The KORUS Effect:

Revisiting trade agreements and trade balances*

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Abstract: We analyze disaggregate trade data to determine whether tariff preferences for South Korean goods imported by the U.S. after the Korea-U.S. Free Trade Agreement (KORUS) went into force drew U.S. import demand away from imports from other trading partners, a phenomenon called trade diversion. Adding up the effects across goods and third-country trading partners, total trade diversion is an estimated $10.3 billion in 2013 and $10.7 billion in 2014, mainly from existing FTA partners. This is roughly the same size as the increase in the U.S. bilateral goods trade deficit with South Korea relative to 2011. The findings may support the common assumption in structural models that trade agreements may affect bilateral trade balances without directly affecting the overall trade balance.

Keywords: Korea-U.S. Free Trade Agreement, preferential trade agreements, trade imbalances, trade diversion

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1. Introduction

The Korea-U.S. Free Trade Agreement (KORUS) received intense criticism from many quarters after going into force in March 2012, alleging that the agreement allows South Korea to exploit the United States. Many critics pointed to the ensuing increase in the U.S. bilateral trade deficit to motivate their complaints. This paper asks the question of whether trade diversion may contribute to bilateral trade deficits after free trade agreements go into force, using KORUS as a case study.

Whether and how regional free trade agreements affect trade imbalances more generally 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).

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).

Our mission is not to try to forecast the U.S. trade deficit with South Korea, but to assess whether (1) trade diversion may have played a role in the expansion of the U.S. bilateral trade deficit with South Korea in the years after KORUS went into force, and (2) how big trade diversion is in comparison to the increase in the U.S. bilateral deficit with South Korea after 2012. The question is important because trade diversion may increase the U.S. bilateral trade imbalance with an FTA partner, without affecting the overall U.S. trade balance.

To address the issue, we provide estimates for the effect of trade diversion on U.S. imports from South Korea under KORUS. First, we use a method of detecting 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 appear to be sensitive to the degree of U.S. tariff preference toward South Korean goods, using imports by Australia and Canada as reference points to condition for external factors. We find that a 1 percent decline in the U.S. tariff on a South Korean (HS-6) goods categories is associated with between 0.7 percent and 1.4 percent lower 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. The effect we identify is similar to Romalis's (2007) NAFTA effect, despite the shorter horizon over which we are able to measure the effects taking place (3 years versus 5).

In aggregate, we find that trade diversion may have redirected between $10 billion and $11 billion worth of U.S. imports away from third countries in 2013 and 2014, amounts roughly the same size as the difference between the U.S. bilateral goods trade deficit in those years compared with 2011. In theory, trade diversion affects bilateral trade balances but leaves the overall trade balance (across all trading partners) the same. Therefore, our empirical findings support the common assumption in structural models that trade agreements may affect bilateral trade balances without directly affecting the overall trade balance– though naturally, the overall trade balance could be affected by growth resulting from increased trade under a new agreement. In addition, our observed trade diversion mainly occurs with earlier FTA partners, suggesting that trade diversion under KORUS corrected earlier distortions suppressing growth in imports from South Korea when the United States granted preferential treatment to competing suppliers in other countries. Consequently, the trade diversion reported here need not imply the negative welfare effect generally associated with the phenomenon.

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

As with many countries, 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, when KORUS went into force, and 2016. 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 to more than 10 percent. Using statistics from Comtrade, 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

U.S. and South Korean producers of many manufactured goods industries received new tariff preferences under KORUS, relative to the most favored nation (MFN) tariff schedule. Figure 2 below shows the HS-2 categories with the greatest new preferences for South Korean producers

