

EU-UK Global Value Chain trade and the indirect costs of Brexit*

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PRELIMINARY DRAFT

Abstract

Production networks in the European Union (EU) and the United Kingdom (UK) are highly integrated and Brexit poses a threat to supply and demand linkages across the Channel. In a world of Global Value Chains (GVC), tariffs might be more harmful than in a world where trade is purely direct. In this paper we highlight the features of GVC-trade between the EU and the UK, disentangling the complex network of bilateral EU-UK value-added flows. Assuming that upon Brexit the UK adopts the same Most-Favoured-Nation tariff schedule as the EU, we compute the direct and indirect costs of these tariffs, taking into account the EU-UK GVC-trade patterns. Tariffs would add almost 1 percentage point to the cost of manufacturing inputs in the UK, while the corresponding input cost in the EU would be only marginally affected, despite some heterogeneity at the country-level.

Keywords: Brexit, tariffs, global value chains.

JEL classifications: D57, F13, F15.

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1 Introduction

One of the defining features of modern international trade is the pervasiveness of the global value chains (GVC) that connect countries specialised in different phases of the same production process.¹ The Single Market greatly facilitated cross-border integration of production chains in the European Union (EU), which have significantly increased in number and nowadays span borders within and outside the EU. Not surprisingly, the dense production network involving EU countries is often called “Factory Europe” (Baldwin and Lopez-Gonzalez, 2015).

On March 29th 2019 the United Kingdom (UK) will withdraw from the EU. This is an unprecedented event (dubbed “Brexit” for Britain’s exit from the EU) in the history of European integration, and raises many questions on the future evolution of the trade and production linkages between the two economies.²

Brexit can be a threat to the existing EU-UK GVC linkages because of tariff- and non-tariff barriers. Aside from the direct effect of tariffs, indirect effects could be sizable in a world of GVC. First, exported goods embed imported intermediates and the relative tariffs cumulate as many times as the intermediates cross the EU-UK border, thus the upstream structure of the GVC is important to assess the total cost-push effect. Second, a relevant share of goods and services reaches destination countries only indirectly, through other countries’ exports, and thus these intermediates face trade costs that are not immediately evident.

Given the existence of GVC, traditional trade statistics no longer provide an adequate representation of supply and demand linkages, so we use Inter-Country Input-Output (ICIO) tables (specifically the WIOD³ 2016 release, containing data for 2014). ICIO tables have been developed by combining traditional trade statistics with national Input-Output tables in order to map production and consumption linkages between different countries. Combining these data with new tools,⁴ we explore a wide range of indicators based on gross and value-added trade flows

¹Cfr., among others, Landesmann et al. (2015), Keppel and Prettnner (2015), Amador et al. (2015) and Guerrieri and Vergara Caffarelli (2012).

²Since we place our analysis after Brexit has occurred, from now on we will use EU to refer to the Union of the 27 remaining Member States.

³See Timmer et al. (2015).

⁴See Borin and Mancini (2016) for a survey of recent methodologies developed to measure trade in value added and countries’ participation in GVCs.

of goods and services between the UK and the EU. In particular, we retrieve the portion of EU-UK trade flows related to GVC activity, and we assess the upstream and downstream linkages of the two regions, including indirect Brexit exposure.

We assume that the UK adopts the current Most-Favoured-Nation tariff schedule adopted by the EU, which is the worst case scenario for the EU-UK post Brexit relationship. We construct a tariff schedule for the EU and the UK at the sector and, for the first time to our knowledge, at the end-use level details. In this way, we focus on the hypothetical total effect of tariffs, taking into account both direct and indirect costs related to GVC-trade.

From the import side, we retrieve the cost-push effect of post-Brexit tariffs on imported goods, by computing (see Miroudot et al., 2013) the accumulated burden of upstream tariffs for the EU (UK) imports from the UK (EU). Moreover, we show how tariffs affect the overall production costs in both regions.

From the export side, we measure the direct and indirect costs incurred by exports on their way to the destination (see Muradov, 2017). In other words, considering both direct and indirect costs uncovers how much obstacles exports face along the GVC to reach the user.

The indirect costs of tariffs computed both from the import and the export side are clearly related to the features of the production and consumption networks between the EU and the UK. Indeed we show that indirect costs of tariffs are correlated with relevant measures of trade in value added, such as the foreign content in exports. This suggests that, more in general, it could be possible to quantify the cumulative tariff effects on countries and sectors with a proper analysis of the trade in value-added, even without knowing the actual level of all the tariffs.

We do not attempt to quantify the effect of tariffs on growth or macroeconomic performance, we aim at understanding the link between the GVC structure and the direct and indirect effects of tariffs costs to dig deeper into the “black box” that empirical models, such as gravity models, are using.

We find that, after Brexit, average tariffs imposed on final products would be higher (8.6 and 5.8 per cent on average, respectively on the UK and the EU imported products) than those on the intermediates (3.2 and 2.8 per cent, respectively).⁵

⁵It should be noted that the difference between the EU and UK direct tariffs is completely

As to the total cost-push effect on imported goods, we find that cumulative tariffs on EU intermediates imports from the UK would be higher than direct tariffs by around 0.4 p.p. (from 2.8 to 3.2). Thus, 12 per cent of the total cost would be driven by indirect upstream inter-linkages.

Instead, cumulative tariffs on the UK intermediate imports from the EU are much more in line with the direct tariffs. This is not surprising, since a very high share of the UK exports to the EU embed EU products (around 9 per cent of the total, 20 in motor vehicles). These goods cross the Channel – and are levied by a tariff – twice before entering the EU. *Viceversa* the British content of EU exports to the UK is much lower (around 2 per cent), and hence the cost-push effect is negligible.

However, the cost impact of the tariffs on the whole economy is much higher for the UK: manufacturing input costs increase by around 0.9 p.p., two thirds due to direct tariffs, the rest to upstream linkages, while the corresponding input costs in the EU would be only marginally affected. Size matters: around one fifth of the total manufacturing inputs, imported and domestic, used by the UK comes from the EU, while just 1.5 per cent of the total EU inputs are imported from the UK.

Given the density of intra-EU linkages and the sizable share of indirect trade between the two regions, exporters in both the UK and the EU Member States face higher costs when the indirect trade is taken into account. In other words, indirect routes entail tariffs that are not perceived by the exporters (as intra-EU trade is free of tariffs), but weigh around 20 per cent of the total costs.

Our analysis bears some important *caveat*. First, it is a partial equilibrium analysis: we do not consider possible trade creation and diversion that can be induced by EU-UK bilateral tariffs. Secondly the persistence of tariffs between the two economies is not plausible in the long run: the expectation is that a EU-UK Free Trade Agreement will be eventually signed. Finally non-tariff-barriers are not considered and left for further research.

In summary, we are able to compute measures of cost and resistance of trade flows that take into account and are related to the EU-UK GVC structure, which can be useful in the negotiations for the future bilateral free trade agreements, and provide clear evidence of the direct and indirect costs due to Brexit.

driven by sectoral composition, since the hypothetical tariff schedule is the same.

The rest of the paper is organized as follows. Section 2 provides a review of the related literature. Section 3 presents some preliminary evidence on the EU-UK GVCs. Section 4 digs deeper into the bilateral GVC relations, sourcing and selling strategies of the two economies. Section 5 illustrates the construction of the tariffs and calculates the cumulative impact of bilateral EU-UK tariffs. Section 6 concludes.

2 Related literature

We borrow from various strands of the literature. After the seminal contribution by Leontief (1936), the development of ICIO tables gave new life to input-output analysis. Koopman et al. (2014) propose a new method for the decomposition of total gross exports by source and destination of their embedded value added⁶. Borin and Mancini (2017) introduce the follow-the-value-added methodology that refines and corrects Koopman et al. (2014) analysis, allowing for a proper investigation of the bilateral, as well as sectoral, dimension of trade flows and for the analysis a country’s backward and forward linkages within the GVC.

The average tariffs, on intermediate and final goods traded between the EU and the UK, are based on the methodology developed in Cappariello (2017).⁷

We compute the indirect costs of tariffs following the works of Miroudot et al. (2013), Rouzet and Miroudot (2013), and Muradov (2017). The former contribution develops a methodology to compute the accumulated burden of upstream tariffs for a given importer, drawing from standard cost-push analysis in the input-output literature. It shows that that, given the interdependence between services and goods in international trade, in 2009 almost one third of tariffs levied on goods was in fact applied to value added coming from services embedded in merchandise imports. The pervasiveness of the GVC structure implies that, domestically, tariff reductions in one sector generate significant productivity gains in others and, internationally, the benefits of sectoral trade agreements spill over both up- and downstream.⁸ Using OECD-TiVA input-output tables and tariff data drawn from

⁶Previously also Hummels et al. (2001) and Johnson and Noguera (2012) applied input-output analysis to the study of GVCs.

⁷See also Lawless and Morgenroth (2016).

⁸Cross-sectoral spillovers have by now become a well-known phenomenon, see for instance

the UNCTAD-TRAINS database Rouzet and Miroudot (2013) show that even small tariffs can have a significant impact on trade because of their cumulative effect.

