. Products	4,380	4,380	4,140	4,140

Note: Standard errors in parentheses with ***, **, and * respectively denoting significance at the 1%, 5% and 10% levels.

goods and the U.S.-South Korea tariff is negative, significant, and larger than the coefficient on the tariff alone. An F-test[1] fails to reject that the sum of the two coefficients is different from zero. Thus, intermediate goods as a broad category do not appear subject to trade diversion within the first 3 years of KORUS.

In contrast, consumption goods are sensitive compared to non-consumption categories. In fact, consumption goods drive much of the sensitivity observed for the sample as a whole: the inclusion of the consumption interaction term takes on more than the full value and significance of the baseline coefficient (in Column (2) of Table 2) on the tariff by itself, leaving the coefficient estimate on the tariff by itself negative and without significance. An F-test[2] rejects the null hypothesis that the sum of the two coefficients equal zero. Together with the positive sum of the point estimates, the F-test implies that indeed, the overall association between changes in the U.S. tariff on South Korean goods and U.S. imports relative to Canada is nonzero and positive, indicating that consumption goods are subject to trade diversion under KORUS. Capital goods show no special sensitivity either way, as the coefficient on the interaction term is relatively small

[1] F(1,115143)=0.68.

[2] F(1,115143)=7.93, significant at the 1 percent level.

and not significant. An F-test[3] also fails to reject that the sum of the coefficient on the tariff alone and the tariff interacted with the capital goods indicator is different from zero.

The absence of systematic trade diversion and thus relative persistence of trading relationships for intermediate goods is consistent with Figure 4, where we observe a very gradual increase in U.S. imports of intermediate goods from South Korea after KORUS took effect and the increase in South Korean import shares persisting mainly for goods with new tariff preference greater than 5 percent. We surmise that it often may take time for firms to respond to new tariff preferences by reorganizing supply chains in this case, or that there are costs involved which make it unprofitable to do so, similar to lags in the response by Indian firms to changes in tariffs on intermediate goods found by Vandenbussche and Viegelahn (2018). Were our sample to include 2015 and 2016, one might find more sensitivity for intermediate goods.

Table 3: Log of U.S.-Canada import ratio on U.S. tariff for South Korean goods by end-use

	(1)	(2)	(3)
$\tau_{it}^{US,Korea}$	1.011***	-0.564	0.780**
	(0.357)	(0.592)	(0.347)
Intermediate Good$\times\tau_{ijt}^{US,Korea}$	-1.150***		
	(0.561)		
Consumption Good$\times\tau_{ijt}^{US,Korea}$		1.564***	
		(0.560)	
Capital Good$\times\tau_{ijt}^{US,Korea}$			0.554
			(1.785)
Constant	3.421***	3.423***	3.409***
	(0.864)	(0.864)	(0.864)
MFN Tariffs	Yes	Yes	Yes
Partner Country-Year FE	Yes	Yes	Yes
HS-6 Product FE	Yes	Yes	Yes
Partner Countries	Ap. A	Ap. A	Ap. A
N	120,058	120,058	120,058
R^2	0.198	0.198	0.198
No. Products	4,380	4,380	4,380

Note: Standard errors in parentheses with ***, **, and * respectively denoting significance at the 1%, 5% and 10% levels.

Trade diversion in its simplest form arises when an importer grants a new tariff preference

[3] F(1,115143)=0.32.

to one of its trading partners while leaving third countries at a disadvantage. If the importing country starts from an initial set of goods tariffs that are levied uniformly on all trade partners, preferential treatment of just one partner can generate negative welfare effects if the new tariff preference diverts import purchases to less efficient suppliers in the favored country at the expense of suppliers in the countries that don't receive improved tariff rates. In this setting, the importing country also experiences a reduction in the tariff revenue it collect on imports. Results in Column (1) of Table 4 show that this is often not the case for new tariff preference under KORUS. Instead, new tariff preference under KORUS appears to draw U.S. imports more strongly away from existing U.S. FTA partners, as Korean exporters gain access to reduced tariff levels that were already conferred on countries with an existing U.S. FTA. In other words, prior to KORUS, U.S. tariffs levied on South Korea placed South Korea at a disadvantage relative to FTA partners of the U.S.