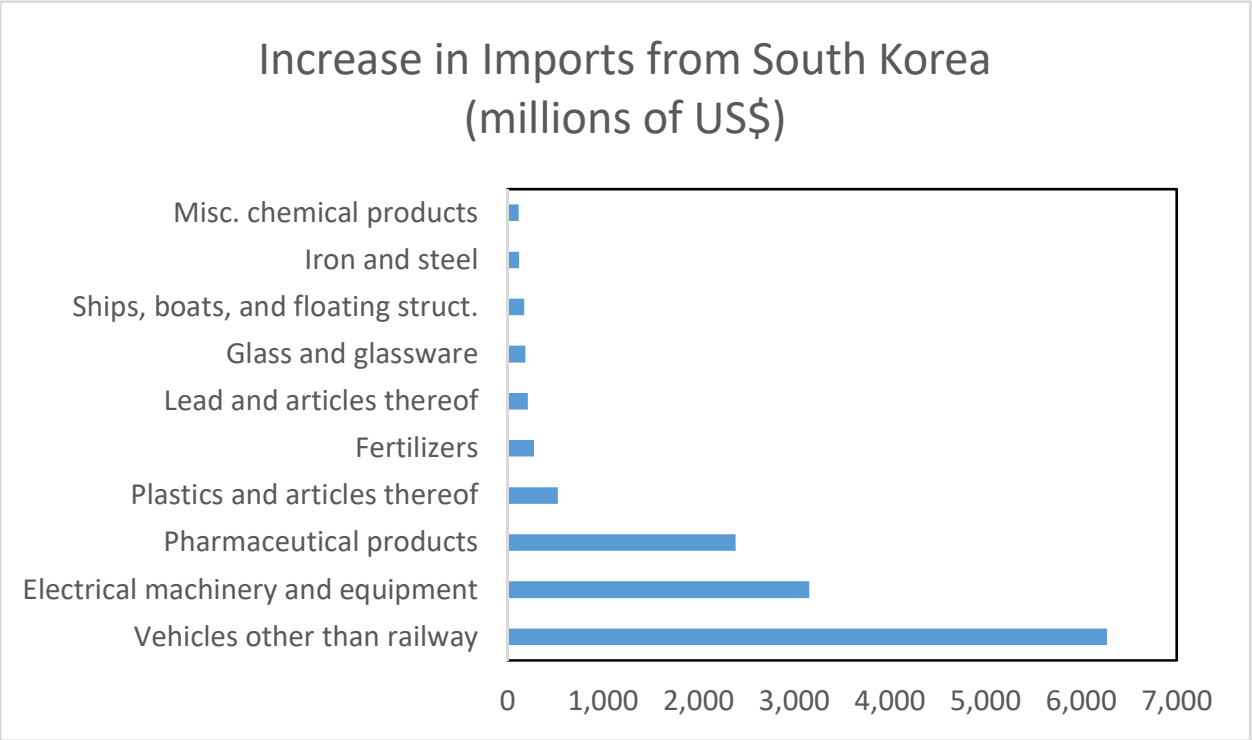
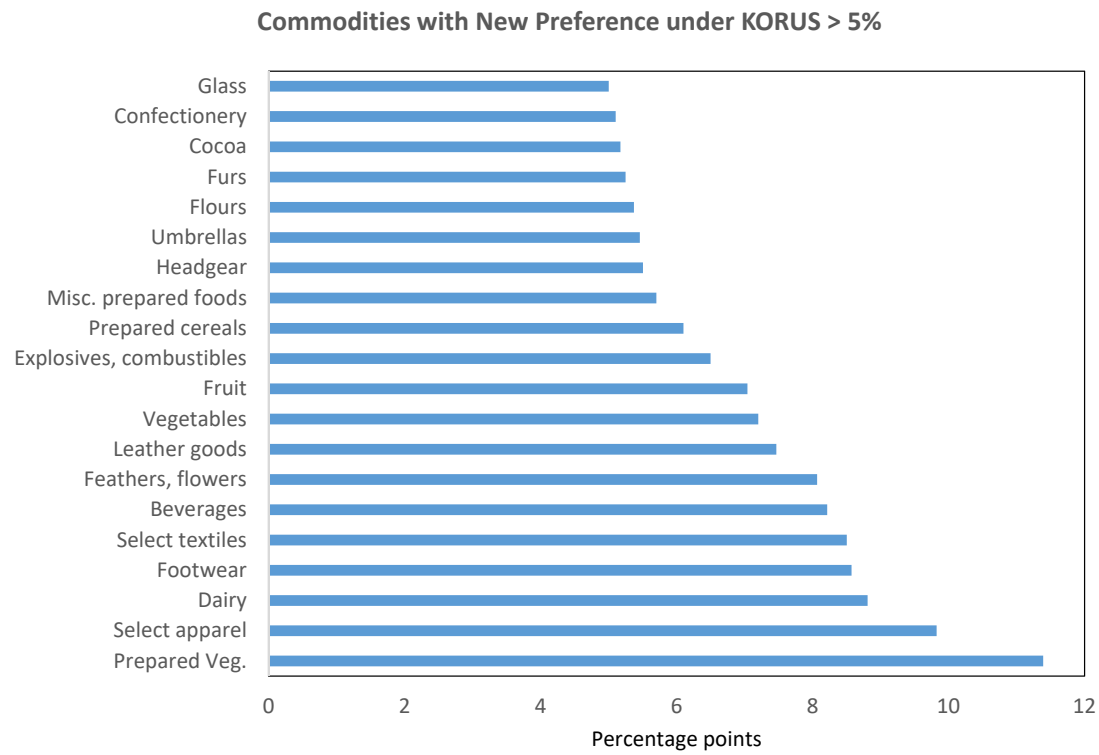