Muradov (2017) provides a framework to compute two new measures (cumulative tariffs at origin and at destination) that proxy the obstacles which a country's export face on its path to the user, and are useful to evaluate the indirect effects of free trade agreements on third countries. In the case of the Trans-Pacific Partnership (TPP) agreement, the author shows that non-members would have some benefits because some of their intermediates exports reach the destination markets after being embedded in products of the TPP partners.

Other studies addressed the issue of Brexit taking into account the existence of EU-UK GVCs, using different analytical frameworks. Vandenbussche et al. (2017) estimate a gravity model in value added, featuring sector-level input-output production linkages. Pisani and Vergara Caffarelli (2018) develop a dynamic model with tradable intermediate goods and services (as well as intermediate non-tradable services) calibrated on the Euro Area and the UK, and assess the effects of alternative tariff scenarios.⁹

3 A first look at EU-UK trade: from gross to value-added statistics

The first step is to investigate¹⁰ the bilateral exposure of the UK, the EU and its Member States (tab. B.1).¹¹ Exploiting basic accounting relationships (Leontief, 1936; Johnson and Noguera, 2012), we compare gross and net export shares. The latter are measured as value added originated in a certain country (the exporter in value-added terms) and absorbed in a foreign market (the new 'importer'). The UK receives about 6 per cent of EU gross exports, slightly more in value-added terms. France, Netherlands and Belgium sell between 7 and 8 per cent of their

Carvalho and Voigtländer (2015).

⁹Other interesting studies on Brexit are Dhingra et al. (2017) and OECD (2016), which do not explicitly feature GVCs, and Rojas-Romagosa (2016).

¹⁰The methodology employed in this section is discussed in Appendix A.1.

¹¹Countries considered in our analysis are listed in Appendix C.

exports to the UK, while Germany and Italy around 6. The value-added shares of these countries in the UK final demand are higher by around 0.5 p.p., meaning that the British market activates the EU productions more intensively than what standard trade statistics might suggest. Malta¹² and Ireland are the countries for which the UK market is an extremely significant export destination, with a gross share about 29 and 14 per cent, respectively (about 26 and 13 per cent in value added terms). This result might be driven by a country’s specialisation: Amador et al. (2015) find that Luxembourg and Ireland have strong ties with the UK, Denmark and Sweden, which can be explained by common financial services specialization both in the UK and in Luxembourg, and Ireland headquartering many Anglo-Saxon and Nordic multinationals.

Conversely, the overall exposure of the UK to the EU is extremely high, reaching almost 40 per cent in gross terms, (32 in value-added terms; tab. B.1). This discrepancy suggests that the UK value added exported to the EU might often be re-exported by EU countries to some other market. We will dig further on this aspect when we evaluate the bilateral trade flows and their value-added components. The largest UK export destinations are Germany, France and Ireland with shares around 5 per cent, whereas in the case of Ireland the share almost halves once it is corrected for value added. Hence market size and proximity seem to be important in the selection of the destination of UK export.

In a world of increasing production fragmentation across country borders, the interconnectedness should not only be seen in terms of trade flows but also from the perspective of reciprocal production dependency. Using the ICIO framework we can examine to what extent a specific country’s production depends on imported inputs from other countries.¹³ The dependency of the EU economy on inputs from the UK is relatively small (about 1 per cent, 2 if we consider exports instead of total

¹²Malta figures seem to be upward biased in WIOD data. While WIOD tables are based on official statistics only, OECD TiVA tables combine official data with firm-level evidence, providing a more reliable assessment of value added trade flows. Exploiting this latter ICIO database, the shares for Malta, both in gross and net terms, are lower by around 10 percentage points in 2011 with respect to WIOD ones. Unfortunately, the last available year for TiVA data is 2011. Since our aim is to provide the most up-to-date picture of the EU-UK GVC, we chose to rely on WIOD.

¹³Production dependency is calculated as the imports coming from a particular country embedded in total production.

production; tab. B.2). High dependency is found for Luxembourg (16 per cent in total, 18 for exports), Malta (8 and 10 per cent, respectively) and Ireland (about 6 per cent for both). On the contrary, the UK dependency on the EU economy is sizable, about 7 per cent in total production and 10 per cent for exports. The largest values are attained by imports from Germany (about 2 per cent), France and the Netherlands (about 1.5), and Italy, Ireland and Belgium (slightly less than 1).

This analysis, however, cannot quantify the actual share of trade due to the presence of GVC, nor disentangle the indirect flows of goods and services between the two economies, which is the subject of the next section.

4 EU-UK Global Value Chain: insights from bilateral exports

To gauge a better understanding of EU-UK trade it is important to uncover the share of the export flows between EU countries and the UK that is related to GVC activities. Following Borin and Mancini (2017), GVC-related trade is defined as goods and services crossing more than one border, in the spirit of the definition proposed by Hummels et al. (2001). The rationale is that GVC schemes must imply at least two production stages located in different countries before the final good or service reaches the destination market (intermediates crossing just one border are not part of GVC-trade).

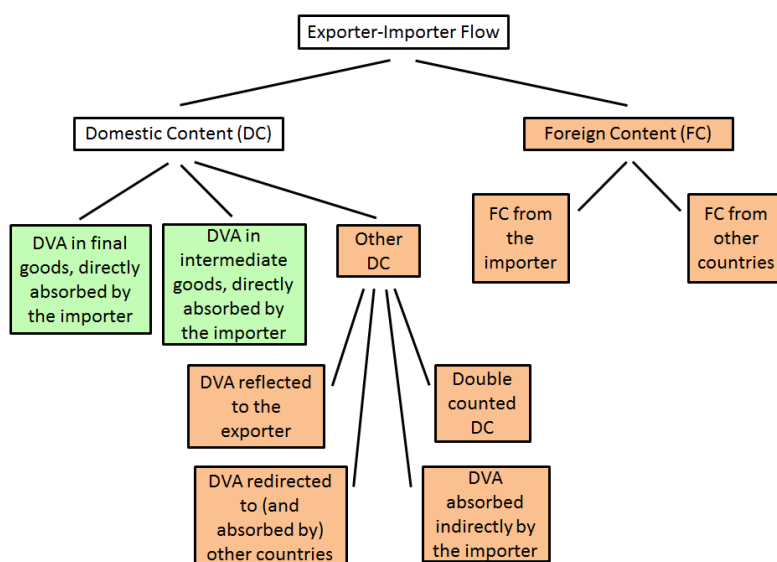
Figure 1 illustrates the decomposition of (gross) bilateral export flows into its domestic and foreign component (see Borin and Mancini, 2017).

The domestic component of bilateral export can be further divided in three parts i) domestic value added (DVA) in final goods directly absorbed by the importing country, ii) DVA in intermediate goods directly absorbed by the importing country, and iii) other domestic content components. The other domestic content components are 1) DVA reflected (i.e. re-sold) to the exporting country, 2) DVA redirected to, and absorbed by other countries, 3) DVA indirectly absorbed by the importer, and 4) double counting. According to our definition of GVC trade, DVA in both final and intermediate goods directly absorbed by the importing country

constitutes a traditional trade flow. Instead, DVA reflected to the exporting country, DVA redirected to other countries, DVA indirectly absorbed by the importer, and double counting care a part of GVC trade: the first and the forth items travel back and forth across the exporter-importer border,¹⁴ whereas the second and the third items pass both the exporter-importer border and the one between the importer and a third country.

The foreign component of bilateral export flows is divided into two parts depending on its origin, from the importer and from other countries, and both belong to GVC trade.

Figure 1: Decomposition of bilateral exports



Note: Traditional trade is in green, GVC trade in orange.
Based on Borin and Mancini (2017).

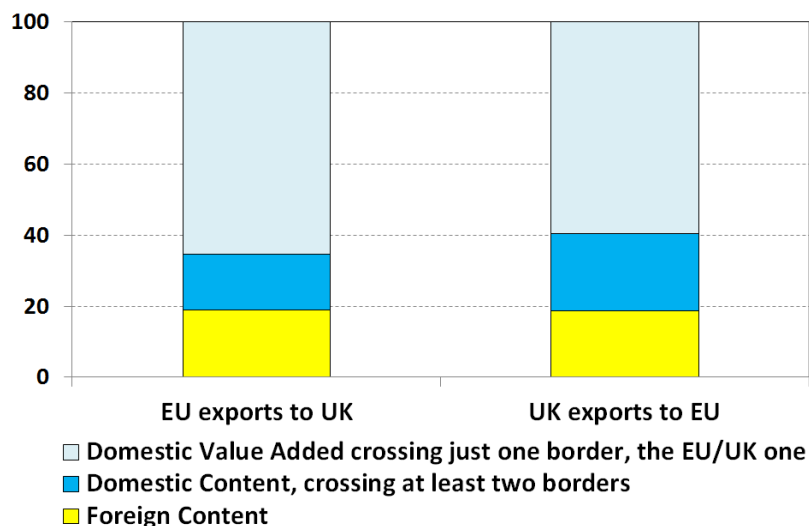
Since our focus is on the EU as a whole, and not on single Member countries, we exclude all the intra-EU borders, and compute the GVC-trade as defined above. It turns out that the share of EU exports to the UK related to GVC is about 35 per cent (40 for the UK exports to the EU). Thus, even without considering intra-EU

¹⁴More precisely, double counting is DVA that crosses a producer's border at least twice (Koopman et al., 2014).

borders, still more than one third of the trade flows between EU area and UK consists of goods and services that cross at least two borders (the Channel and some other extra-EU border, or the Channel at least twice).

