The University of Nottingham

research paper series

Political Economy of Globalisation

GEP

Deep Integration and UK-EU Trade Relations[1]

Alen Mulabdic, Alberto Osnago, Michele Ruta[2]

World Bank

21 December 2016

Abstract

This paper studies the impact of deep agreements on United Kingdom–European Union trade relations. A standard gravity model is applied to assess the effect that European Union membership had on the United Kingdom's trade. The paper uses new information on the content of trade agreements to build a measure of "depth" based on the number of provisions the agreements cover. The analysis relies on information on goods, services, and value-added trade from the World Input Output Database. Deep trade agreements are found to increase goods and services trade by 42 percent, and value-added trade by 14 percent on average. European Union membership had a particularly strong effect on United Kingdom's services and global value chain trade. Because of its membership, the United Kingdom's services trade more than doubled, and the country's backward and forward participation in global value chains increased by more than 30 percent each. The paper uses these estimates to evaluate the future of United Kingdom–European Union trade under different scenarios. The findings show that United Kingdom–European Union trade declines under all scenarios, ranging between 6 and 28 percent for trade in value added. This drop is sharper (particularly for services and global value chain trade) the lower is the depth of the future arrangement relative to the depth of the European Union agreement. As trade flows adjust slowly to changes in trade costs, these effects are expected to emerge over time. But the trade-off between the depth of trade agreements and trade intensity will delimit policy choices going forward.

Keywords: Deep Trade Agreements, Trade Effects, European Union, United Kingdom

JEL codes: F13, F15

1

1. Introduction

What is the impact of undoing trade agreements on trade? In this paper, we try to address this question by focusing on the effect that EU membership had on trade of the UK, most notably with its European partners, and then use this information to assess the future of UK-EU trade under different scenarios. While the EU is a complex institution, the outcome of a (still ongoing) project of economic and political integration which had its founding moment with the Schumann Declaration in the aftermath of World War II, in this paper we see it through the lenses of trade agreements. This allows us to anchor the analysis of Brexit, the exit of the United Kingdom (UK) from the European Union (EU), to a well-established economic literature that studies the trade impact of Preferential Trade Agreements (PTAs).

The landscape of trade and trade agreements has radically changed in the last 25 years. First, we have seen a surge in the number of preferential arrangements: in 1990, only 51 PTAs were in force, while there were 279 agreements in force and notified to the WTO in 2015. In addition, modern PTAs are increasingly "deeper" in the sense that they cover many regulatory issues and policy areas that go beyond tariff reduction, such as services, investment, competition and intellectual property rights protection.[3] The nature of trade has also dramatically changed since the early 1990s, particularly as a result of the growing internationalization of production and the rise of Global Value Chains (GVCs). Deep provisions in PTAs may potentially influence trade relations among members either directly, as services commitments, or indirectly, as investment and competition provisions may make it easier to operate production activities that span multiple borders. The letter sent by the Japanese government to the UK and the EU in the aftermath of Brexit, outlining a number of requests by Japanese businesses operating in the UK on the content of a future UK-EU PTA, illustrates the importance of a finer understanding of what Brexit entails, beyond a focus on changes in tariffs and gross goods trade flows.[4]

The EU has been a precursor of deep integration. We use new information on the content of trade agreements from the World Bank (Hofmann, Osnago and Ruta, 2016) to build a measure of "depth" based on the number of provisions covered by the agreement.[5] The data indicate that the EU is the deepest PTA among the 279 currently in force. The relationship between the UK and the rest of the EU members before Brexit will actually happen is regulated by the European Community (EC) Treaty and the following enlargement agreements, which cover 44 policy areas ranging from standards to movements of capital, to labor mobility. Europe is also the region that has the largest share of intra-regional trade. The UK economy is part of this intense network of trade relations. First, the EU is the most important trade partner of the UK, accounting for 52 percent of the UK's exports of goods and services. Second, the UK is closely integrated in regional value chains. For instance, the share of

---

[3] The distinction between "deep" agreements and "shallow" agreements, where the latter focus on tariffs and other border measures, was first introduced by Lawrence (1996).

[4] The letter by the Japanese government on Brexit to the UK and the EU can be accessed at:
http://www.mofa.go.jp/files/000185466.pdf

[5] The database is available on the World Bank website at http://data.worldbank.org/data-catalog/deep-trade-agreements

intermediates value added on total domestic value added in UK exports (the majority of which goes to the EU) is close to 70 percent.

We first investigate the extent to which the depth of the EU contributed to boost trade between the UK and other EU members. We use data from the World Input Output Database (WIOD) on goods, services and value added trade and the World Bank data on the content of deep agreements to estimate a gravity equation augmented with a measure of depth for the period 1995-2011. By interacting the depth of PTAs with dummies identifying the UK, we can quantify the effect of the depth of trade agreements on UK imports and exports of goods, services and value added. Deep trade agreements are found to increase goods and services trade by 42 percent on average. The depth of the UK's trade agreements strongly increased trade in services: as a result of its EU membership and its participation in deep PTAs signed by the EU with third countries, UK services trade more than doubled. Deep PTAs also increased domestic value added in gross exports of the UK. This effect is mainly driven by stronger GVC relationships of the UK with its EU partners: the UK's intermediates value added in gross exports (forward linkages) increased by 31 percent thanks to deep PTAs. In addition, foreign value added in UK exports (backward linkages) was boosted by EU membership by 37 percent. Finally, breaking down the EU into "new" and "founding" members reveals that EU membership has been particularly important to increase UK exports of services directed to the latter.

We then analyze the impact that changes in the UK-EU trade agreement can have on UK-EU trade relations going forward. This is a difficult task, as the only certainty on the future institutional setting is its uncertainty. We address this problem by considering three distinct scenarios, with decreasing depth of the future agreement between the UK and the rest of the EU. The first scenario assumes that the PTA between the UK and the EU will be as deep as the agreement the EU has with Norway. In the second scenario, the UK and the EU will sign a PTA as deep as the average PTA the EU currently has with third countries. Finally, the third scenario has no agreement. We find that bilateral UK-EU trade declines under all scenarios and that this drop is sharper the lower the depth of the future arrangement relative to the depth of the EU agreement. In terms of value added trade, the decline ranges from 6 percent of the "Norway" scenario to 28 percent of no agreement. In all scenarios, the largest declines are for UK services and GVC trade with the rest of the EU. These predictions should be seen as average effects. As it takes time for trade flows to respond to changes in trade costs, we expect the impact in the short-run to be smaller than in the longer term.

Our work is closely related to two strands of economic literature. The first is the large body of literature that investigates the impact of trade agreements on members' trade relations, which has recently been summarized in Limão (2016). As many of these studies, we use a gravity framework to guide our analysis of the trade effects of PTAs. Second, our work also relates to the small and recent literature that focuses on the economic and trade effects of Brexit (e.g. Dinghra et al., 2016 and Kee and Nicita, 2016). Our paper differs from others in two main respects. First, we employ an explicit new measure of depth based on the content of PTAs. Second, we do not just focus on goods (or total) trade, but assess the impact of UK membership of the EU and its exit on goods, services and value added trade. Our study also relates to the economic literature that aims at assessing the economic effects of European economic and political integration (e.g. Brou and Ruta, 2011, and Campos, Coricelli, Moretti, 2014). Differently from this literature, we focus on EU trade-related institutions and trade effects.