Figure 1: Commodities with greatest new preference under KORUS



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 preference under KORUS

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, like 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 greatest (excluding passenger vehicles).

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,

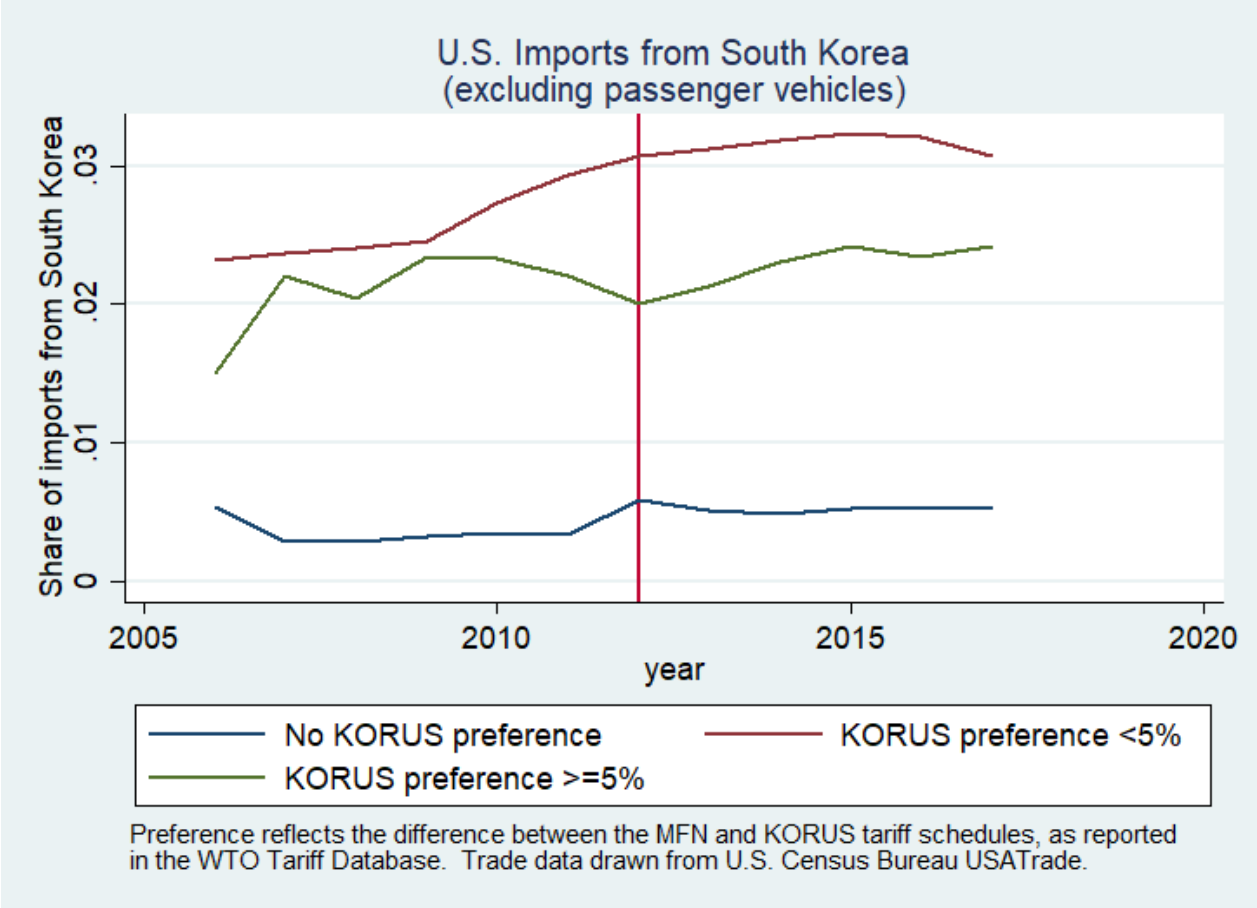


Figure 3: Imports by degree of new KORUS preference

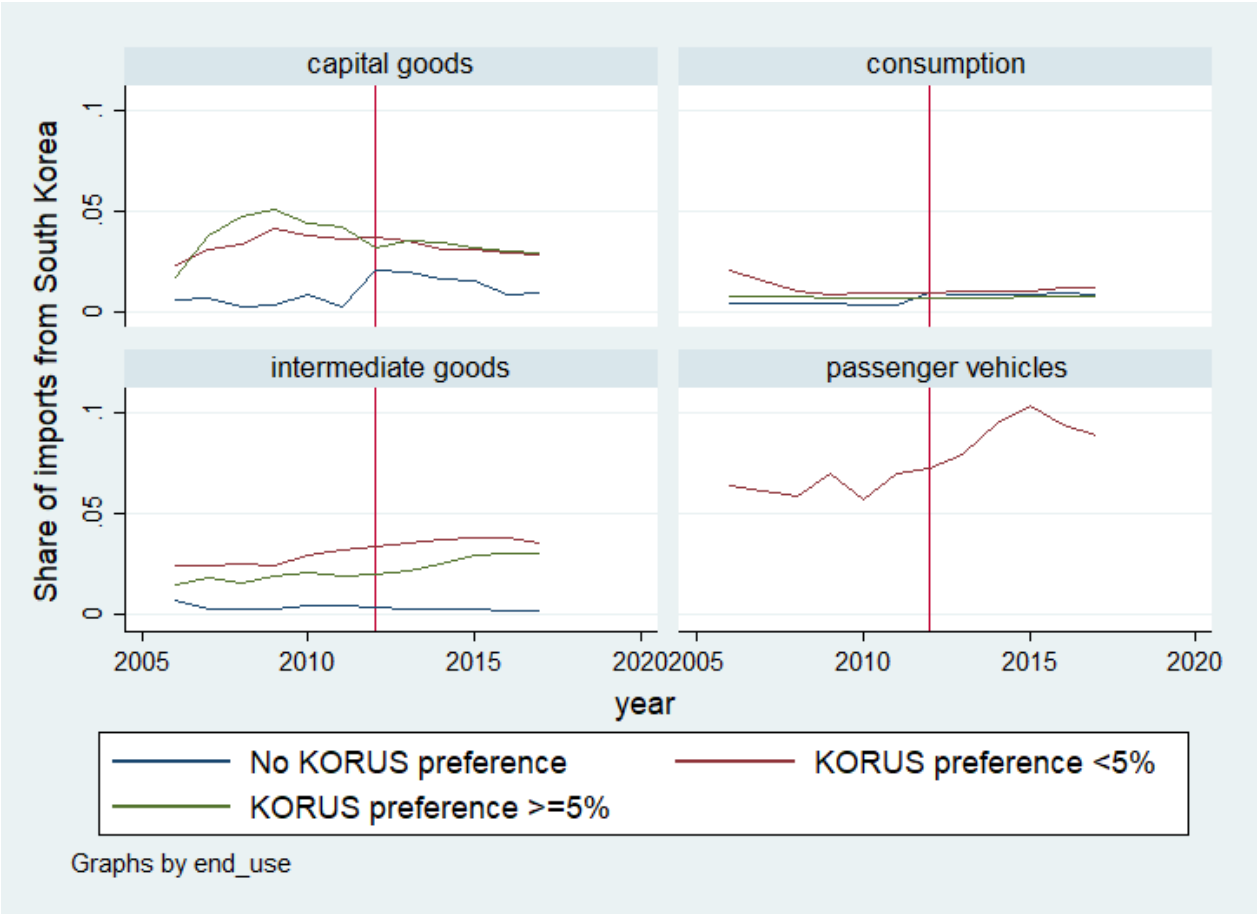


Figure 4: Imports of intermediate goods and passenger vehicles increase most under KORUS

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.

Finally, we examine whether all import shares for South Korean intermediate goods increased after KORUS, or whether there is reason to believe the new tariff preference may be driving the shift. Figure 5 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 suggests the presence of adjustment costs and other hangups or persistent cost differentials between source countries that outweigh tariff cuts between 0 and 5 percent.