Figure 2 depicts the three elements of bilateral export flows, Ricardian trade (65.4 per cent for the EU and 59.6 for the UK), domestic value added in GVC trade (15.6 and 21.8 per cent, respectively), and foreign content (19 and 18.6 per cent, respectively). The upstream linkages might be evaluated by looking at the foreign content from other countries embedded in the bilateral exports between EU and UK, while the downstream linkages by looking at where the domestic value added is absorbed, either in the exporting country itself (reflected domestic value added) or redirected to other economies.

Figure 2: Decomposition of EU-UK bilateral exports

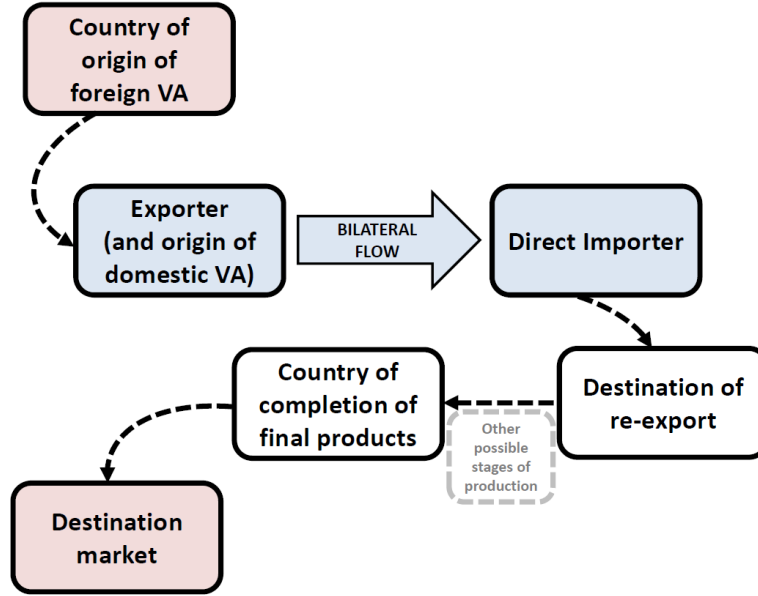


Note: percentage points. Source: Authors' calculations on WIOD data.

Exploiting Borin and Mancini (2017) decomposition, we are able to identify in each particular bilateral export flow: i) the country where the foreign content has been originated; ii) the destination market, where the final good is ultimately absorbed (fig. 3).

First, we look at the upstream structure, retrieving the countries of origin of the foreign content embedded in the bilateral flows between UK and EU, to assess

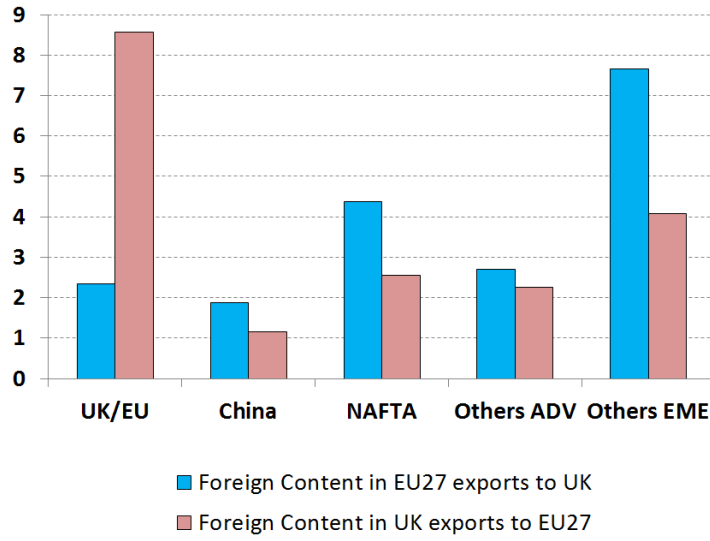
Figure 3: Bilateral exports in a GVC perspective



the different sourcing strategies of the two economies (fig. 4). In total, around 20 per cent of UK and EU bilateral exports are made of goods and services that have been produced outside the exporting country. More specifically, about 9 per cent of UK exports to EU consists of intermediate products that are actually produced in the EU, while the UK foreign-content share in EU exports to the UK is just 2 per cent. Thus, some of the production stages, carried on within UK and needed to produce goods and services that will be exported to the EU, heavily rely on intermediates coming from the EU itself. Almost 8 per cent of EU exports to UK are originated in emerging market economies.

Following the value added also allows to uncover downstream linkages of the EU and UK economies. Although traditional trade statistics cannot shed light on this aspect, identifying the ultimate destination market of bilateral trade flows could be quite relevant, especially if tariffs are passed through to final consumers. It turns out that 18 per cent of the UK exports to the EU is redirected to some other final market (fig. 5), suggesting that UK exploits *Factory Europe* as a hub to reach other markets, such as emerging-market economies (11 per cent of the

Figure 4: Foreign content in bilateral exports, by country of origin



Note: percentage points. Source: Authors' calculations on WIOD data.

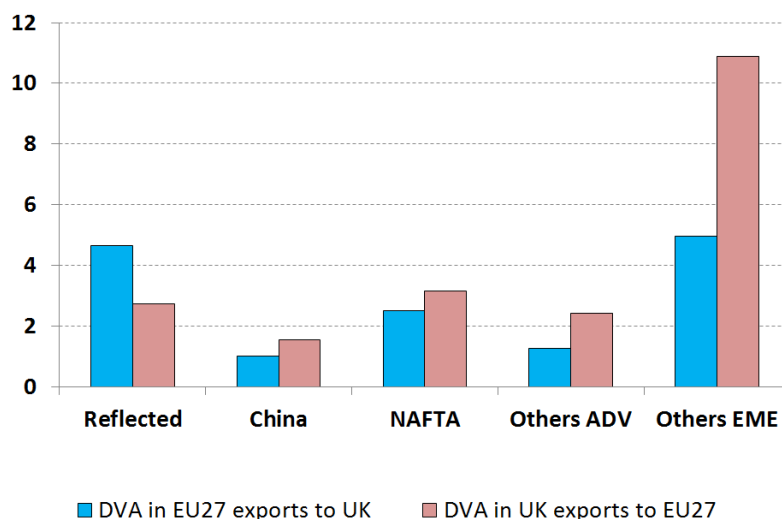
total exports from the UK to EU) and NAFTA countries (3 per cent). It seems that the opposite is not true for the EU. Interestingly more than 4 per cent of EU exports to the UK comes back to be consumed in the EU (reflection), therefore crossing the Channel twice.

4.1 Sectoral GVC-trade

The *follow-the-value-added* methodology allows us to decompose bilateral export flows into their value-added components and to identify their origin and destination, also at the sector level.¹⁵ Tables B.3 and B.4 present the sectoral GVC-related bilateral exports for the UK and the EU, respectively. Sectors with the highest overall share of GVC-related trade in bilateral exports are basic metals (67 per cent for the UK and 68.4 for the EU), coke and petroleum (67.7 per cent for the UK and 63.2 for the EU), and forestry and logging (60.8 per cent for the UK) and chemical products (53.5 per cent for the EU). This is not surprising, since these productions are usually more upstream in the manufacturing process, and are used

¹⁵See Appendix C for the list of sectors.

Figure 5: Re-exported domestic value-added in bilateral exports, by final destination



Note: percentage points. Source: Authors' calculations on WIOD data.

as inputs in more downstream sectors in the same and/or in foreign markets.

As discussed above, domestic value added in exports can be reflected back to the exporting country. The largest shares of British value added reflected into the UK are in forestry and logging, crop and animal production, and paper products (8.8, 6.9, and 4.9 per cent respectively), whose share of domestic value added are 30.6, 24.8 and 23.1 per cent, respectively (tab. B.3). EU value added exported to the UK and then reflected back to the EU is highest in basic metals, chemical products, and mining and quarrying (11, 9.6 and 8.5 per cent, respectively), which are also the sectors with the largest domestic content (tab. B.4).

We can also retrieve some insight regarding the upstream structure of these sectoral trade flows, looking at the other region's value-added in the bilateral export flows. For the EU the top sectors in terms of UK value-added content in exports to the UK are crop and animal production, food products, and coke and petroleum (5.7, 4.3 and 3.8 per cent, respectively), while computer and optical products, one of the sectors with the highest foreign content has just a share 1.9 per cent of UK value added (tab. B.4). The first three sectors combined constitute

21.6 per cent of European exports to the UK. For the UK, the share of EU value-added content in the bilateral exports to the EU is much higher. Interestingly, the UK sectoral exports to the EU that embody the largest shares of European value added are motor vehicles, chemical products, and basic metals (20.4, 17.8, and 14.9 per cent, respectively; tab. B.3). These three sectors account for 27.8 per cent of British exports to the EU. In section 5 we will show that this evidence relates to the accumulated burden of upstream tariffs for a given importing sector. In particular, these goods and services cross the Channel twice and thus are subject to post-Brexit tariffs more than once.