The rest of the paper is organized as follows. Section 2 presents a number of stylized facts on UK-EU trade agreements and trade relations. The empirical analysis of the impact of trade agreements on UK trade with the EU and other partners is in section 3. The future scenario analysis is presented in Section 4. Concluding remarks follow.

2. Trade agreements and UK-EU trade

This section presents some key stylized facts on UK-EU trade relations. The first subsection looks at the trade policy regime, while the second one focuses on trade flows.

a. Trade agreements

Part of the current public debate on trade policy presents trade agreements merely as institutions aimed at lowering tariffs among member countries and thus sees the trade effects of undoing trade agreements as the result of changes in preferential market access in goods. Modern trade policy institutions are, however, more complex than this. How have trade agreements evolved? How does the EU compare to other agreements?

A new database by the World Bank (Hofmann et al., 2016) reviews 279 PTAs, offering new insights on the changing nature of trade agreements. The approach followed by Hofmann et al. (2016) for the identification of provisions and their legal enforceability follows closely the seminal paper by Horn et al. (2010) and the World Trade Report 2011 (WTO, 2011). Horn et al. (2010) identify 52 policy areas included in PTAs signed by the EU and US. They consider a policy area to be legally enforceable if the language is sufficiently precise, implying clear legal obligations, and if the area is not excluded from dispute settlement procedures under the PTA. Using this approach, WTO (2011) constructed a data set mapping the same set of provisions for 100 PTAs in force in 2011 signed by mostly developed countries that contribute to more than 90 percent of world trade. In an effort to include a larger number of developing countries, Hofmann et al. (2016) updated the WTO data set and coded all the remaining agreements notified to the WTO and in force until 2015.

The number of trade agreements and their content changed dramatically since the early 1990s (Figure 1). The number of PTAs in force increased slowly in the 1960s and 1970s and then remained constant until the beginning of the 1990s when a large number of agreements entered into force. The number of PTAs has increased more than fivefold from 51 agreements in 1990 to 279 in 2015. Along with the number, the content of trade agreements has changed. The number of provisions included in PTAs raised over time suggesting an increase in the "depth" of agreements. The majority of PTAs signed after 2003 include at least 10 legally enforceable provisions. That is, modern PTAs are "deep" in the sense that they cover substantially more policy areas than traditional (or "shallow") PTAs that focused mostly on tariff liberalization.

Figure 1: Number of trade agreements over time and depth
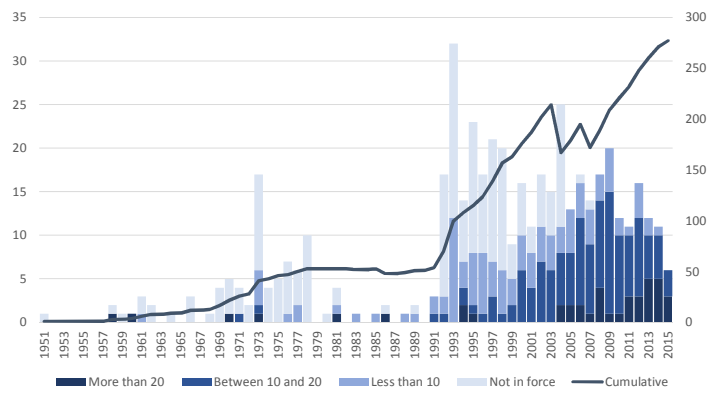
Europe has been a precursor of this process. The EC Treaty signed in 1958 and successive enlargement of the European Union already included more than 20 legally enforceable provisions. Thanks to the EU, European countries are among the most integrated countries in terms of number and depth of PTAs. At the end of 2015, EU members were involved in 36 trade agreements. Each EU member has on average more than 25 enforceable provisions with its PTA partners (see Figure 2). As discussed below, the high average number of provisions in force for EU countries is mainly due to the strong integration inside the EU. As a comparison, each European Free Trade Area (EFTA) country (Iceland, Liechtenstein, Norway and Switzerland) has around 30 agreements in force in 2015 with an average depth of 23. Also PTAs signed by Japan and the Republic of Korea are quite deep and include on average 21 and 20 provisions respectively. Other non-European countries such as the United States and Australia; Taiwan, China, and most Latin American countries established relatively deep relationships with their partners, although shallower compared to European countries. On the other hand, South East Asian countries do not seem to be involved in very deep agreements.

5

Figure 2: Average depth across countries (2015)
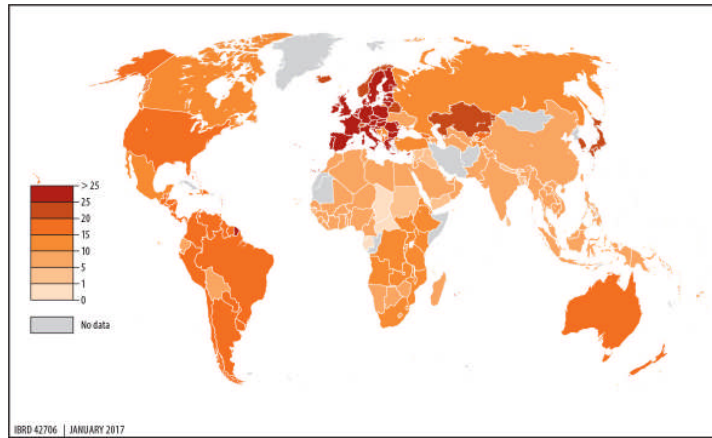
The provisions identified by Horn et al. (2010) can be divided in two categories: "WTO plus" or WTO+ and "WTO extra" or WTO-X. WTO+ covers policy areas that fall under the current mandate of the WTO, while WTO-X refers to obligations outside the WTO's mandate. A complete list of provisions can be found in Table 1. Not surprisingly, the two most frequent provisions included in PTAs are tariffs on manufacturing and agricultural goods. Other important WTO+ policy areas are customs procedures, export taxes, anti-dumping, countervailing measures, Technical Barriers to Trade (TBT), and Sanitary and Phytosanitary Standards (SPS). WTO-X policy areas most frequently included in PTAs encompass investment, competition policy, movement of capital and Intellectual Property Rights (IPR) protection.