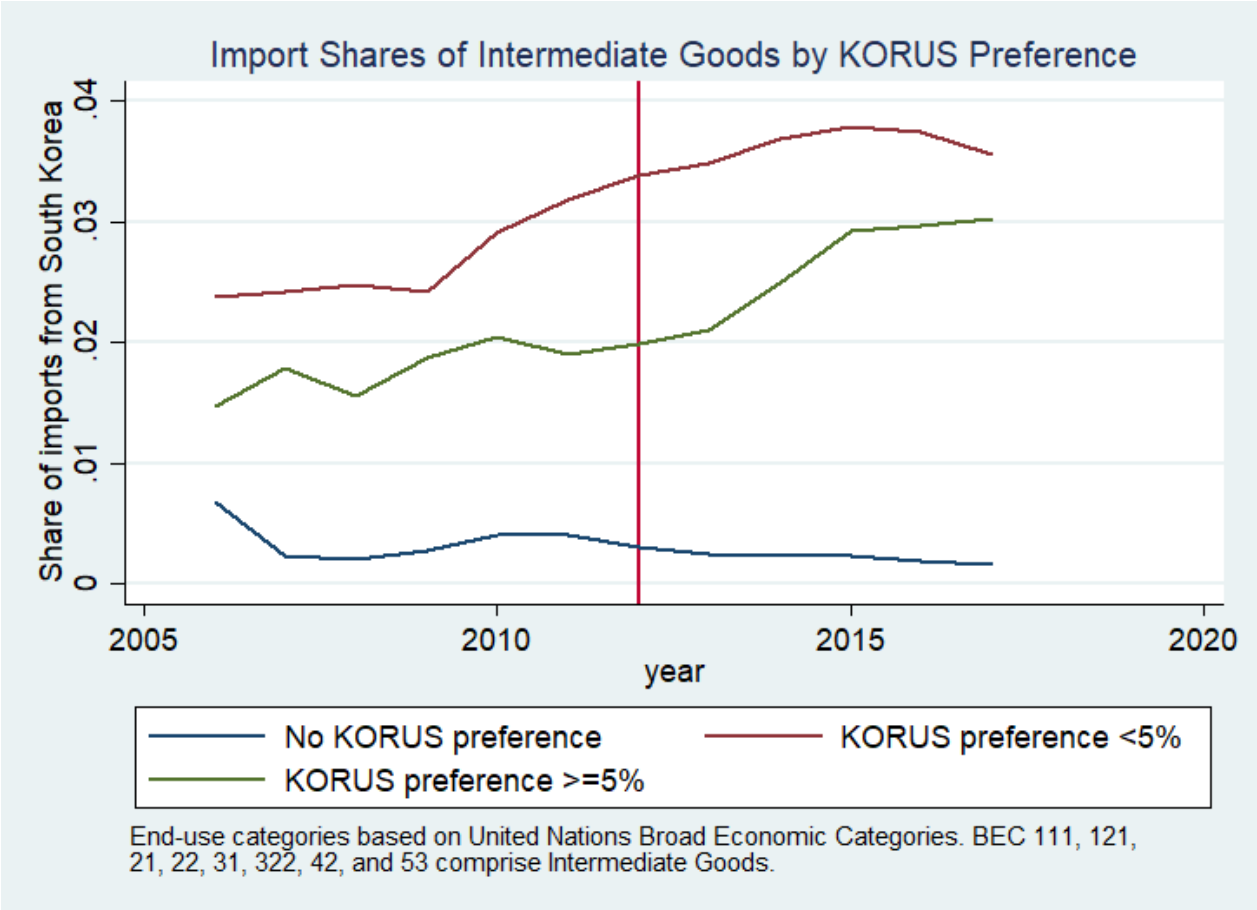


Figure 5: Imports of intermediate goods by degree of new KORUS preference

3. Trade Diversion

The literature on trade diversion is vast. Viner (1950) pioneered the theoretical treatment of preferential (regional) trade agreements like KORUS, developing the concepts of trade creation arising from tariff reduction and trade diversion occurring when tariffs redirect trade from lower-cost to tariff-protected higher-cost suppliers. 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 like Clausing (2001) attempt to estimate counterfactuals using demand-based methods. Magee (2008) draws on varying approaches and incorporates exporter-year fixed effects from the gravity literature, which we will also introduce into the Romalis (2007) approach to avoid overestimating the degree of trade diversion.

Some question whether in the age of proliferating preferential trade agreements, trade diversion is still 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 South Korean exports and toward earlier FTA partners may illustrate the "defensive" or "contagious" nature of FTA proliferation, in the spirit of Baldwin and Jaimovich (2012) and Missios, Saggi, and Yildiz (2016), also apparent in Dai, Yotov, and Zylkin (2014).