4.2 UK and *Factory Europe*: within-EU trade

In Table B.5 we show how UK goods and services reach the EU countries as final markets. On average, around 75 per cent of UK value-added is delivered to a given EU country directly. However, around 18 per cent is first exported to some other economy in *Factory Europe*, and only after some processing stages it reaches the destination market. Heterogeneity is substantial: while the indirect trade to EA-3 countries (Germany, France and Italy) is in line with the average, more than one third of UK products destined to Austria and Eastern EU countries (in particular Slovakia, Slovenia and, to a lesser extent, Romania) reaches those countries indirectly, embedded in the exports of other *Factory Europe* economies.

Let us now consider how EU-countries value added reaches the UK. The indirect trade is still substantial, around 17 per cent (tab. B.5). Not surprisingly, Ireland delivers the vast majority of its goods and services to the UK in a direct way, while Malta shows a very low degree of indirect trade. Again, some Eastern EU economies, such as Slovenia, Romania and Czech Republic take advantage of the EU network to process their products and reach the UK.

In section 5, we will relate these results to a measure of indirect obstacles that EU and UK products have to face to reach the partners. In fact, since EU and UK products are embedded in other *Factory Europe* countries' exports, they will indirectly face a trade cost that is not immediately evident.

5 The impact of tariffs in the EU-UK GVCs

In the previous sections we highlighted some of the features of GVC-trade between the EU and the UK. Here we investigate the impact of tariffs.

We first compute the hypothetical tariffs schedule that will be in place after Brexit: this the traditional manner in which the trade cost of Brexit has been evaluated (Cappariello, 2017; Lawless and Morgenroth, 2016), which we innovate by distinguishing tariffs according to the end-use of the goods (final or intermediate). Then we uncover how the network structure of trade flows and the interconnections between the two regions would affect the post-Brexit accumulation of trade costs on intermediate goods, i.e. the indirect tariffs due to the presence of GVC-trade, on top of the direct tariffs. In this way we are able to extend traditional analyses on trade costs of Brexit, taking explicitly into account two features of GVC-trade flows: a) exported intermediate goods embed imported intermediates and their relative tariffs; b) a relevant share of goods and services reach destination countries only indirectly, through other countries' exports, and thus is subject to tariffs that are not immediately evident. We apply two different methodologies, developed in the literature by Rouzet and Miroudot (2013) and Muradov (2017), respectively.

Rouzet and Miroudot (2013) compute the so-called “cumulative tariff” (i.e. the accumulated burden of upstream tariffs for a given importer), which quantifies the total cost-push effect of direct and indirect tariffs, taking into account the upstream GVC structure (in section 5.2 we compute the cumulative tariff on post-Brexit tariffs on EU-UK trade).¹⁶

Instead, Muradov (2017) stresses the importance of indirect bilateral trade flows and proposes two alternative measures to account for the related costs, the cumulative tariff at origin and at destination. Consider any given country pair, exports originating in the first country (called the producer) can take many possible paths to reach the second (the user): the producer can export directly to the user or it can do it indirectly, i.e. its exports can reach the user embedded in third countries' exports to the latter. The cumulative tariff at origin traces the direct and indirect cost levied on exports as soon as they leave the producer. Conversely,

¹⁶See also Johnson (2017) for an up-to-date review of the cost-push effect of trade costs.

cumulative tariff at destination traces the direct and indirect costs of the producer’s exports upon entry into the user. Differently from Rouzet and Miroudot (2013), these measures cannot be interpreted as cost-push effects as the cumulative tariff, but as a proxy of the relative resistance of trade flows, since they measure direct and indirect costs that an exported product has to face on its path from the producer to the user (see section 5.3).

Our first step is to compute the post-Brexit tariffs.

5.1 Post-Brexit Tariffs

In order to estimate the average tariffs that after Brexit would affect both the consumers and the producers in each EU Member State and in the UK, we construct a tariffs schedule for the EU and the UK at the sector and, for the first time to our knowledge, at the end-use level detail. We assume that upon Brexit the UK adopts the current EU tariffs; in other words, the trade tariffs that the EU currently applies to countries with which there is no free trade agreement will apply between the EU and the UK (as well as between the UK and other third countries).¹⁷ These are the so called Most-Favoured-Nation tariffs (MFN). We are hence considering the worst case scenario in terms of EU-UK post Brexit relationship. Indeed, if a free trade agreement is struck, tariffs on bilateral trade will be lower, potentially even zero.

Tariffs are public information. Yet the calculation of the average tariffs is far from straightforward and is described in Appendix A.2. Table B.6 (Table B.7) lists the average bilateral tariffs that, according to our estimates, would be applied to the EU (UK) imports from the UK (EU) at the sector level, with the detail for final use and intermediates. Given the product composition of bilateral trade in 2014, the average duty imposed by the UK on goods imported from the EU would be 5.9 per cent whereas the duty imposed by the EU on British goods would be 3.9 per cent. As expected, duties imposed on final products would be higher (8.6 and 5.8 per cent on average respectively on the UK and the EU imported products) than those on the intermediates (3.2 and 2.8 per cent).

¹⁷This is consistent to the joint letter to the WTO members by the EU and the UK of 11th October 2017 in which the UK stated that it “intends to replicate as far as possible its obligations under the current commitments of the EU.”

The high discrepancy of tariff rates between the final and intermediate use even within the same industry confirms the importance of taking into account all the stages of the global value chain for the calculation of the impact of potential EU-UK tariffs along the production linkages.

Tables B.6 and B.7 show also that the EU imports a relatively high share of intermediate inputs from the UK: almost 63 per cent of the value of imports from the UK is constituted by goods subsequently processed in the EU economies – especially chemical, mining and metal products (tab. B.6). On the contrary, the British economy imports relatively more final goods, mainly motor vehicles and food products, from the EU. Indeed, half of the value of total imports from the EU is given by final goods (tab. B.7).

Tariffs can also be aggregated at the country level using sectoral import shares. Tables B.8 and B.9 present the average tariffs for intermediate, final and total bilateral imports for the UK and the EU Member States. There is a very high cross-country variability that is driven by the underlying sectoral specialisation of each country.¹⁸ Moreover tariffs on final goods are higher and even more variable than those on intermediates.

5.2 Import-side analysis: cost-push effect of tariffs

In this section we compute the cumulative tariffs that EU and UK imports would have to face after Brexit, comparing the results with the direct tariffs. Moreover, we show how tariffs affect the overall production costs in the two regions.¹⁹

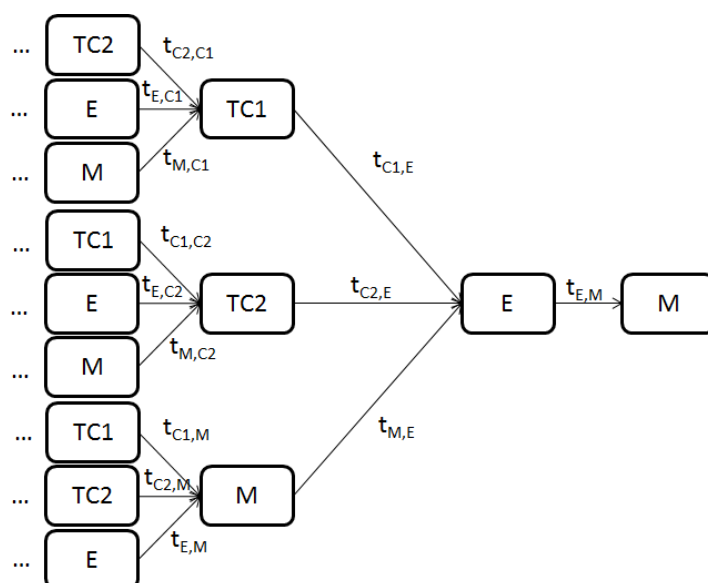
In Figure 6 we show a graphical representation of the cumulative tariff by Rouzet and Miroudot (2013). In this simplified scheme, there are only four countries: E (last exporter), M (importer), TC1 and TC2 (third countries). Country M imports a unit of good, paying the direct tariff $t_{E,M}$. However, the last exporter (E), in order to produce exports, has sourced inputs from M itself and from third

¹⁸Cappariello (2017) presents a more detailed analysis of average country tariffs to which we refer the interested reader.