Table 1: List of provisions

WTO+	WTO-X	
• Tariffs Industrial goods	• Anti-corruption	• Financial assistance
• Tariffs agricultural goods	• Competition policy	• Health
• Customs administration	• Environmental laws	• Human Rights
• Export taxes	• IPR	• Illegal immigration
• SPS measures	• Investment measures	• Illicit drugs
• State trading enterprises	• Labor market regulation	• Industrial cooperation
• TBT measures	• Movement of capital	• Information society
• Countervailing measures	• Consumer protection	• Mining
• Anti-dumping	• Data protection	• Money laundering
• State aid	• Agriculture	• Nuclear safety

Public procurement	Approximation of legislation	Political dialogue
TRIMS measures	Audiovisual	Public administration
GATS	Civil protection	Regional cooperation
TRIPS	Innovation policies	Research and technology
	Cultural cooperation	SMEs
	Economic policy dialogue	Social Matters
	Education and training	Statistics
	Energy	Taxation
		Terrorism
		Visa and asylum

The relationship among EU members is the deepest when we use as a measure of depth the number of legally enforceable provisions. The EC Treaty and the EU enlargements encompass 44 legally enforceable provisions. They include all WTO+ provisions and a large number of WTO-X areas. In addition, the EU is a member of 36 trade agreements with third countries. Some of these PTAs are also very deep. This is the case for the agreements with Moldova, Ukraine and the European Economic Area (EEA), an agreement that includes the EU and all EFTA members except Switzerland. These PTAs respectively include 44, 43 and 36 legally enforceable provisions. All the other PTAs signed by the EU are shallower. Table 2 lists all the provisions in the data set and identifies those included in the EU and the number/share of EU agreements with third countries that include these provisions.

Table 2: Provisions in the EU agreement and number and share of EU's PTAs with third countries including each provision

	EU28	EU-3rd Countries PTAs	
Provision	Legally enforceable	Number	Share
Tariffs on manufacturing goods	Yes	35	100%
Tariffs on agricultural goods	Yes	35	100%
Anti-dumping	Yes	34	97%
Customs	Yes	33	94%
Export taxes	Yes	32	91%
Countervailing measures	Yes	29	83%
Competition policy	Yes	28	80%
State aid	Yes	26	74%
TRIPS	Yes	23	66%
IPR	Yes	22	63%
STE	Yes	21	60%
Movement of capital	Yes	19	54%
Public procurement	Yes	14	40%
TBT	Yes	10	29%
GATS	Yes	10	29%

Investment	Yes	10	29%
SPS	Yes	9	26%
Social matters	Yes	9	26%
Data protection	Yes	8	23%
Environmental laws	Yes	5	14%
Labor market regulations	Yes	5	14%
Approximation of legislation	Yes	5	14%
Financial assistance	Yes	5	14%
Cultural cooperation	Yes	4	11%
Illegal immigration	Yes	4	11%
Audiovisual	Yes	3	9%
Energy	Yes	3	9%
Health	Yes	3	9%
Visa and asylum	Yes	3	9%
Consumer protection	Yes	2	6%
Economic policy dialogue	Yes	2	6%
Education and training	Yes	2	6%
Industrial cooperation	Yes	2	6%
Research and technology	Yes	2	6%
Statistics	Yes	2	6%
Terrorism	Yes	2	6%
Anticorruption	Yes	1	3%
Agriculture	Yes	1	3%
Mining	Yes	1	3%
Regional cooperation	Yes	1	3%
SME	Yes	1	3%
Taxation	Yes	1	3%
TRIMS	Yes	0	0%
Nuclear safety	Yes	0	0%
Civil protection	No	2	6%
Public administration	No	2	6%
Illicit drugs	No	1	3%
Information society	No	1	3%
Money laundering	No	1	3%
Political dialogue	No	1	3%
Innovation policies	No	0	0%
Human rights	No	0	0%

b. Trade relations

To illustrate the UK-EU trade relations, we use the information available in the World Input-Output Database (WIOD). There are two important advantages in using this data set: i) it covers trade in services at the bilateral level, and ii) it allows the decomposition of gross exports in value added terms. The main limitation of the data set is that it provides data for a restricted number of countries, 40 plus an aggregate for the rest of the world, limited to the 1995-2011 period.

The UK accounts for 3.8 percent of world exports and 3.9 percent of world imports. In 2011, the UK exported $440 billion of goods and it imported $550 billion.[6] In terms of services, the UK exported $260 billion and it imported $163 billion. Table 3 highlights the importance of the EU as the UK's trading partner. Trade in goods with the EU accounts for more than half of the UK's exports and imports. The EU is also an important market destination for UK services, absorbing almost half of UK exports. The importance of the EU as a source of services for the UK is instead much smaller: only one-third of imports of services come from the EU.

While the share of UK exports to the EU remained constant in the period under consideration, the composition of trade changed substantially. In 1995, more than 80 percent of UK exports were goods. This share declined to around 63 percent in 2011. The reshaping of UK exports towards services is even clearer when looking at trade with the EU. The share of exports of services to the EU more than doubled in 16 years, going from 8 to 18 percent of total exports. The pattern for exports outside the EU is similar, but the increase is more moderate. This evidence suggests a "servicification" of UK exports.

Table 3: UK trade in goods and services

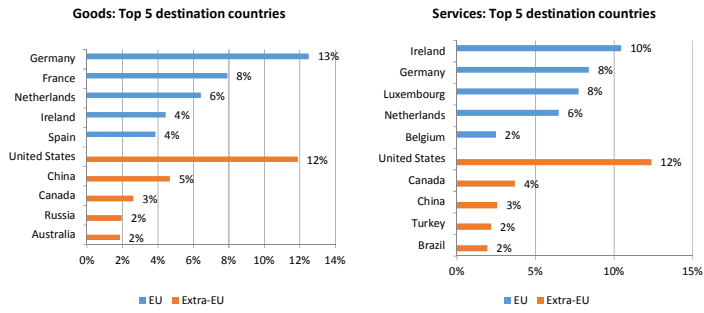|		UK Exports			UK Imports		
		Services	Goods	Total	Services	Goods	Total
2011	**Extra-EU**	$135,599 M	$212,739 M	$348,338 M	$108,268 M	$243,531 M	$351,799 M
		19%	30%	49%	15%	34%	49%
	EU28	$124,412 M	$228,725 M	$353,137 M	$55,527 M	$308,208 M	$363,735 M
		18%	33%	51%	8%	43%	51%
	Total	$260,012 M	$441,464 M	$701,476 M	$163,795 M	$551,739 M	$715,534 M
		37%	63%	100%	23%	77%	100%
1995	**Extra-EU**	$33,866 M	$121,579 M	$155,445 M	$21,048 M	$95,116 M	$116,164 M
		11%	40%	51%	7%	33%	40%
	EU28	$24,437 M	$123,086 M	$147,524 M	$23,275 M	$146,607 M	$169,882 M
		8%	41%	49%	8%	51%	59%
	Total	$58,304 M	$244,665 M	$302,969 M	$44,323 M	$241,723 M	$286,045 M
		19%	81%	100%	15%	85%	100%

Germany is both the main destination and source country of goods, accounting for 13 percent of the UK's exports and 15 percent of the UK's imports (see Figure 3). The other top 4 destination countries in the EU are France, the Netherlands, Ireland and Spain. As to the source of UK imports, the Netherlands, France, Belgium and Italy are in the top 5. Outside the EU, the US is the main destination country, absorbing 12 percent of UK exports, followed by China, Canada, the Russian Federation and Australia. UK imports from outside the EU come mainly from China (8 percent), US, Japan, India and Canada. The main markets for UK services are US, Ireland, Germany, Luxemburg and the Netherlands, all importing more than 5 percent of UK services. Other top destination markets are Canada, China, Belgium, Turkey