Thus, some trade diversion we measure as associated with KORUS appears to be a reversal of trade diversion locked in under earlier U.S. FTAs that suppressed U.S. imports from South Korea in favor of earlier FTA partners. Given the importance of U.S. Mexico trade, we test whether this result hinges on the inclusion of Mexico in the sample. However, our tests for robustness demonstrate that the results are not sensitive to the inclusion or exclusion of Mexico. In addition, we find that this result emerges clearly whether we use Canada or Australia as the reference country.

Given the current interest in trade models that are based on sectoral linkages, we repeat our analysis of tariff sensitivity using Australia as the comparison country. This might be important if the lack of a strong result for intermediates was caused by South Korea's distance from the United States. However, as shown in Table 5 the central patterns based on differential goods sensitivity continue to hold when we use Australia as a reference country. U.S. trade in intermediate goods with control countries is more resilient to the new KORUS tariff preferences than the baseline estimates in Table 2, while U.S. imports of consumption goods are much more prone to trade diversion than the baseline. An F-test[4] rejects the null hypothesis that the sum of the coefficient on the tariff and on the positive tariff-consumption interaction term equal zero and the sum of the point estimates is $1.908 > 0$, indicating the presence of trade diversion for consumption goods.

[4]F(1,81449)=21.91, significant at the 1 percent level.

Table 4: Log of U.S.-Canada import ratio on U.S. tariff for South Korean goods by FTA status

	Including Mexico		Without Mexico	
	Canada	Australia	Canada	Australia
	(1)	(2)	(3)	(4)
$\tau_{it}^{US,Korea}$	0.329	1.020**	0.299	1.146***
	(0.352)	(0.397)	(0.362)	(0.399)
FTA Partner$\times\tau_{ijt}^{US,Korea}$	2.312***	3.929***	1.992***	2.395***
	(0.337)	(0.620)	(0.412)	(0.740)
Constant	3.433***	1.764	3.382***	1.524
	(0.864)	(2.187)	(0.863)	(2.177)
MFN Tariffs	Yes	Yes	Yes	Yes
Partner Country-Year FE	Yes	Yes	Yes	Yes
HS-6 Product FE	Yes	Yes	Yes	Yes
Partner Countries	Ap. A	Ap. A	Ap. A	Ap. A
N	120,058	86,031	110,097	81,762
R^2	0.199	0.447	0.207	0.420
No. products	4,380	4,140	4,359	4,136

Note: Standard errors in parentheses with ***, **, and * respectively denoting significance at the 1%, 5% and 10% levels. Columns (1)-(3) contain the full sample as in earlier tables, while Column (4) contains only HS-6 goods within the Consumption end-use category.

Again, no evidence of trade diversion emerges for HS-6 goods across the intermediate goods or capital goods categories and F-tests fail to reject that the sum of each of these with the coefficient on the tariff is different from zero.

4. Aggregate estimates

How much trade diversion is there overall? We first estimate a slightly modified version of Eq. (2),

$$\ln(M_{ijt}^{US}) = \beta_1 \ln(1+\tau_{it}^{US,Korea}) + \beta_2 \ln(1+\tau_{it}^{US,MFN}) + \ln(M_{ijt}^{R}) + D_i + D_{jt} + \varepsilon_{it}. \qquad (3)$$

We compute a KORUS effect for any year t in the interval 2013-2014, the years in our sample after the year that KORUS went into force holding everything but the U.S. tariffs on South Korean goods constant,

$$\ln \frac{M_{ijt}^{US}}{M_{ij,2011}^{US}} = \beta_1 \left(\frac{\ln(1+\tau_{it}^{US,Korea})}{\ln(1+\tau_{i,2011}^{US,Korea})} \right),$$

Table 5: Log of U.S.-Australia import ratio on U.S. tariff for South Korean goods by end-use