¹⁹Owing to the changing nature of GVCs we also performed this analysis with the ICIO data for 2000, provided by WIOD. The results are basically unchanged, indicating that within Europe the GVCs are pretty stable. This is consistent with the history of GVCs in Europe that developed in the 1990's, when Eastern European countries entered into transition (Guerrieri and Vergara Caffarelli, 2012).

countries TC1 and TC2, paying the corresponding tariffs. In turn, these three countries have already paid tariffs embedded in their export flows, and this process could be iterated even further upstream. Thus, imports to country M embed direct tariffs $t_{E,M}$, and all the indirect tariffs incurred in the upstream value chain, weighted by the amount of imports needed to produce exports. Then, the share of the indirect costs levied on a particular import flow is obtained as the ratio between the indirect costs and total cost-push effect, that takes into account also the direct trade costs.²⁰

Figure 6: Graphical representation of Rouzet and Miroudot (2013) cumulative tariff



In principle, with a complete tariff schedule between all country-sector pairs in the world, it is possible to compute a cumulative tariff taking into account the entire structure of the international production network.²¹ This is not the aim of our work. In fact, our emphasis is just on the EU-UK border, and the only tariff that we consider is the one that will probably be in place after Brexit. Hence, in

²⁰For a formal overview of the cumulative tariffs see Appendix A.3.

²¹See Rouzet and Miroudot (2013). They compute cumulative tariffs exploiting WIOD Input-Output tables and tariffs between each country-sector pair in the WIOD tables based on UNCTAD-TRAINS database.

this particular setting, tariffs are cumulated only when goods and services cross the EU-UK border more than once.

As an example, consider the following scenario. The EU and the UK charge the same tariff equal to 5 per cent to both intermediate and final imports. The UK imports €10 of intermediates from the EU, combines them with other €10 of British value added and exports the final product back to the EU. By assumption on each border crossing a tariff of 5 per cent is charged on (gross) imports. Hence UK producers pay €10.5 for the EU intermediates. If the UK producer passes-through the tariff entirely, the export price of the final goods is €20.5. The EU then charges a 5 per cent tariff and the EU consumer consequently pays €21.525 for the imported final good, as opposed to the no-tariff price of €20. Hence a 5 per cent tariff on both intermediate and final imports implies a price increase for the final consumer equal to 7.625 per cent. Had there been no GVC relationship between the EU and the UK (i.e., if the final good was 100 per cent British value added) the impact of tariffs would have just been 5 per cent (i.e. the EU tariff on final imports from the UK). This is the tariff magnification effect of back-and-forth trade.

There is only one case in which there is no tariff magnification effect: this occurs if UK producers fully absorb import tariffs into their profits, and do not pass them through. In this case the export price of the final good from the UK to the EU would be €20 (as in the no-tariff scenario) and the final price €21. Yet UK firms' profits reduce by 5 per cent. Since firms' behaviour and, in particular, their pricing strategy is a complex issue that falls beyond the scope of this preliminary investigation, we assume that both European and British firms fully pass through tariffs into prices, since in a Leontief framework firms are price setters. This is also consistent with our partial-equilibrium approach and the nature of this study as an impact assessment exercise.²²

We are now ready to compute the cumulative tariffs induced by the new post-Brexit tariffs given the existing EU-UK GVC as mapped in WIOD.

Tables B.10 and B.11 show the cumulative tariffs on EU and UK merchandise

²²In the longer run firms will consider the existence of tariff in their sourcing decision and may consequently restructure their GVCs, substituting suppliers across the Channel with others located in third countries.

imports by sector, respectively. The cost-increase of EU imports of intermediate goods turns out to be sizable: while the average direct tariffs is 2.76 per cent, total cost-push effect turns out to be 3.15 per cent (tab. B.10). Thus, all else equal, around 12.6 per cent of the total cost-increase of EU imports of intermediates after Brexit is due to indirect backward inter-linkages.

Sectoral heterogeneity is substantial. The total cost of EU imports of intermediate goods in the motor vehicles and chemical sectors, which account for around 20 per cent of total imports of intermediates from the UK, increases by around 1 p.p., and the indirect effect accounts for around 16 per cent of the total increase. Traditional EU sectors seem less affected: indirect tariffs on food and textiles account just for 5 per cent of total cost-increase. In two sectors, mining and paper products, direct tariffs on intermediates, both for EU and UK imports, are almost zero, and the total costs are almost entirely due to the indirect backward linkages.

In turn, the indirect cost-increase of UK imports would be small: the difference between direct and total tariffs is just 0.05 p.p. (tab. B.11).

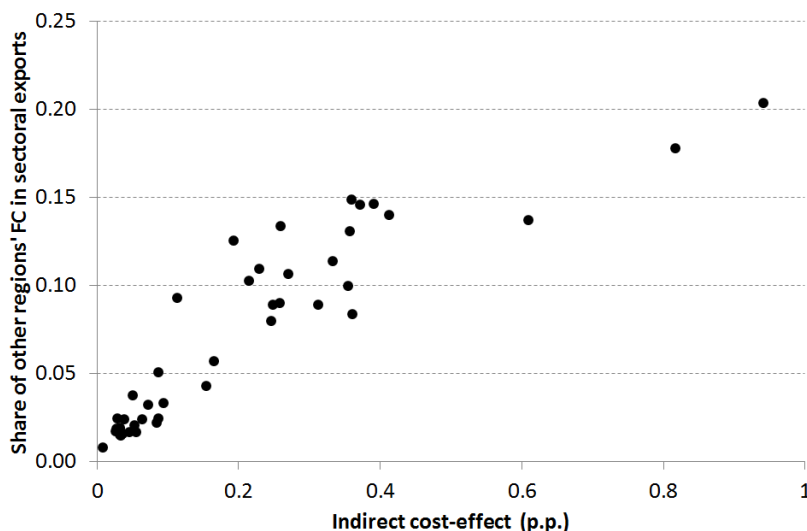
The total cost-increase is purely indirect for services sectors (Table B.12). Despite direct tariffs being absent by definition, services producers pay tariffs on imported intermediates goods. Again, the cost increase is on average around 0.1 p.p. for EU imports of services and even smaller for UK imports.

In Table B.13 we show the direct and indirect cost-increase for different Member countries. As for the UK, only the cost of the imports from Ireland seems to be higher due to indirect backward linkages (by around 0.22 p.p.). Instead, indirect costs on EU imports from the UK are higher on average, and range from 0.56 p.p. for Austria to 0.29 p.p. for Greece.

The magnification of direct costs measured as cumulative tariffs is clearly related to backward participation in the regional value chain. The higher indirect cost for EU importers is due to the fact that the EU exploits the UK to perform some processing stages and imports back these products. In this way, these intermediates cross the Channel twice, and thus tariffs are levied both directly, the first time that the goods are imported by the UK, and indirectly, once the goods are embedded in UK products imported by the EU. A proxy of this back-and-forth trade between the two regions is offered by the UK (EU) foreign value added in the bilateral exports to the EU (UK), seen in section 4, which is positively

correlated with the indirect cost-push effect at the sectoral level (fig. 7). This evidence suggest that if these tariffs are levied on EU imports after Brexit, the cost-increase might induce some EU producers to divert exports from the UK to other EU countries, in order to perform these processing stages within *Factory Europe*.

Figure 7: Other region's foreign content in exports and indirect cost effect



Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

Finally, we can compute the magnification effect in the trade flows with third countries. Table B.14 presents the cumulative tariffs that would arise in European and British exports and imports with other countries. For the UK tariff magnification will raise export costs towards Russia, Turkey and Mexico (by half of a percentage point), as well as towards large Commonwealth countries such as Australia (0.45 p.p.), India (0.36 p.p.) and Canada (0.32 p.p.),²³ whereas for EU exports the impact is very small. Not surprisingly, the effect of cumulated EU-UK tariffs on the import side is practically null for both economies.

Using the same analytical framework of the tariff magnification effect we can

²³The effect on Canada is likely to be an underestimate because the last available data, which we use, are for 2014, but in the meanwhile the Comprehensive Economic and Trade Agreement has entered into force, albeit provisionally.

compute the impact of (cumulative) tariffs on domestic production costs. Even if tariffs are levied only on goods and services crossing the Channel, it should be indeed clear that any intermediates coming from any country might directly or indirectly embed EU or UK goods on which a tariff has been imposed. Moreover, even domestic inputs embed intermediates that have been imported from the other side of the Channel.

In Table B.15 we show, for any country, the total cost increase of its manufacturing inputs, whichever their origin.²⁴ It turns out that in the UK the cost of manufacturing inputs increases by almost 0.9 p.p. when domestic and global value chains are taken into account, while the direct effect of tariffs is around 0.6 p.p. Instead, the overall impact on EU costs would be 0.08 p.p. However, the cost-increase is very heterogeneous across EU countries, and particularly high for Ireland (around 1 p.p.). These results are not surprising: around one fifth of the total manufacturing inputs, imported and domestic, used by the UK comes from the EU, while just 1.5 per cent of the total EU inputs are imported from the UK. In other words, size matters, and this is true also at the sectoral level (tab. B.16).

5.3 Export-side analysis: the cumulative resistance of export flows

In order to complement the analysis on the effect of post-Brexit tariffs, let us now adopt a totally different perspective, i.e. the one of the exporter. In this section we will try to answer the following question: What obstacles will exports face on their way to the destination? Here we aim at investigating this issue from the point of view of both the EU and the UK; we will concentrate on bilateral direct and indirect export flows, and consider the effect of tariffs on the EU-UK border after Brexit.

In this context, we consider the “full” bilateral relations between EU Member States and the UK by computing the cumulative tariffs at the origin and destination developed by Muradov (2017),²⁵ which allows to obtain an index of the

²⁴If we hold true the hypothesis full pass-through of tariffs, these figures for the cost increases are actual increases of the producers’ prices.