To the best of our knowledge, this literature has not so far framed its results in a way that addresses recent questions about the effect of trade agreements on trade balances, which is the purpose of this study of trade diversion under KORUS.

3.1 Detecting trade diversion

We use the measure of trade diversion constructed by Romalis (2007) 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 here, it is given by

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

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. MFN and KORUS schedules from the 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:

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

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.

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 1 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 0.74 and 1.44 percent relative to Canadian imports. These baseline estimates overlap heavily with 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.

Table 1: Log of U.S.-reference country import ratio on U.S. tariff for South Korean goods

Reference Country	Canada		Australia	
	(1)	(2)	(3)	(4)
$\tau_{it}^{US,Korea}$	1.177***	0.740**	1.195**	1.443***
	(0.370)	(0.378)	(0.476)	(0.426)
Constant	3.075***	3.484***	1.516*	1.573
	(0.180)	(1.308)	(0.802)	(2.197)
MFN Tariffs	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	No
Control Country-Year FE	No	Yes	No	Yes
HS-6 Product FE	Yes	Yes	Yes	Yes
Control Countries	Ap. A	Ap. A	Ap. A	Ap. A
N	99,456	99,456	73,248	73,248
R^2	0.174	0.214	0.230	0.434
No. Products	4,333	4,333	4,098	4,098

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

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 2 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 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 1) 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 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 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. Were our sample to include 2015 and 2016, one might find more sensitivity for intermediate goods.

Trade diversion in its simplest form, where new tariff preference is granted between two trading partners and leaves a third country at a disadvantage, is associated with a negative welfare effect overall because the new tariff preference diverts import purchases to less efficient suppliers in the favored country and reduces tariff revenues. Results in Column (1) of Table 3 show that this is generally not the case for new tariff preference under KORUS. Instead, trade diversion appears

[1] $F(1,94608)=0.58$.

[2] $F(1,94608)=5.46$, significant at the 5 percent level.

[3] $F(1,94608)=0.32$.

Table 2: Log of U.S.-Canada import ratio on U.S. tariff for South Korean goods by end-use

	(1)	(2)	(3)
$\tau^{US,Korea}$	0.908**	-0.590	0.745**
	(0.385)	(0.687)	(0.378)
Intermediate Good $\times \tau_{ijt}^{US,Korea}$	-1.428**		
	(0.644)		
Consumption Good $\times \tau_{ijt}^{US,Korea}$		1.486**	
		(0.0.687)	
Capital Good $\times \tau_{ijt}^{US,Korea}$			0.427
			(2.003)
Constant	-1.983	-2.003	-1.981
	(2.246)	(2.246)	(2.246)
MFN Tariffs	Yes	Yes	Yes
Control Country-Year FE	Yes	Yes	Yes
HS-6 Product FE	Yes	Yes	Yes
Control Countries	Ap. A	Ap. A	Ap. A
N	99,456	99,456	99,456
R^2	0.214	0.214	0.214
No. Products	4,333	4,333	4,333

Note: Standard errors in parentheses with ^{a}, ^{b}, and ^{c} respectively denoting significance at the 1%, 5% and 10% levels.

to draw U.S. imports away mainly from existing U.S. FTA partners, who had pre-existing tariff preference. The 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.

Columns (2) and (3) of Table 3 show that U.S. trading relationships with countries in the Asia-Pacific region generally are more resilient (less subject to KORUS-related trade diversion) than trading relationships elsewhere. Given a one-percent reduction in the U.S.-South Korea tariff, U.S. imports from third countries outside of the Asia-Pacific region are 1.526 percent lower relative to Canada, nearly double the baseline sensitivity in Column (2) of Table 1. Yet the coefficient on the on the Asia-Pacific-tariff interaction term is -1.181, almost the same magnitude as the coefficient on the tariff by itself, and significant at the one-percent level. An F-test[4] fails to reject that the sum of these two coefficients is different from zero. So U.S. imports from countries in the Asia-Pacific region are not sensitive to South Korea's new U.S. tariff preference under KORUS in a statistically significant way.