---

[6] Data from COMTRADE show that UK trade increased between 2011 and 2015, but it remains in the same order of magnitude. The UK exported 466 billion dollars and it imported 629 billion dollars in 2015.
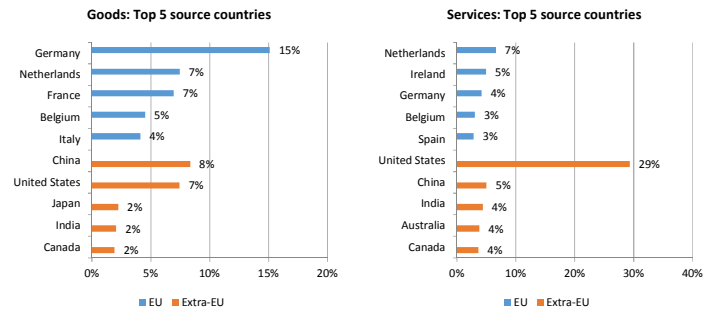
and Brazil. The most relevant source of services for the UK is the US, representing 29 percent of UK imports. All other sources are much less relevant, being lower than 7 percent.

Figure 3: Top trading partners

Panel A

Goods: Top 5 destination countries

Country	Value
Germany	13%
France	8%
Netherlands	6%
Ireland	4%
Spain	4%
United States	12%
China	5%
Canada	3%
Russia	2%
Australia	2%

■ EU ■ Extra-EU

Services: Top 5 destination countries

Country	Value
Ireland	10%
Germany	8%
Luxembourg	8%
Netherlands	6%
Belgium	2%
United States	12%
Canada	4%
China	3%
Turkey	2%
Brazil	2%

■ EU ■ Extra-EU

Panel B

Goods: Top 5 source countries

Country	Value
Germany	15%
Netherlands	7%
France	7%
Belgium	5%
Italy	4%
China	8%
United States	7%
Japan	2%
India	2%
Canada	2%

■ EU ■ Extra-EU

Services: Top 5 source countries

| Country	Value
Netherlands	7%
Ireland	5%
Germany	4%
Belgium	3%
Spain	3%
United States	29%
China	5%
India	4%
Australia	4%
Canada	4%

■ EU ■ Extra-EU

The most important exporting sector for the UK is transport equipment, followed by chemicals and electrical equipment (see Figure 4). More than half of transport equipment exports go outside the EU while chemicals are exported mainly to other EU countries. Fuels and machinery complete the list of the top 5 exported goods. Transport and electrical equipment are also the largest imported goods in the UK and more than half of the value comes from other EU countries. Imports of mining, food and chemicals

are also relatively important for the UK. In terms of services, two sectors stand out as the most important exports: financial intermediation and business services. While roughly half of the value of financial intermediation is provided to the EU, almost two-thirds of the value of business activities is consumed by other EU countries. Renting of machinery and equipment and other business services are the most imported services and more than half of the value comes from non-EU countries. Tourism-related and financial services are among the top imported sectors, mainly from outside the EU, but in terms of value they account for only about half of the business services sector.

Figure 4: Top traded sectors

UK Exports: Top 10 Products

■ EU ■ Extra-EU

UK Imports: Top 10 Products

■ EU ■ Extra-EU
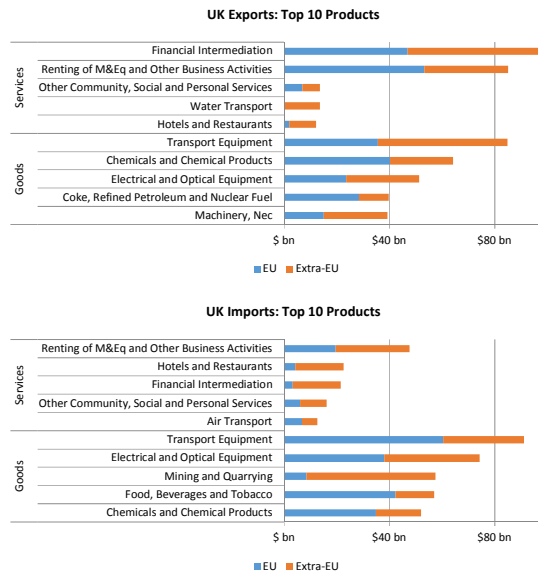
We next look at the extent to which the UK economy is integrated in global value chains with the EU and other non-EU partners. In a world of international production networks, gross trade statistics are inflated by the double-counting of goods and services that cross borders multiple times. Wang et al. (2016) offer a decomposition of gross exports based on the work by Koopman et al. (2014). This

11

decomposition allows to analyze the extent of GVC integration of an economy. Specifically, gross exports are decomposed into different value added components that distinguish whether the value has been created domestically, abroad or it has been double-counted. Figure 5 gives a graphical representation. The components from 1 to 4 represent the domestic value added content of gross exports. The sum of the components 2, 3 and 4 is the value added of intermediate goods in exports (i.e. forward linkages). Foreign value added (component 5) is the foreign content of exports and it represents backward linkages. The last component is pure double counting due to goods crossing borders multiple times.

Figure 5: Decomposition of gross exports (*Wang et al.,2016*)
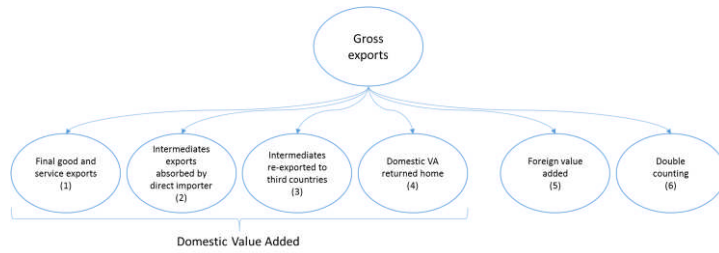
We use this decomposition of WIOD data to explore where the value of UK exports has been created and how the UK is integrated in GVCs. The data suggest that the UK is highly integrated in global value chains. Backward linkages account for 16 percent of gross exports. Forward linkages are even more important for the UK. The share of intermediates value added in total domestic value added of UK exports is almost 70 percent in 2011 (Figure 6).[7] This share increased by 7 percentage points since 1995. The increase is mainly due to an expansion of the integration of the UK in European GVCs after 2004, as suggested by the increase of the value of intermediates value added exported to other EU members. The UK's integration in GVCs with other countries also slightly increased over time.

---

[7] Almost 80 percent of UK exports are made of domestic value added.