²⁵See Muradov (2017) for a formal derivation of these measures.

resistance of trade flows, defined as the sum of direct and indirect costs, that an exported product has to face on its path from the producer to the user. The intuition is very clear: in a GVC world one country's exports reach another both directly and indirectly, embedded in other country's exports (possibly more than one); in a traditional, "Ricardian" world, trade is just direct. Then, comparing direct and indirect costs determines how much additional resistance exports face along the GVC to reach the destination.

The logic behind this exercise is simple. Final or intermediate demand in the UK activates both direct and indirect exports from the EU. Direct exports directly satisfy the demand in the UK. Indirect exports are parts and components supplied to the (last) exporter in the UK. The opposite occurs to EU exports. As noted in section 4.2 the high interconnectedness within Factory Europe makes it worth investigating indirect exports as well as direct ones.

In our specific context we are interested in the impact of EU-UK bilateral tariffs, as these are the only changes in the tariff structure after Brexit.²⁶ In particular no tariff will be introduced within the Single Market and the transactions affected by the new tariffs will be just those involving the UK, on the one side, and any EU Member State, on the other.

Hence British exporters will face the new tariffs as soon as their goods leave the UK, while European exporters will face the new tariffs only when their goods enter the UK. Consequently, when we focus on the British exports to the EU we will compute the cumulative tariffs at the origin, while we will compute the cumulative tariffs at the destination for the EU exports to the UK.

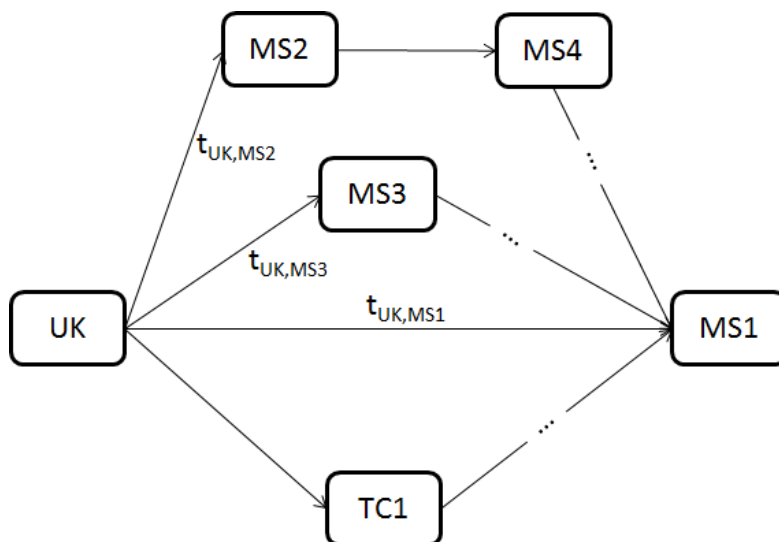
5.3.1 Resistance (at origin) of UK exports

Figure 8 provides an illustration of the typical UK exports to a given EU Member State. In order to record tariffs levied on British intermediate goods used by a given EU Member State (MS1), our analysis focuses on the UK and the perspective is forward-looking. The key point is that indirect tariffs on intermediates that will end up in MS1 are applied *as soon as inputs leave the UK*. Apart from the direct tariff ($t_{UK,MS1}$), the indirect tariffs ($t_{UK,MS2}$, $t_{UK,MS3}$) increase the resistance that

²⁶It may be that the tariffs the UK faces vis-a-vis third countries change as well, but we abstract from that.

this intermediates have to face to be delivered to MS1. Note that no new tariff is applied to British export to third countries, for instance to TC1.

Figure 8: Graphical representation of Muradov (2017) cumulative tariff at the origin

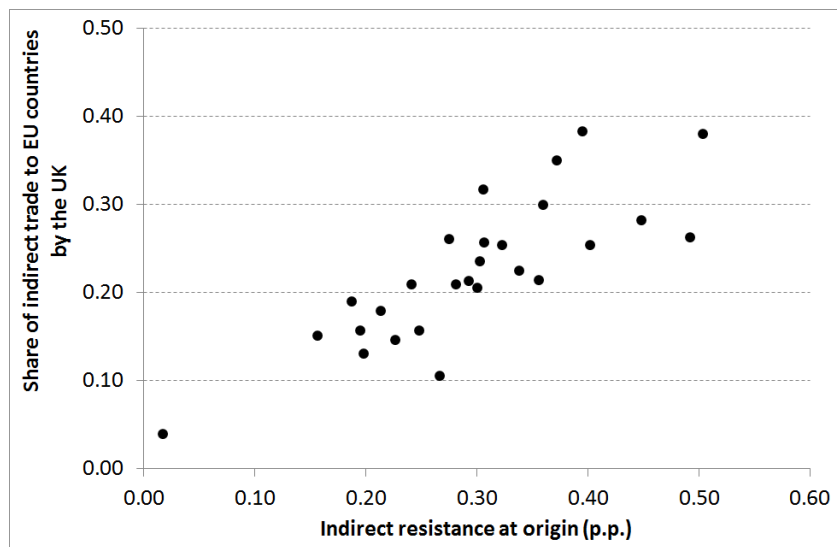


In Table B.17 we show the current dollar values of the direct tariffs and of the indirect tariffs at origin for British exports to the EU Member States. Indirect tariffs amount to a substantial part of the overall burden of the cumulative tariffs at the origin (around 20 per cent, on average). In fact, a relevant share of UK intermediates are first exported to some EU country, and then reach the EU destination only indirectly, as highlighted in section 4.2. Thus tariffs are levied not only on the direct trade from the UK to a certain EU market, but also indirectly, since UK products are first exported to other EU countries before reaching another EU destination.

For instance exports to Germany are levied by the largest burden in terms of both direct (\$526.1 million) and indirect tariffs (\$167.3 million), coherently with the central position of the German economy in *Factory Europe*. Given its proximity with the UK, the tariff burden with Ireland is essentially direct, whereas for Slovakia the burden of direct and indirect tariffs is approximately the same (almost \$ 10 millions).

Indeed the indirect tariff takes into account the fact that UK exploits the production structure of *Factory Europe* in order to reach a particular EU Member State. This reasoning is confirmed by the correlation between the indirect trade from the UK to EU countries through other EU countries exports, computed in section 4.2, and the resistance measure (Figure 9).

Figure 9: UK indirect trade to the EU and resistance by the origin

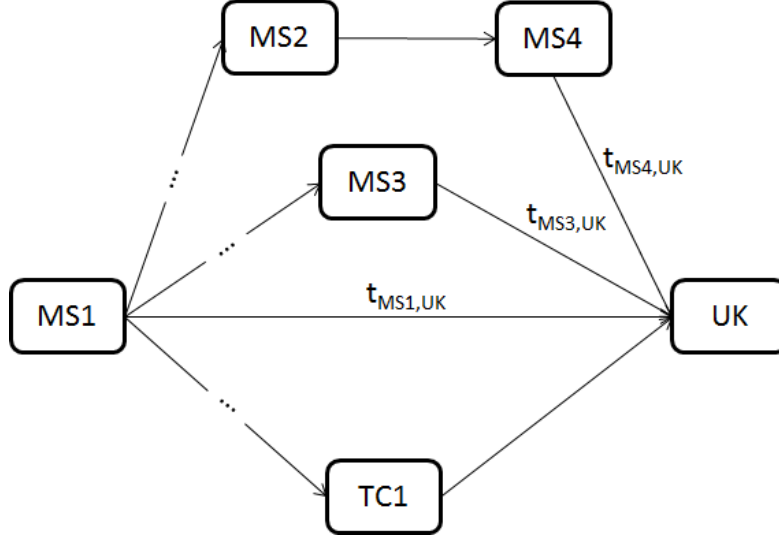


Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

5.3.2 Resistance (at destination) of EU exports

Figure 10 depicts the paths through which products of a given Member State, MS1, reach the UK. Now we focus on the UK and indirect tariffs are recorded with a backward-looking perspective, *when embodied inputs reach the UK*. It does not matter whether these intermediates are directly exported by MS1 or another EU Member State; the relevant unit of observation is the last shipment of goods and services. In this way, although by definition tariffs do not apply to services, if the last shipment concerns exports that embed services produced in MS1, an indirect tariff will be applied to them. Hence the relevant tariffs here are the direct tariff ($t_{MS1,UK}$) and the indirect tariffs through other EU countries ($t_{MS3,UK}$ and

Figure 10: Graphical representation of Muradov (2017) cumulative tariff at the destination

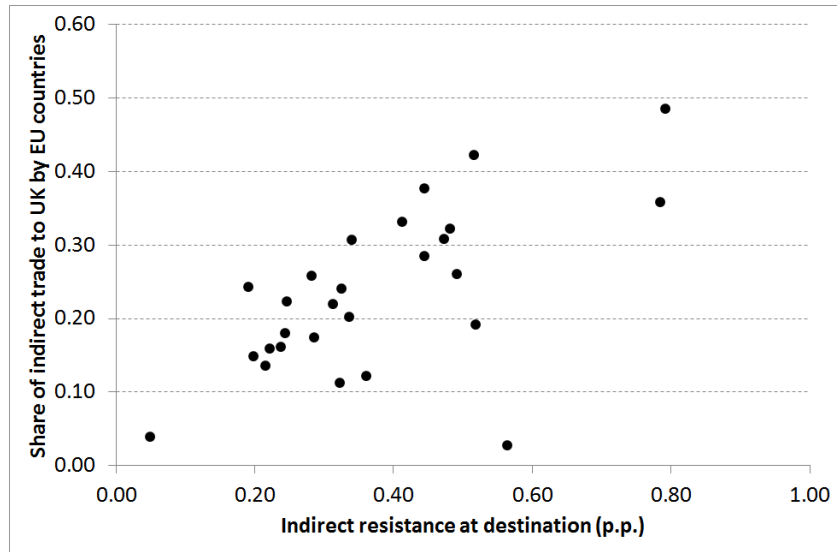


$t_{MS4,UK}$). Again, any path entering the UK from third countries provides no contribution, since we assume that those tariffs are not affected by Brexit.