We also break out the other large countries in the region to observe whether their trade with the U.S. appears differentially responsive to U.S. tariff preferences for South Korea under KORUS. Column (3) of Table 3 shows that the resilience of U.S. trade with the region overall likewise applies to China, and to a perhaps (judging from point estimates) somewhat lesser degree Japan and other Asia-Pacific countries in our sample. F-tests fail to reject that the sum of the coefficient on the tariff and any of the regional interaction terms in Column (3) are different from zero.[5]

We noted above that trade diversion occurs principally within the consumption end-use category. Confining the sample to HS-6 categories in the consumption end-use category in Column (4) of Table 3, the resilience among Asia-Pacific countries observed in Column (3) still holds outside of Japan. Resilience for Chinese goods looks at least as strong for consumption goods as in the full sample. The coefficient on the tariff interaction term for China is larger in absolute magnitude than in Column (3) and an F-test[6] again fails to reject that the sum of the coefficients on the tariff and the interaction term for Chinese goods is different from zero. The point estimate for the tariff interacted with goods from the smaller countries in the Asia-Pacific region is a little smaller than

[4] F(1,94608)=0.77.

[5] F(1,94606)=0.32 in the case of China, F(1,94606)=0.23 in the case of Japan, and F(1,94606)=1.58 in the case of Other Asia-Pacific.

[6] F(1,38333)=0.73

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

	(1)	(2)	(3)	(4)
$\tau^{US,Korea}$	0.446	1.526***	1.515***	1.629***
	(0.384)	(0.439)	(0.440)	(0.552)
FTA Partner$\times\tau_{ijt}^{US,Korea}$	1.793***			
	(0.418)			
Asia-Pacific$\times\tau_{ijt}^{US,Korea}$		-1.181***		
		(0.337)		
China$\times\tau_{ijt}^{US,Korea}$			-1.841***	-2.280***
			(0.530)	(0.674)
Japan$\times\tau_{ijt}^{US,Korea}$			-1.158	0.009
			(0.730)	(0.947)
Other Asia-Pacific$\times\tau_{ijt}^{US,Korea}$			-0.993***	-0.793*
			(0.361)	(0.418)
Constant	02.004	-2.008	-2.007	-2.010
	(2.246)	(2.246)	(2.246)	(2.092)
MFN Tariffs	Yes	Yes	Yes	Yes
Control Country-Year FE	Yes	Yes	Yes	Yes
HS-6 Product FE	Yes	Yes	Yes	Yes
Control Countries	Ap. A	Ap. A	Ap. A	Ap. A
N	99,456	99,456	99,456	39,705
R^2	0.214	0.214	0.214	0.199
No. products	4,333	4,333	4,333	918

Note: Standard errors in parentheses with ^{a}, ^{b}, and ^{c} 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 categories within the Consumption end-use category.

for the full sample, but the F-test[7] fails to reject that its sum with the coefficient on the tariff is different from zero.

In contrast, the coefficient on the tariff interaction for Japan in Column (4) remains insignificant but the sign switches from negative to slightly positive. An F-test weakly rejects (at the 10-percent level) that the sum of the coefficients on the tariff and the interaction term for goods from Japan is different from zero, with the sum of the point estimates being positive, indicating trade diversion.[8]

To check for robustness, Tables 4 and 5 show that the central patterns hold again using 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 1, while U.S. imports of consumption goods are much more prone to trade diversion than the baseline. An F-test[9] 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 $1.993 > 0$, indicating the presence of trade diversion for consumption goods. Again, no evidence of trade diversion emerges for HS-6 goods across the intermediate goods or capital goods categories.

The main qualitative difference between the results with Canada as the reference country versus the robustness check with Australia arises in the regional breakdowns. Using Australia as the reference country, the point estimate indicating trade diversion among U.S. FTA partners (the coefficient on the FTA-tariff interaction term) in Column (1) of Table 5 is still much larger than the coefficient on the U.S.-Korea tariff by itself. Yet in this case, the tariff coefficient remains nearly as large as the Australia-baseline estimate in Column (4) of Table 1 and retains its significance. The result in the Canada-benchmark that trade diversion occurs mainly within existing U.S. FTA partners, seen in Column (1) of Table 3, is still present here using Australia instead of Canada as the reference country, but much less stark. In Columns (3) and (4) of Table 5, we see no suggestion that Japan is subject to trade diversion under KORUS, but some evidence that smaller countries in the Asia-Pacific region may be, in contrast to Table 3.

[7] F(1,38333)=2.62, not quite significant at the 10 percent level.

[8] F(1,38333=2.79, significant at the 10-percent level in the case of Japan.

[9] F(1.68722)=20.80, significant at the 1 percent level.