Figure 6: UK value added of final and intermediate goods and services
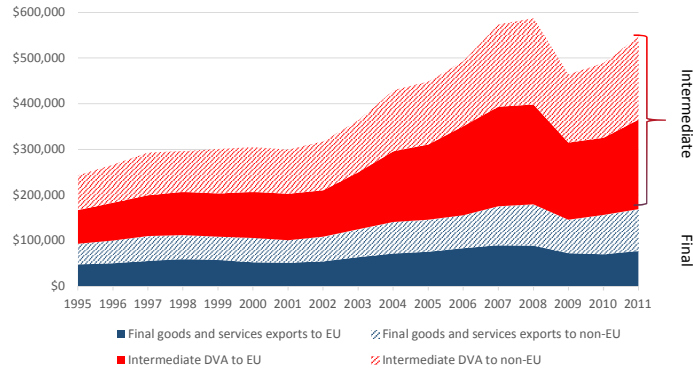
A deeper look at the decomposition of value added sheds more light on the structure of GVCs in which the UK is involved. While intermediate value added of UK exports to the EU is similar to that of exports to non-EU countries, the re-exported value added content of exports, a measure of how much intermediates value added are used as inputs to produce exports in other countries, is much higher. This suggests that UK exports to the EU are an important element of EU exports, whereas they are important for domestic consumption in non-EU countries.

3. Depth of trade agreements and UK-EU trade

This section empirically investigates the extent to which the depth of the EU and of the PTAs the EU has with other countries had an impact on UK trade. The empirical estimation of the trade effect of PTAs is based on a gravity model similar to Mattoo et al. (2016) and Osnago et al. (2016). Different from the large body of literature on trade agreements (see Head and Mayer, 2014; Limão, 2016), we explicitly account for the depth of PTAs, exploiting the novel information on the content of trade agreements presented in Section 2. Moreover, we include an interaction term to accommodate heterogeneous effects of deep PTAs for the UK. Specifically, we estimate the following gravity equation:

$$Trade_{ijt} = exp\{\beta_1 Depth_{ijt} + \beta_2 Depth_{ijt} * UK_{ij} + \mu_{ij} + \delta_{it} + \rho_{jt}\} + \varepsilon_{ijt} \qquad (1)$$

where $Trade_{ijt}$ is bilateral exports from country *i* to country *j* in year *t*, $Depth_{ijt}$ is the number of legally enforceable provisions in the PTA between *i* and *j* (normalized between 0 and 1), UK_{ij} is a dummy variable equal to 1 if the exporting or importing country is the UK, ρ_{jt} and δ_{it} are importer-time and exporter-time fixed effects that account for country-time specific shocks and the multilateral resistance

terms (Anderson and van Wincoop, 2003, 2004). Finally, μ_{ij} is a set of *undirected* country-pair fixed effects that captures all the time-invariant determinants of trade costs and addresses the endogeneity in the formation of PTAs (Baier and Bergstrand, 2007). To account for the presence of zeroes in trade flows, we estimate equation (1) using the Poisson pseudo maximum-likelihood (PPML) estimator proposed by Santos Silva and Tenreyro (2006).

We analyze the effect of deep agreements on different types of trade. First, using data from WIOD, we define $Trade_{ijt}$ as the total exports of goods and services from *i* to *j*. Second, we estimate equation (1) for export of goods and services separately to allow for heterogeneous effects of depth. Finally, we use the decomposition of gross trade into value added components proposed by Wang et al. (2016) to measure the effect of deep PTAs on GVC-related trade.

The $Depth_{ijt}$ variable comes from the content of PTAs data set constructed by Hofmann et al. (2016) and is defined as the count of legally enforceable provisions included in each agreement. To identify the effect of depth on exports, we include country-pair fixed effects and exploit the within country-pair variation, while controlling for any country-year shocks. The coefficient β_1 in equation (1) captures the effect of signing the deepest agreement in the sample.[8] While the coefficient of the interaction term β_2 tests if the UK's exports or imports are more or less sensitive to deep agreements than other countries. A positive (negative) and significant coefficient implies that for the same level of depth the UK exported or imported relatively more (less) than the average country in the sample. Both coefficients capture the average effect of depth after the agreements enter into force and assume linear effects on trade, with a percentage point increase in depth having similar effects for deep and shallow agreements.

Two caveats need to be kept in mind. First, the model assumes that the marginal effect of an additional provision is the same regardless of what type of provision is included. It is well possible that provisions in deep trade agreements have a different impact depending on how relevant they are for trade. Provisions on standards, investment or competition are likely to have a larger impact on trade than provisions that do not pertain to trade or economic cooperation (e.g. statistics, cultural cooperation). Second, we expect the short-run impact to be smaller than in the longer term, because it takes time for trade flows to respond to changes in trade costs (Johnson and Noguera, 2014; Baier and Bergstrand, 2007).

a. Goods and services trade

We begin our investigation from a more conventional analysis of gross trade flows. The first 3 columns of Table 4 report the PPML estimates of our baseline regressions of depth on gross trade. The gravity equation is augmented with the interaction of depth with a dummy that identifies observations for the UK as importer or exporter. The results in column 1 suggest that country pairs that signed the deepest PTA increased their total bilateral trade by 42 percent. The UK was not affected more than the average since the coefficient of the interaction is not significantly different from zero. In other words, the depth of UK trade agreements with the other EU members and with other partners with which the EU had signed PTAs increased UK trade by 42 percent –not differently from other countries.

The data in WIOD allow to split total trade into trade in goods and trade in services. Columns 2 and 3 report the coefficients of depth and the interaction with the UK dummy for goods and services

---

[8] Since trade data from WIOD are limited to the 1995-2011 period, the deepest agreement in our sample is the EC (27) Enlargement with 41 provisions.

respectively. Depth seems to have a much stronger average effect on trade in goods than trade in services. Signing the deepest PTA increases members' trade in goods by 69 percent and trade in services by 20 percent. The larger effect for trade in goods could be explained by GVC trade, in which intermediate goods cross the borders many times before they are assembled into final products. We come back to the link between deep PTAs and GVCs in the next subsection. The interaction with the dummy UK reveals an interesting result. While the depth of the UK's trade agreements did not increase trade in goods more than the average country, it strongly increased trade in services. The UK more than doubled its trade in services as a result of its EU membership and its participation in deep PTAs signed by the EU with third countries.

So far, the analysis has not distinguished the gains for the UK as an importer or an exporter. The second three columns of Table 4 explore if the UK was affected by deep PTAs depending on being an importer or an exporter. We split the dummy UK into two variables that identify if the UK is an importer or an exporter and we include in the regression the interactions of these dummies with depth. Columns 4 and 5 show that the depth did not increase UK imports and exports of goods more than the average country. Column 6 instead, shows that the UK both imported and exported more services than the average after signing deep agreements. The comparison of the coefficients of the two interaction terms suggests that the UK's services exports increased more than its imports.