Table B.18 shows the dollar values of direct tariff and of the indirect tariffs at destination for the EU products sold in the UK. The indirect tariff burden on UK imports computed with this latter methodology is not negligible: it accounts for 25 per cent of the total cost faced by British users of EU intermediates. German direct and indirect exports to the UK face the largest tariff burden (\$1248.1 and \$357.3 million, respectively), while Irish goods are essentially charged the direct tariffs only (amounting to \$417 million). Conversely, small countries, such as Cyprus, Luxembourg, Malta, Slovenia and Slovakia face very high indirect tariffs.

The indirect resistance for EU products is driven by the fact that EU countries deliver around 25 per cent of their products to the UK in an indirect way, through other EU countries' exports, as highlighted in section 4.2. Thus, these intermediates face an indirect tariff that is not immediately perceived by the EU exporting country. This is confirmed by the fact that the indirect trade to the UK through other EU countries exports, computed in section 4.2, is related to the resistance measure (Figure 11).

Figure 11: EU indirect trade to the UK and resistance by the destination



Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

Moreover, also EU services face tariffs at destination, entirely indirect, since they are embedded in other EU countries' intermediates goods exported to the UK.²⁷

6 Conclusions

On March 29th 2019 the United Kingdom (UK) will leave the European Union. The so-called Brexit will bear significant consequences for the dense network of Global Value Chains (GVC) that currently spans Europe, across the Channel.

In this paper we present, for the first time, a mapping of such networks, focusing in particular on those GVC that require back-and-forth trade between the UK and the rest of the Union. Up to two fifths of bilateral export flows are attributable to trade related to GVCs. We also uncover the indirect Brexit exposure arising from the dense network of intra-EU production and trade linkages.

We construct the whole schedule of tariffs that both the EU and the UK would

²⁷Conversely UK services exported to the EU face no tariff by definition.

apply to bilateral trade in case of a no free-trade agreement between the two economies. We assume that the UK replicates the tariffs currently used by the EU, depending on whether they apply to intermediate or final goods. Final-goods tariffs are usually higher than those levied on intermediates. Yet the failure to properly account for the back-and-forth-trade in EU-UK GVC may lead to significant underestimation of the actual impact of tariffs.

We compute various indicators of the impact of the indirect tariffs that span from the more traditional cost-push effect to indices of resistance for exporters. Our aim is to provide policy makers a measure of cost and resistance of trade flows that takes into account the whole EU-UK GVCs structure, in order to clarify the impact of barriers to trade in the negotiations for the future bilateral free trade agreement.

All in all, the total cost-push effect is much higher for the UK, as manufacturing input costs increase by around 0.9 p.p. The corresponding input costs in the EU would be only marginally affected (0.1 p.p). This result is due to the specific links between the two regions: around one fifth of the total manufacturing inputs, imported and domestic, used by the UK comes from the EU, while only 1.5 per cent of the total EU inputs are imported from the UK.

As to the import side, the total cost increase on imported intermediates faced by the EU and British exporters is of the same magnitude. However, tariff magnification due to GVC appears significant just for the European firms. This result is at a large extent due to the fact that the EU exploits the UK to perform some processing stages and imports back these intermediate products with the subsequent amplification of the tariff burden. In the longer run this could induce trade diversion away from the UK (for services the effect is small).

As to the export side, given the density of intra-EU linkages and the sizable share of indirect trade between the two regions, exporters in both the UK and the EU Member States face higher costs when the indirect trade is taken into account. In other words, the export path towards the destination matter and indirect routes entail tariffs that are not perceived by the exporters (as intra-EU trade is free of tariffs), but weigh around 20 per cent of the total costs.

More generally the methodology used in this paper is not Brexit-specific and it can be applied to any type of tariffs; obviously we expect that the magnification

effect will be higher, the larger the number of borders on which tariffs will be imposed.

Our analysis has some limitations. Firstly, we adopt a partial equilibrium approach and consequently exclude any trade creation and diversion potentially triggered by EU-UK bilateral tariffs. Secondly, it is an impact assessment exercise: in the long run we expect that an EU-UK Free Trade Agreement will be signed and tariff will return substantially to zero. Finally it concentrates only on tariff barriers.

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A Methodology

A.1 An primer on input-output

The analysis presented in section 3 exploits the basic accounting relationship of the Input-Output framework. In the inter-country Input-Output framework with M countries and N sectors, one can assume that a gross output of a country s is either absorbed in form of intermediate consumption (C) or final-good consumption (Y):

$$X_s = C\mu + Y\nu = \sum_r^M c_{sr} + \sum_r^M y_{sr}, \quad (1)$$

where X_s is an $N \times 1$ vector of gross output produced by N sectors in country s , C is a $N \times NM$ matrix of intermediate consumption according to country and sector of absorption, Y represents a $N \times M$ matrix of final consumption by country, μ and ν are $NM \times 1$ and $M \times 1$ vectors of ones respectively.

By dividing each country's intermediate consumption with its total gross product we can obtain an $NM \times NM$ matrix of direct input-output (I-O) coefficients A , where individual $N \times N$ block, A_{sr} , represents country r 's *production dependency* on inputs provided by sectors in country s . More specifically, the individual element of each block, $a(si, rj) = c(si, rj)/X_{rj}$, expresses the proportion of the total output of a sector j in country r , produced with inputs provided by sector i in country s . Using matrix of direct I-O coefficients we can re-express equation 1 as:

$$X = AX + Y \quad (2)$$

Following Leontief's (1936) seminal work, the solution for equation 2 is the Leontief inverse (B), which represents both direct and indirect output generated in different stages of production to meet additional unit of final consumption:

$$X = (I - A)^{-1}Y = BY \quad (3)$$

The starting point of the trade in value-added analysis is the augmentation of the above identity with direct value-added coefficients corresponding to each

particular sector in individual country. Direct value added coefficients capture the difference between a unit of final product, produced by a particular sector j in country r , and the share of intermediate goods used in the process, i.e. $V_{rj} = 1 - \sum_{i=1}^N \sum_{s \neq r}^M a_{si,rj}$. Moreover, let V_s be a $N \times N$ diagonal matrix with direct sectoral value-added coefficients for particular country on diagonal. The matrix representation of the value-added based input-output identity is then given by the following identity:

$$VX = VBY = \begin{bmatrix} V_1 & 0 & \dots & 0 \\ 0 & V_2 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & V_M \end{bmatrix} \begin{bmatrix} B_{11} & B_{12} & \dots & B_{1M} \\ B_{21} & B_{22} & \dots & B_{2M} \\ \vdots & \vdots & \ddots & \vdots \\ Y_{M1} & Y_{M2} & \dots & Y_{MM} \end{bmatrix} \begin{bmatrix} Y_{11} & Y_{12} & \dots & Y_{1M} \\ Y_{21} & Y_{22} & \dots & Y_{2M} \\ \vdots & \vdots & \ddots & \vdots \\ Y_{M1} & Y_{M2} & \dots & Y_{MM} \end{bmatrix} \quad (4)$$

Using the inter-country input-output framework derived above, we can define the total gross exports of a country s as:

$$E_s = \sum_{r \neq s}^G c_{sr} + \sum_{r \neq s}^G y_{sr} \quad (5)$$

Considering instead the country of absorption, where value-added produced in country s is eventually consumed, we can derive country s ' value-added exports as defined in Johnson and Noguera (2012):

$$VAE_s = \sum_{r \neq s}^G VX_{sr} = V_s \sum_{r \neq s}^G \sum_{g=1}^G B_{sg} Y_{gr} \quad (6)$$

When bilateral balances are of concern, sums are dropped and subindices s and r are assigned to specific countries of interest. The same inter-country I-O framework can be used to derive production dependency of a country s on products from abroad:

$$A^m(1 - A^d)^{-1}X_s/\tau'X_s, \quad (7)$$

with $A^m = \sum_{s \neq r}^M A_{sr}$ being a $N \times N$ matrix of direct input coefficients corresponding to non-domestic sectors, $A^d = A_{ss}$ is a $N \times N$ matrix of direct input coefficients corresponding to domestic sectors, and τ is a $N \times 1$ vector of ones.