	(1)	(2)	(3)
$\tau^{US,Korea}$	-0.927	-1.190*	1.305***
	(2.953)	(0.643)	(0.394)
Intermediate Good$\times\tau_{ijt}^{US,Korea}$	-2.536***		
	(0.616)		
Consumption Good$\times\tau_{ijt}^{US,Korea}$		3.098***	
		(0.617)	
Capital Good$\times\tau_{ijt}^{US,Korea}$			-4.028**
			(1.877)
Constant	1.825	1.870	1.756
	(2.188)	(2.188)	(2.188)
MFN Tariffs	Yes	Yes	Yes
Partner Country-Year FE	Yes	Yes	Yes
HS-6 Product FE	Yes	Yes	Yes
Partner Countries	App. A	App. A	App. A
N	86,031	86,031	86,031
R^2	0.447	0.447	0.447
No. Products	4,140	4,140	4,140

Note: Standard errors in parentheses with ***, **, and * respectively denoting significance at the 1%, 5% and 10% levels.

where I is the total number of HS-6 goods categories and J is the total number of third-country partners. Let Z be the amount of trade diversion in terms of dollar expenditures on U.S. imports. A bit of algebra yields a formula for the change in import expenditures as a function of this KORUS effect from (4),

$$Z_t = \sum_{i=1,j=1}^{I,J} Z_{ijt} = \sum_{i=1,j=1}^{I,J} \left[\exp \beta_1 \left(\frac{\ln \tau_{it}^{US,Korea}}{\ln \tau_{i,2011}^{US,Korea}} \right) - 1 \right] M_{ij,2011}^{US}. \quad (4)$$

The exercise, using Canada as the reference country, yields a figure for total trade diversion equal to $13.1 billion in 2013 and $13.8 billion in 2014.[5] This is roughly the same size as the increase in the goods trade deficit in 2013 and 2014 compared to 2011, as the U.S. bilateral trade deficit with South Korea in goods was $7.5 billion greater in 2013 than in 2011 and $11.8 billion greater in 2014 than in 2011. The aggregate result is consistent with the common assumption that trade agreements can affect bilateral trade balances but do not directly affect aggregate trade balances when assessing the aggregate impact of trade agreements— used both in computable general equilibrium and Ricardian general equilibrium approaches.

4.1 Country and goods breakdowns

We break down the implied gross trade diversion by summing Z_{ijt} over goods by country, or over countries by good. Figure 5 shows that half of U.S. import purchases diverted to South Korean suppliers due to the new tariff preference comes from China, less than one-fifth from Mexico, and various countries and country-groups in East and Southeast Asia and CAFTA-DR hovering around one-twentieth each. Even though estimates in Table 4 reveal that U.S. imports from China may be more resilient than other third-country U.S. trading partners, the volume of U.S. imports from China relative to other countries is quite large and in categories where South Korean suppliers received substantial new preference under KORUS. Absent any country-year fixed effects, for example,[6] China would account for a large portion of trade diversion under KORUS. Among goods, Figure 6 consistent with observed KORUS tariff preferences in Figure 2, apparel and other textiles, footwear, and leather goods constitute a substantial portion of implied gross trade diversion, in addition to electronics and parts for vehicles and machinery. Footwear,

[5] Estimates using Australia as the reference country are somewhat larger, $21.1 billion in 2013 and $22.3 billion in 2014. We prefer the estimates for Canada as our benchmark due to the similar distance from South Korea and the greater integration of the Canadian and U.S. economies, suggesting other broader similarities.

[6] For instance, this gross effect abstracts from changes in bilateral exchange rates or special resilience that may arise from the fraction of Chinese exports anchored by processing and assembly trade.