Table 4: Trade and depth

	(1) Total	(2) Goods	(3) Services	(4) Total	(5) Goods	(6) Services	(7) Total	(8) Goods	(9) Services
Depth	0.353***	0.522***	0.182***	0.353***	0.522***	0.182***	0.326***	0.483***	0.184***
	(0.022)	(0.036)	(0.037)	(0.022)	(0.036)	(0.037)	(0.039)	(0.05)	(0.056)
Depth*UK exp/imp	0.017	0.128	0.693***						
	(0.098)	(0.106)	(0.145)						
Depth*UK exp				-0.002	0.129	0.712***	0.062	0.211	0.530***
				(0.102)	(0.111)	(0.16)	(0.118)	(0.144)	(0.161)
Depth*UK imp				0.037	0.126	0.670***	0.09	0.051	0.665***
				(0.102)	(0.118)	(0.149)	(0.124)	(0.161)	(0.134)
Depth*founding EU imp							0.073	0.062	-0.021
							(0.056)	(0.074)	(0.084)
Depth*founding EU exp							0.011	0.058	0.02
							(0.056)	(0.073)	(0.089)
Depth*UK exp*founding EU imp							-1.286	1.544	3.529***
							(1.04)	(0.994)	(1.299)
Depth*UK imp*founding EU exp							-1.206	1.767*	3.208**
							(1.013)	(0.988)	(1.261)
Observations	27,200	27,200	27,200	27,200	27,200	27,200	27,200	27,200	27,200

Where did the gains from deep PTAs for the UK come from? Did deep PTAs increase trade with the original members of the EU or the new members? In order to address these questions, we add additional interaction terms to equation 1. The interaction of depth with UK exporter dummy is further interacted with a dummy equal to one if the partner is one of the founding EU members (Belgium, France, Germany, Italy, Luxemburg and the Netherlands). The coefficient of the triple interaction tests for differences between the UK's exports to the original and newer EU members as depth increases. A positive coefficient would suggest that the UK exported disproportionally more to the founding EU members as the EU agreement deepened. Similarly, we also add the triple interaction of depth with the UK importer and the original EU importer dummies. The results in columns 8 and 9 suggest that the deepening of the EU was particularly important for exports of services directed to the original members that in turn exported relatively more goods to the UK.

b. GVC trade

A body of economic literature suggests that the rise of deep agreements and the increasing importance of GVCs are tightly related. Intuitively, the unbundling of stages of production across borders creates new forms of cross-border policy spillovers and time-consistency problems. This, in turn, generates a demand for deeper forms of integration as certain national policies need to be disciplined in PTAs for GVCs to operate smoothly. Lawrence (1996), Baldwin (2010) and WTO (2011) are some of the first studies that look at how deep PTAs are related to GVCs from an informal theoretical perspective. A first formal model of how GVCs affect the design of trade agreements is presented in Antras and Staiger (2012). More recently, a number of studies have also provided empirical evidence of such relationship (Orefice and Rocha, 2014; Johnson and Noguera, 2014; Osnago, Rocha and Ruta, 2015).

Here we build on Osnago et al. (2016) and estimate the specific effect of deep PTAs on different measures of trade in value added for the UK. We estimate the gravity equation (1) for four left hand side variables of trade in value added with country-pair, importer-year and exporter-year fixed effects. From WIOD, we use the decomposition of gross exports in value added components by Wang et al. (2016) to measure the domestic value added of exports (i.e. the total value produced in the exporting country), intermediates value added (i.e. the value of all intermediate goods created in the exporting country), re-exported value added (i.e. the value produced in the exporting country that is processed by the importing country and re-exported to third countries or to the source country) and foreign value added (i.e. the total value produced by foreign countries included in exports).

As before, the coefficient of depth is the average effect of signing the deepest PTA in our sample. The interaction of depth with dummies identifying the UK tells whether the UK increased GVC-trade more or less than the average country by signing deep PTAs. The PPML estimates of the gravity equation are reported in Table 5. Odd columns are results for the UK independently of it being an importer or an exporter; even columns instead distinguish the additional effect of deep PTAs for the UK as exporter and importer. The comparison of the effects of depth on domestic value added with the effects of depth on intermediates value added sheds light on the importance of forward linkages in GVCs for the UK. The

interaction term of depth with UK for foreign value added exports identifies the impact of EU membership on the UK's backward linkages in GVCs.

The domestic value added in gross exports increased on average by 14 percent for the country-pairs that signed the deepest PTA. The effect for the UK is larger by an additional 21 percent. Splitting the UK dummy into importer and exporter suggests that the effect of deep PTA increased both the UK's value added imports and exports. Deep PTAs are also found to have a positive effect on intermediates value added. Signing the deepest PTA increased domestic intermediates value added by 14 percent on average and by an additional 17 percent for the UK. The close similarity of these coefficients with those for domestic value added and the fact that intermediates represent around two-thirds of UK's value added in exports (Figure 6) suggest that deep agreements increased the relative importance of value added of intermediate goods with PTA members. In other words, the depth of the UK's trade agreements with the EU and with the third-countries the EU had signed PTAs largely contributed to the UK's forward integration into GVCs.

The estimates for re-exported value added and foreign value added shed more light on the structure of UK GVCs. Comparing the coefficient of the interaction term in column 3 with that in column 5 indicates that the additional increase in domestic intermediate value added for the UK is driven by the value of intermediates that are directly absorbed by the importer. In fact, the left hand side variable of columns 5 and 6 is a subset of on the variable in columns 3 and 4 since it includes only the value of intermediates that are re-exported by the importer to third countries or returned home. Deep PTAs increased the foreign value added content of UK exports by 37 percent.[9] Column 8 shows that depth had an additional effect on both the foreign content of UK exports and imports. This result suggests that the UK used more foreign inputs to produce its exports after signing deeper PTAs and, at the same time, also countries that export to the UK increased foreign value added in their exports to the UK.

Table 5: Value added trade and depth

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	DVA		Intermediates VA		Re-exported VA		FVA	
Depth	0.130**	0.131**	0.127**	0.127**	0.176***	0.177***	0.0786	0.0786
	(0.0548)	(0.0548)	(0.0626)	(0.0626)	(0.0672)	(0.0672)	(0.0545)	(0.0545)
Depth*UK	0.189***		0.160***		0.0436		0.315***	
	(0.0582)		(0.0594)		(0.0600)		(0.0814)	
Depth*UK exporter		0.169**		0.152**		0.0337		0.309***
		(0.0749)		(0.0762)		(0.0821)		(0.109)
Depth*UK importer		0.213***		0.172**		0.0599		0.318***
		(0.0745)		(0.0849)		(0.104)		(0.0913)
Observations	26,520	26,520	26,520	26,520	26,520	26,520	26,520	26,520

The estimator is PPML. All specifications include bilateral fixed effects and country-time fixed effects. Robust standard errors, clustered by country-pair, are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

---

[9] The results in the last columns of the table suggest that on average deep PTAs did not increase foreign value added in gross exports. This may be due to the fact that in our data we do not know the origin of foreign value added in the bilateral relationship.

4. Possible future scenarios

In this section we use the estimates of our econometric analysis to investigate the future of UK-EU trade relations after Brexit. Once Britain invokes Article 50 it has two years to negotiate a withdrawal agreement from the EU (unless a unanimous decision of all remaining members is reached to extend the period). Given the high uncertainty about the future of the UK-EU trade relationship, we evaluate the results of the empirical analysis assuming several post-Brexit scenarios, characterized by different degrees of depth. In the first case, we assume that the negotiations lead to the UK signing an agreement similar to the one in force between the EU and Norway, while the least optimistic scenario evaluates the trade impact of the outcome being no agreement between the UK and EU.