Table 4: Log of U.S.-Australia import ratio on U.S. tariff for South Korean goods by end-use

	(1)	(2)	(3)
$\tau^{US,Korea}$	1.954***	-1.831***	1.380***
	(0.440)	(0.726)	(0.427)
Intermediate Good $\times \tau_{ijt}^{US,Korea}$	-3.202***		
	(0.686)		
Consumption Good $\times \tau_{ijt}^{US,Korea}$		3.824***	
		(0.688)	
Capital Good $\times \tau_{ijt}^{US,Korea}$			-4.136**
			(2.048)
Constant	1.693	1.745	1.605
	(2.197)	(2.197)	(2.197)
MFN Tariffs	Yes	Yes	Yes
Control Country-Year FE	Yes	Yes	Yes
HS-6 Product FE	Yes	Yes	Yes
Control Countries	App. A	App. A	App. A
N	73,243	73,243	73,243
R^2	0.434	0.434	0.434
No. Products	4,098	4,098	4,098

Note: Standard errors in parentheses with ^{a}, ^{b}, and ^{c} respectively denoting significance at the 1%, 5% and 10% levels.

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

	(1)	(2)	(3)	(4)
$\tau^{US,Korea}$	1.273***	3.239***	1.450***	0.866
	(0.429)	(0.430)	(0.539)	(0.718)
FTA Partner$\times\tau_{ijt}^{US,Korea}$	2.557***			
	(0.747)			
Asia-Pacific$\times\tau_{ijt}^{US,Korea}$		-2.237***		
		(0.460)		
China$\times\tau_{ijt}^{US,Korea}$			-2.208***	-4.521***
			(0.628)	(0.948)
Japan$\times\tau_{ijt}^{US,Korea}$			-3.384***	-2.371***
			(0.844)	(1.220)
Other Asia-Pacific$\times\tau_{ijt}^{US,Korea}$			1.341***	1.369***
			(0.461)	(0.575)
Constant	1.600	1.581	1.577	5.769
	(2.197)	(2.197)	(2.196)	(2.088)
MFN Tariffs	Yes	Yes	Yes	Yes
Control Country-Year FE	Yes	Yes	Yes	Yes
HS-6 Product FE	Yes	Yes	Yes	Yes
Control Countries	App. A	App. A	App. A	App. A
N	73,243	73,243	73,243	26,418
R^2	0.434	0.434	0.434	0.465
No. products	4,098	4,098	4,098	876

Note: Standard errors in parentheses with ^{a}, ^{b}, and ^{c} 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 categories within the Consumption end-use category.

4. Aggregate estimates

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

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

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,

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

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 $10.3 billion in 2013 and $10.7 billion in 2014.[10] 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 supports the common assumption that trade agreements can affect bilateral trade balances but do not directly aggregate trade balances when assessing the aggregate impact of trade agreementsy— used both in computable general equilibrium and Ricardian general equilibrium approaches— as empirically plausible.

5. Conclusion

We revisit the question of whether trade agreements can affect the trade balances using the lens of trade diversion. U.S. imports of consumption goods are subject to trade diversion under KORUS, with U.S. import purchases shifting toward South Korea after its new tariff preference

[10] Estimates using Australia as the reference country are somewhat larger, $18.5 billion in 2013 and $19.5 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.

begins. U.S. import purchases also shift away from earlier FTA partners toward South Korea after KORUS goes into force. U.S. imports from countries in the Asia-Pacific region, especially from China, appear to be somewhat more resilient in the face of South Korea's new preferential tariff access than other countries, with similar but weaker evidence of resilience among U.S. imports of non-consumption goods from Japan and the smaller countries in the region.

We estimate that trade diversion, summed across all traded goods categories in the KORUS tariff schedule, amounts to $10.3 billion and $10.7 billion annually in 2013 and 2014, apart from any additional macroeconomic forces in those years. 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 may offer support for the common practice of assuming that trade agreements affect bilateral trade balances but do not directly affect global trade balances in the medium-to-long term when undertaking structural estimation of the effects of trade agreements.

Appendix A. Control country list

The third-country trading partners to the U.S. 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*, 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*, and Yemen. Asterices denote Asia-Pacific countries and areas. Two countries in this area, India and Malaysia, currently are missing from the sample due to data limitations, we intend to add them.

Australian, Canadian, and U.S. import data for these countries were downloaded using UN Comtrade API. Tariff data were downloaded from WTO online Tariff Database.

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