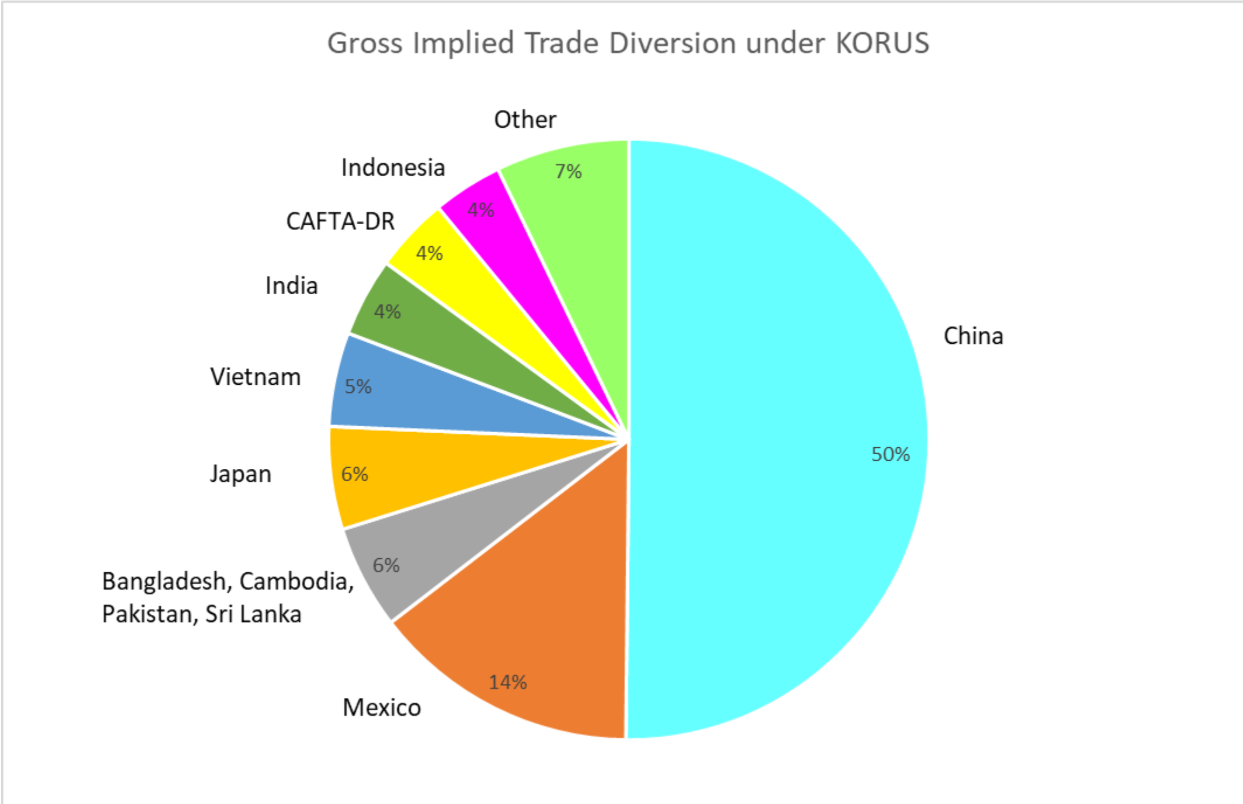


Figure 5: Breakdown of implied gross trade diversion by third-country trading partner

apparel, and textiles top the breakdown of goods affected for China, as well as electronics. For Mexico, the main affected categories are electronics and vehicle parts.

4.2 *Passenger Vehicle Imports*

Although U.S. imports of passenger vehicles from South Korea grew a dramatic 82.5 percent between 2011 and 2017, as U.S. passenger vehicle imports rose from 8.6 million units in 2011 to 15.7 million units in 2017, this surge in vehicle imports from South Korea was almost certainly tied to factors other than the initiation of the KORUS agreement in 2012. To begin, the initial implementation of KORUS had no effect on the U.S. 2.5 percent tariff levied on automobiles or the 25 percent tariff levied on light trucks. Instead, the KORUS agreement allowed the U.S. to retain its 2.5 percent auto tariff for the first four years, followed by the removal of the auto tariff in the fifth year. Nonetheless, passenger vehicle imports from South Korea jumped to 17.3 million units in 2016 before any tariff reductions were available to South Korean exporters.