In the "Norway" scenario, we assume that the UK bargains an agreement with the EU as deep as the EEA, which covers 36 policy areas. This agreement would allow the UK to be part of the European Single Market and to retain the "four freedoms": free movement of goods, capital, services and people. In addition, the UK would have to comply with competition and state aid rules and horizontal areas related to the four freedoms without being able to influence them. Based on estimates from the empirical analysis, this scenario would lead to a 12 percent decrease in gross exports of goods from the UK to the EU (see Table 6).[10] While the estimates for services and domestic value added suggest decreases of 16 percent and 6 percent in exports respectively. Forward and backward GVC participation would decline by 5 and7 percent respectively. These results need to be interpreted with caution. Since, as discussed in Section 3, we do not identify the impact of the inclusion of specific provisions and assume the marginal effect on trade to be log-linear, the model may be over-estimating the trade effect of the "Norway" scenario.

The "average PTA" scenario assumes an agreement between the UK and the EU with a depth equal to the average depth of EU's agreements with non-member countries. By looking at the agreements that the EU signed in the past, we would expect the new agreement to include around 14 provisions. Agreements with this depth guarantee market access for goods and, to some extent, services but do not usually go beyond areas that are not covered by the WTO (i.e. WTO-X areas) other than competition policy and investment. Estimates suggest that the sharp drop in the agreement's depth between the UK and the rest of the EU would lead to a 38 percent drop in gross exports of goods, 26 percentage points more than in the "Norway" scenario. The largest decrease would be for exports of services that are estimated to fall by 48 percent. Intermediates value added exports are predicted to drop by 18 percent, almost four times the drop of the "Norway" scenario. The sharp reduction in intermediates and foreign value added trade (25 percent) implies that the UK would participate substantially less in international production networks.

In the "no-agreement" scenario, the UK and the EU do not sign any preferential agreement. In this case the variable depth would drop to zero, meaning that areas such as investment, competition policy and movements of capital (just to name key ones) would no longer be regulated by the agreement and the UK would have to pay Most Favored Nation (MFN) tariffs to access the EU market. In this scenario, gross trade in goods from the UK to EU countries would be halved, while export of value added would be

---

[10] Since the depth variable is normalized to be equal to 1 when the value of depth is 41, the maximum depth in our sample, we use the following formula to calculate the percentage change $\frac{\exp\left((.522+.129)*\frac{36}{41}\right)}{\exp\left((.522+.129)*\frac{44}{41}\right)} - 1 = -0.1193$.

reduced by 28 percent. According to the estimates, services exports would fall by 62 percent, which implies a 14 and 46 percentage points drops with respect to the intermediate and "Norway" scenarios. Intermediates value added exports would decrease by about a quarter and foreign value added in the UK's exports would decrease by one-third.

To better understand these magnitudes, we use the 2011 data from WIOD to obtain the dollar equivalent of the losses for the three different scenarios. It should be noted that these back-of-the-envelope calculations account for the partial effects and do not have general equilibrium or welfare implications since they do not account for possible re-direction of exports to non-EU countries (i.e. trade diversion and deflection), price adjustments or changes in wages. Although the largest percentage changes are for service exports, in terms of dollar equivalents we find that export of goods would decrease the most in all three scenarios. The "Norway" case, in which the UK signs an agreement similar to the EEA, suggests that export of goods would decrease by $27.447 billion, while services and value added exports would drop by $19.906 billion and $16.445 billion respectively. To put these numbers in perspective, the impact on total (goods and services) trade is equal to 1.83 percent of the UK's GDP and 0.63 percent for value added exports. In the worst case scenario, we find that goods exports would decrease by $114.363 billion, which is equivalent to 4.41 percent of the UK's GDP. [11] For services and value added exports, the values are lower, around $78 billion each, which accounts for 3 percent of GDP.

Table 6: Changes in UK's bilateral trade with the EU under different scenarios

	"Norway" scenario (36)	"average PTA" scenario (14)	"no-agreement" scenario (0)
Goods	-12%	-38%	-50%
Services	-16%	-48%	-62%
Domestic Value Added	-6%	-20%	-28%
Intermediates Value Added	-5%	-18%	-26%
Foreign Value Added	-7%	-25%	-34%

Notes: Depth decreases from 44 to 36 in the "Norway" scenario, to 14 in the "average PTA", and to 0 in the "no-agreement" scenario. Calculations are based on estimates in Table 3, column 5 for goods and column 6 for services trade, while results for value added trade use estimates from column 2 in Table 5

We compare our results with estimates from earlier studies that either use a different approach or use different data. Baier et al. (2008) adopt a methodology similar to ours based on a gravity model to identify the effect of various agreements, among which are the EU and the EEA, using PTA specific dummy variables. Their estimates suggest that if the UK were to exit the EU and sign the EEA, its gross exports of goods would fall by 25 percent.[12] One possible explanation for the difference in effects is that in our database the EEA is one of the deepest agreements, as it covers 36 policy areas. Instead, Baier et

---

[11] The data on GDP are from the World Bank.
[12] Based on estimates in Table 3, column 1 of Baier et al. (2008).

al. (2008) capture the trade impact of the EEA as the average effect of the trade agreement between the European Economic Community and the EFTA countries, signed in 1973, and the EEA of 1994.[13]

A more recent study by Dhingra et al. (2016), based on a general equilibrium trade model à la Costinot and Rodriguez-Clare (2013), finds that the losses associated with Brexit range between 1.28 percent and 2.61 percent of GDP. Combining our reduced form results and estimates on the elasticity of income to trade in goods by Feyrer (2009), we find that Brexit would imply larger impacts on the UK's income: a decrease by 3 percent in the "Norway" scenario and by 13 percent in the no-agreement case. A possible interpretation of the difference is that the reduced form estimates deliver a higher impact because they capture both the dynamic and static effects, while the structural model only accounts for static effects due to the increase in trade barriers (Dhingra et al., 2016).[14]

Our focus is on UK-EU trade relations, but Brexit will also impact trade relations the UK has with countries that have singed a PTA with the EU. What would be the trade effect if Brexit also implied the exit of the UK from all the EU's PTAs? The average number of provisions included in these agreements is around 14. The group of the UK's non-EU PTA partners account for 14 percent of the UK's total export of goods, of which the most important partners are Switzerland, South Africa, Turkey and Norway that together account for 11 percent of exports.[15] By exiting all the non-EU PTAs, the UK would decrease its exports to these countries by 17 percent, equivalent to $12.212 billion. Obviously, the UK could re-negotiate these agreements seeking deeper integration or decide to pursue deep trade agreements with other important trade partners such as the US, Canada and China.