In viewing the surge in U.S. imports of South Korean passenger vehicles, the rapid expansion

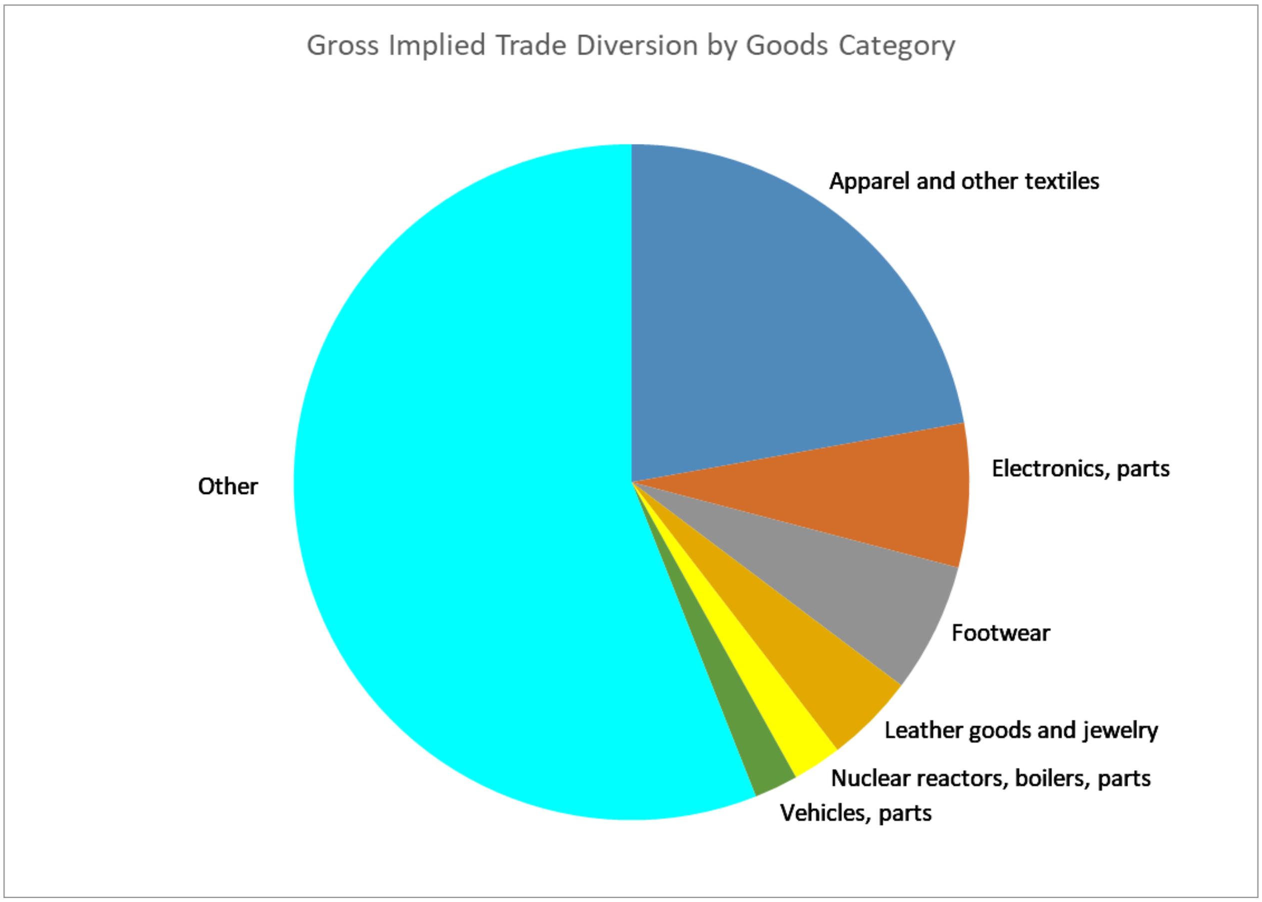


Figure 6: Breakdown of implied gross trade diversion by goods category

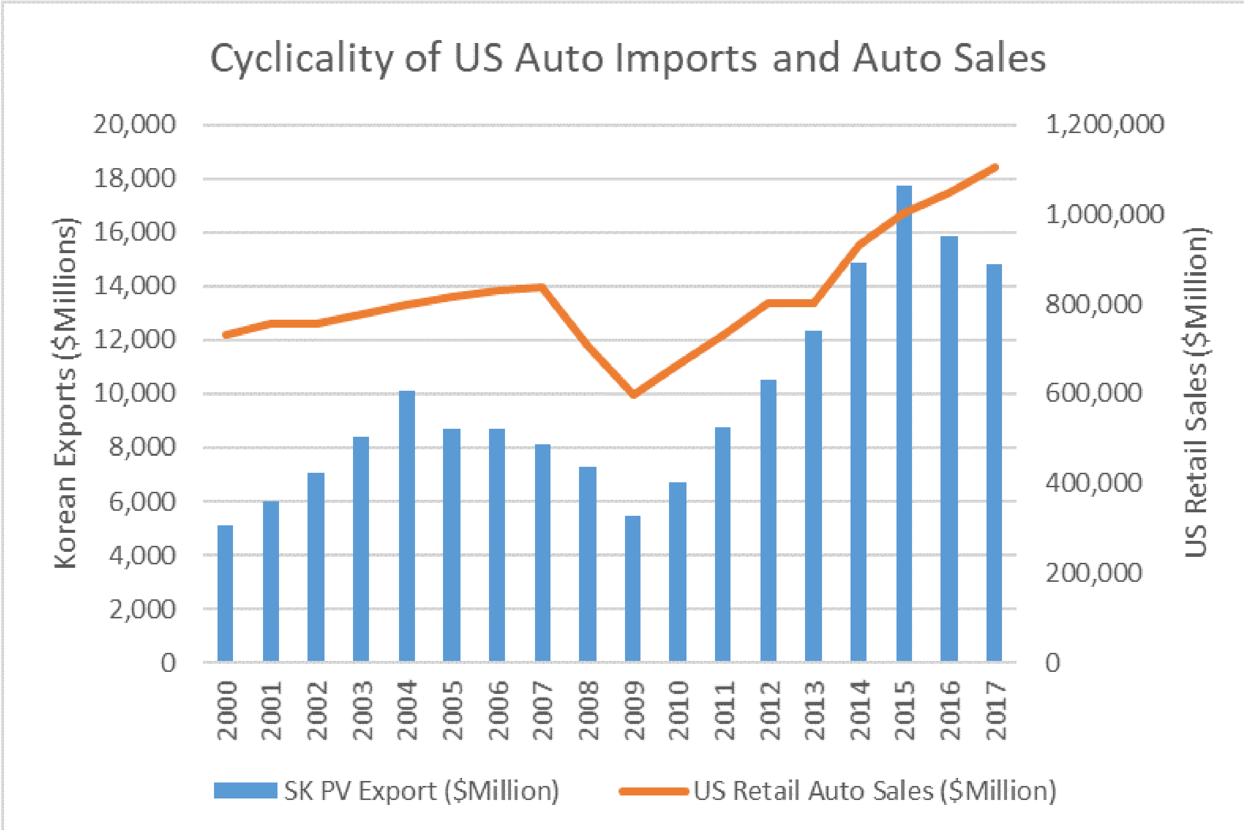


Figure 7: South Korean exports of passenger vehicles to the U.S. track U.S. domestic auto sales

in U.S. vehicle purchases requires attention. In particular, overall U.S. vehicle purchases rose from 156.6 million units in 2011 to 210.7 million units in 2017. Thus, it appears that macro factors such as the U.S. economic rebound following the global financial crisis and sustained low fuel costs, were most likely the primary factors driving U.S. customer purchases of vehicles, not just from South Korea, but from all locations. (See Figure 7 above.)

Since the U.S. implementation of its auto tariff commitments lie beyond the scope of our estimating sample, which must be truncated in 2014 due to issues with the reference countries, we look instead at aggregate data on U.S. passenger vehicle imports by origin. This reveals that between 2012 and 2015 the share of imported passenger vehicles arriving from South Korea ranged between 1.32 to 1.72 percent of all passenger vehicle imports. Since the Korean share of U.S. imports in 2016 and 2017 was 1.53 percent and 1.42 percent respectively, it does not appear that tariff-driven trade diversion played an important role in U.S. passenger vehicle import decisions.

Due to tariff changes in free trade agreements, another margin of adjustment is production location and the sourcing of inputs. This alternative does not yet appear to be an important facet in the early years of the KORUS agreement, as U.S. imports of automotive parts rose only slightly from 7.7 billion dollars in 2012 to 7.9 billion dollars in 2017. If the relocation of production requires a longer adjustment period due to the inherent lags in shifting production across countries, as documented by Vandenbussche and Viegelahn (2018), the trade effects on intermediate inputs such as auto parts may be observed in the future.