5. Conclusions

This paper studies the role of deep trade agreements in UK-EU trade relations. We first look at the impact that membership of the EU had on trade of the UK with its partners and then use this information to predict future trade relations based on different scenarios. We find that EU membership had a strong impact on UK-EU trade and that it contributed particularly to the rise of UK services exports and its integration in global value chains. While there is substantial uncertainty on the content of a future agreement between the UK and the rest of the EU, our scenario analysis indicates that there is a clear trade-off between the depth of such agreement and the intensity of future UK-EU trade. In particular, a shallower agreement will have a stronger negative impact on the UK's services trade and GVC integration, which have relied more on the deep arrangements of the EU.

A number of questions remain open. First, the analysis does not account for the possibility that the UK after Brexit may choose to sign new trade agreements with other trade partners and for the EU to continue its process of "ever closer union" by further deepening its integration. Both scenarios would impact future UK-EU trade relations going forward in ways that are difficult to predict, as the effects will depend on the specific content of these agreements. But the trade-off between PTA depth and trade intensity uncovered in this analysis will still likely delimit future policy choices. Policy makers can either

---

[13] Baier et al. (2008) code the dummy EEA equal to 1 from 1973 onwards if one of the countries is in the EU and the other is in EFTA.

[14] Similarly, a recent study by Kee and Nicita (2016) focusing on tariff changes finds that leaving the EU would lead to a 2 percent decrease in the UK's exports in the short run.

[15] Given the limited coverage of WIOD, we compute these statistics using data from COMTRADE.

choose to undertake more binding commitments in deep agreements that support more trade or opt for weaker commitments and less trade. Second, while our focus here has been on the complementarity between deep trade institutions and trade flows, it could be argued that a high level of trade integration requires some form of political integration for its legitimacy and long-run sustainability. Indeed, this complementarity between economic and political integration has been at the core of the European project (Padoa-Schioppa, 1999). In light of this, deeper forms of agreements may be difficult to pursue outside the Union.

References

Anderson, James E., and Eric van Wincoop. 2003. "Gravity with Gravitas: A Solution to the Border Puzzle." *American Economic Review* 93 (1): 170–92.

———. 2004. "Trade Costs." *Journal of Economic Literature* 42 (3): 691–751.

Antras, Pol, and Robert W. Staiger. 2012. "Offshoring and the Role of Trade Agreements." *American Economic Review* 102 (7): 3140–83.

Baier, Scott L., and Jeffrey H. Bergstrand. 2007. "Do Free Trade Agreements Actually Increase Members' International Trade?" *Journal of International Economics* 71 (1): 72–95.

Baier, Scott L., Jeffrey H. Bergstrand, Peter Egger, and Patrick A. McLaughlin. 2008. "Do Economic Integration Agreements Actually Work? Issues in Understanding the Causes and Consequences of the Growth of Regionalism." *The World Economy* 31 (4): 461–97.

Baldwin, Richard. 2010. "Sequencing Regionalism: Theory, European Practice, and Lessons for Asia." CEPR Discussion Paper 7852. C.E.P.R. Discussion Papers.

Brou, Daniel and Michele Ruta. 2011. "Economic Integration, Political Integration, or Both*?" Journal of the European Economic Association*, 9:6, 1143-1167.

Campos Nauro, Fabrizio Coricelli, Luigi Moretti. 2014. "Economic Growth and Political Integration: Estimating the Benefits from Membership in the European Union Using the Synthetic Counterfactuals Method", CEPR discussion paper No. 9968.

Costinot, Arnaud, and Andrés Rodríguez-Clare. 2013. "Trade Theory with Numbers: Quantifying the Consequences of Globalization." NBER Working Paper 18896. National Bureau of Economic Research, Inc.

Dhingra, Swati, Gianmarco I. P. Ottaviano, Thomas Sampson and John Van Reenen. 2016. "The Consequences of Brexit for UK Trade and Living Standards." CEP BREXIT Analysis No.2, London School of Economics and Political Science, CEP, London, UK.

Feyrer, James. 2009. "Trade and Income -- Exploiting Time Series in Geography." NBER Working Paper 14910. National Bureau of Economic Research, Inc.

Head, Keith, and Thierry Mayer. 2014. "Gravity Equations: Workhorse, Toolkit, and Cookbook." Handbook of International Economics. Elsevier.

Hofmann, Claudia, Alberto Osnago, and Michele Ruta. 2016. "Horizontal Depth: A New Database on the Content of Deep Agreements." Mimeo, The World Bank.

Horn, Henrik, Petros C. Mavroidis, and André Sapir. 2010. "Beyond the WTO? An Anatomy of EU and US Preferential Trade Agreements." Blueprints. Bruegel. Accessed August 25.

Johnson, Robert, and Guillermo Noguera. 2014. "A Portrait of Trade in Value Added over Four Decades." Unpublished, Dartmouth College.

Kee, Hiau Looi, and Alessandro Nicita. 2016. "Short-Term Impact of Brexit on United Kingdom Export of Goods." Work in Progress. The World Bank.

Koopman, Robert, Zhi Wang, and Shang-Jin Wei. 2014. "Tracing Value-Added and Double Counting in Gross Exports." *American Economic Review* 104 (2): 459–94.

Lawrence, Robert Z. 1996. *Regionalism, Multilateralism, and Deeper Integration*. Brookings Institution Press.

Limão, Nuno. 2016. "Preferential Trade Agreements." NBER Working Paper 22138. National Bureau of Economic Research, Inc.

Mattoo, Aaditya, Alen Mulabdic, and Michele Ruta. 2016. "Trade Creation and Trade Diversion in Deep Agreements." Work in Progress. The World Bank.

Orefice, Gianluca, and Nadia Rocha. 2014. "Deep Integration and Production Networks: An Empirical Analysis." *The World Economy* 37 (1): 106–36.

Osnago, Alberto, Nadia Rocha, and Michele Ruta. 2015. "Deep Trade Agreements and Vertical FDI : The Devil Is in the Details." Policy Research Working Paper Series 7464. The World Bank.

Osnago, Alberto, Nadia Rocha, and Michele Ruta. 2016. "Deep Trade Agreements and Global Value Chains." Work in Progress. The World Bank.

Ottaviano, Gianmarco, João Paulo Pessoa, Thomas Sampson, and John Van Reenen. 2014. "The Costs and Benefits of Leaving the EU." CFS Working Paper Series 472. Center for Financial Studies (CFS).

Padoa-Schioppa, T. 1999. "Reflections on the Globalisation and Europeanisation of the Economy." Lecture at the University of Göttingen, Göttingen, available at: http://www.ecb.europa.eu/press/key/date/1999/html/sp990630.en.html.

Silva, J. M. C. Santos, and Silvana Tenreyro. 2006. "The Log of Gravity." *The Review of Economics and Statistics* 88 (4): 641–58.

Wang, Zhi, Shang Jin Wei, and Kunfu Zhu. 2016. "Quantifying International Production Sharing at the Bilateral and Sector Levels." Mimeo, Columbia University.

WTO, World Trade Organization. 2011. "World Trade Report 2011- The WTO and Preferential Trade Agreements: From Co-Existence to Coherence." Working Paper id:4335.

22