5. Conclusion

Our analysis of product-level trade uses the lens of trade diversion to test whether trade agreements can affect bilateral trade balances. Our results reveal trade diversion in the case of U.S. imports of products where South Korea benefited from KORUS tariff reductions, an effect that was particularly noticeable in the case of consumption goods. More notable, we find that a substantial portion of this trade diversion involved shifts in U.S. import purchases away from earlier U.S. FTA partners toward South Korea as South Korea gained access to tariff reductions which were comparable to the tariff relief these other countries had attained in earlier years. From a welfare perspective, this form of trade diversion is beneficial, as new imports from South Korea were presumably selected since South Korea is a more efficient producer.

We estimate that trade diversion, summed across all traded goods categories in the KORUS tariff schedule, amounted to $13.1 billion and $13.8 billion annually in 2013 and 2014. The results suggest that trade diversion may have contributed substantially to the increasing U.S. bilateral trade deficit with South Korea after 2012. Because these estimates are similar in size to the increase in the U.S. bilateral trade deficit in 2013 and 2014 compared with 2011, they offer support for the common practice of assuming that trade agreements may affect bilateral trade balances while leaving global trade balances in the medium-to-long term unchanged when undertaking structural estimation of the effects of trade agreements.

Appendix A. Control country list

The third-country trading partners to the U.S. (also called "control countries" in the text) and reference country are taken from Table A.1 of Romalis (2007), omitting countries establishing free trade agreements with Australia, Canada, or the U.S. after 2008:

Angola, Antigua Barbuda, Argentina, Aruba, Bahamas, Bahrain, Bangladesh*, Barbados, Belize, Benin, Bermuda, Bhutan*, Bolivia, Botswana, Brazil, Brunei*, Burkina Faso, Burundi, Cambodia*, Cameroon, Cape Verde, Cayman Islands, Central African Republic, Chad, Chile*, China*, Christmas Island, Cocos Islands, Comoros, Congo (DROC), Congo (ROC), Cook Islands, Costa Rica, Cote d'Ivoire, Cuba, Dijbouti, Dominica Island, Dominican Republic, Ecuador, El Salvador, Equitorial Guinea, Ethiopia, Fiji*, Gabon, Gambia, Ghana, Greenland, Grenada Island, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hong Kong*, India*, Indonesia*, Jamaica, Japan*, Kenya, Kiribati*, Laos*, Lesotho, Liberia, Libya, Macao*, Madagascar, Malawi, Maldive Island*, Mali, Marshall Islands*, Mauritania, Mauritius, Mongolia*, Monserrat Islands, Mozambique, Namibia, Nauru, Nepal*, Netherlands Antilles, New Caledonia*, New Zealand*, Nicaragua, Niger, Nigeria, Niue*, Norfolk Islands, North Korea*, Norway, Oman, Pakistan*, Palau*, Papua New Guinea*, Paraguay, Peru*, Philippines*, Pitcairn Islands, Qatar, Rwanda, Samoa*, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Singapore*, Solomon Islands*, Somalia, Sri Lanka*, St. Kitts-Nevis, St. Lucia Islands, St. Vinc & Gren, Sudan, Suriname, Swaziland, Switzerland, Tanzania, Thailand*, Togo, Tonga*, Trinidad & Tobago, Tuvalu*, Uganda, United Arab Emirates, Uruguay, Venezuela, Vietnam*, Yemen, Zambia, and Zimbabwe. Asterices denote Asia-Pacific countries and areas.

In addition to these countries, we also add Mexico to the sample, which was part of NAFTA and therefore not suitable as a third-country trading partner or control country when measuring trade diversion induced by NAFTA.

Australian, Canadian, and U.S. import data for these countries were downloaded using UN Comtrade API. There was a difficulty downloading data for Malaysia using the API beta at the time of the download and therefore it is missing from the sample of control countries. Tariff data were downloaded from WTO online Tariff Database.

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