By replacing vector of gross output X , corresponding to country s sectoral production, with vector of sectoral gross exports E , we obtain the import content of export as proposed by Hummels et al. (2001):

$$A^m(1 - A^d)^{-1}E_s/\tau'E_s \quad (8)$$

A.2 Calculation of post-Brexit tariffs

Building on Cappariello (2017), in this study we use data on the EU's applied MFN tariffs at the product level from the IDB-WTO database. This data source provides the *ad-valorem* tariffs (i.e. charged as a percentage of the value of the imported good) for over 5,000 product lines (defined according to the Harmonised System Nomenclature at 6-digit level, HS6).

However a number of products, mostly produced in the Food and live animals industry and accounting for about 6 per cent of the overall value of UK imports from the EU27, are levied by trade barriers different from tariffs expressed in terms of prices, such as quantity or weight-based tariffs or tariff rate quotas,²⁸. We have consequently integrated IDB- WTO data with information drawn from the International Trade Centre Market Access Map (ITC MAP), where the burden of these trade barriers has been converted into a common metric. More precisely this latter data set provides the *ad-valorem*-equivalent tariffs imposed on products charged with weight-based tariffs and, in the case of products levied by tariff rate quotas, information on tariffs applied to quantities both below and above the quota.²⁹

After having constructed the (very long) vector of tariffs, two more steps have been implemented.

First, the tariff rate for each product at the HS6 level has been classified according to the end-use of that product, final or intermediate, by using the Broad Economic Category Classification. Second, combining these tariff data with UN

²⁸In this case, imports below a specified quantity is charged at a lower tariff (the Inside Quota Tariff Rate, IQTR) and imports above that quantity at a higher one (the Outside Quota Tariff Rate, OQTR).

²⁹In the case of quotas, we utilise the IQTR under the assumption that the fill rate is lower than the quota, and the quota is not binding.

Comtrade data on trade flows in 2014, the average MFN tariffs for the 22 manufacturing sectors in WIOD – for both intermediate and final use – have been calculated by utilising product-level import values as weights.

In general this method suffers from an endogeneity bias, as the import values serving as weights depend on the tariffs themselves. That is, a high tariff rate for a given product may reduce the import value for that product, lowering the tariff rates contribution to the average tariff that is supposed to reflect the overall protection level of the product group. A low tariff produces the opposite effect. Yet, this critique does not apply to our case, because the imports flows are pre-tariffs (in 2014 the UK was still a member of the EU and hence no tariffs were levied on EU-UK trade).

A.3 Cumulative tariffs

Consider an import flow in sector i from country e to country m and assume that a direct tariff $t_{(e,i),m}$ is paid by country m at the last border. However, all the backward production linkages must be taken into account to compute the cumulative tariff. Producers in the exporting country e paid tariffs on the imported intermediate goods used to produce exports. The amount of foreign intermediates embedded in exports is retrieved by the matrix of technical coefficients A . Each element measures the share of input from a country-sector pair needed to produce one unit of output in another country-sector pair. In other words, each supplier g in sector s provides $a_{(g,s),(e,i)}$ unit of intermediate goods to country e to produce one unit of sector i goods. Thus, the exporter in country-sector (e,i) has paid a tariff on the imported intermediates:

$$\sum_{g,s} a_{(g,s),(e,i)} t_{(g,s),e} \quad (9)$$

We can go further upstream and compute the tariffs paid by the g countries for the imports used to produce the exports destined to country e , that is:

$$\sum_{g,s,j,u} a_{(g,s),(e,i)} a_{(j,u),(g,s)} t_{(j,u),g} \quad (10)$$

At this stage, the cumulative tariff on country m is:

$$t_{(e,i),m} + \sum_{g,s} a_{(g,s),(e,i)} t_{(g,s),e} + \sum_{g,s,j,u} a_{(g,s),(e,i)} a_{(j,u),(g,s)} t_{(j,u),g} \quad (11)$$

The total cumulative tariff paid on an import flow along the entire backward production chain is obtained iterating this process to the infinity. In practice, all the direct and indirect uses of foreign intermediates in the production of one unit of imports are taken into account by the global Leontief inverse, B , that is

$$\lim_{n \rightarrow \infty} A^n = (I - A)^{-1} = B. \quad (12)$$

Thus, the *cumulative cost of trade barriers on intermediates* is hence defined as the sum of direct tariffs at the last border and direct and indirect tariffs on intermediates needed to produce this import flow, as follows:³⁰

$$CT_{interm} = T_{interm} + (e(A \circ T_{interm})B)' e \quad (13)$$

where T_{interm} is the tariff matrix for intermediate goods, A is the matrix of technical coefficients, e a conformable row vector of ones; B the global Leontief inverse matrix, and \circ indicates the Hadamard (or element-by-element) product between matrices.

Note that CT_{interm} is a matrix, whose e, m -th element indicates the cumulative tariff that country m faces in importing directly and indirectly intermediate goods from country e . In other terms, e, m -th element is the total cost-push effect on imported intermediate goods from country e to country m . Finally, we can compute the indirect tariff share on total tariffs as: $ITS_{interm} = 1 - T_{interm}/CT_{interm}$.

³⁰See Rouzet and Miroudot (2013) for a formal proof.

B Tables

Table B.1: Gross and value-added exports by country

| | Export to UK | | UK Export | |
|-------------|--------------|-------------|-----------|-------------|
| | gross | value-added | gross | value-added |
| Austria | 2.6 | 3.7 | 0.5 | 0.6 |
| Belgium | 7.3 | 7.5 | 2.8 | 2.0 |
| Bulgaria | 2.4 | 3.5 | 0.1 | 0.1 |
| Croatia | 2.4 | 3.3 | 0.1 | 0.1 |
| Cyprus | 3.8 | 7.1 | 0.1 | 0.1 |
| Czech Rep. | 4.2 | 5.2 | 0.4 | 0.4 |
| Denmark | 6.3 | 6.8 | 1.1 | 0.9 |
| Estonia | 2.5 | 3.6 | 0.1 | 0.1 |
| Finland | 4.3 | 4.6 | 0.5 | 0.5 |
| France | 7.9 | 8.1 | 6.2 | 6.0 |
| Germany | 6.1 | 6.6 | 7.2 | 6.4 |
| Greece | 3.2 | 3.7 | 0.3 | 0.5 |
| Hungary | 3.9 | 4.9 | 0.3 | 0.2 |
| Ireland | 14.2 | 13.4 | 4.6 | 2.6 |
| Italy | 5.7 | 6.4 | 2.9 | 3.1 |
| Latvia | 4.5 | 5.1 | 0.1 | 0.1 |
| Lithuania | 3.9 | 3.5 | 0.1 | 0.1 |
| Luxembourg | 2.7 | 4.1 | 3.2 | 0.4 |
| Malta | 29.2 | 26.3 | 0.3 | 0.1 |
| Netherlands | 7.6 | 7.8 | 3.1 | 2.3 |
| Poland | 5.6 | 6.4 | 1.0 | 1.0 |
| Portugal | 5.0 | 5.4 | 0.4 | 0.5 |
| Romania | 2.8 | 3.9 | 0.2 | 0.3 |
| Slovakia | 5.6 | 7.6 | 0.1 | 0.1 |
| Slovenia | 1.9 | 3.0 | 0.1 | 0.1 |
| Spain | 5.5 | 5.8 | 1.7 | 1.8 |
| Sweden | 5.1 | 5.2 | 1.6 | 1.4 |
| EU | 6.3 | 6.7 | 38.9 | 31.6 |

Note: Percentage of total gross and value-added exports. Source: Calculations on WIOD data.

Table B.2: Production dependency by country

| | EU on UK | | UK on EU | |
|-------------|----------|--------|----------|--------|
| | Total | Export | Total | Export |
| Austria | 0.4 | 0.6 | 0.1 | 0.2 |
| Belgium | 1.9 | 2.5 | 0.5 | 0.7 |
| Bulgaria | 0.5 | 0.6 | 0.0 | 0.0 |
| Croatia | 0.5 | 0.5 | 0.0 | 0.0 |
| Cyprus | 1.5 | 2.0 | 0.0 | 0.0 |
| Czech Rep. | 0.6 | 0.9 | 0.1 | 0.2 |
| Denmark | 1.5 | 1.9 | 0.2 | 0.3 |
| Estonia | 0.6 | 0.7 | 0.0 | 0.0 |
| Finland | 0.8 | 1.2 | 0.1 | 0.1 |
| France | 1.1 | 1.6 | 1.2 | 1.6 |
| Germany | 0.8 | 1.2 | 1.7 | 2.5 |
| Greece | 0.5 | 0.7 | 0.0 | 0.1 |
| Hungary | 0.7 | 0.9 | 0.1 | 0.1 |
| Ireland | 6.0 | 6.4 | 0.5 | 0.6 |
| Italy | 0.6 | 0.9 | 0.5 | 0.8 |
| Latvia | 0.6 | 0.7 | 0.0 | 0.0 |
| Lithuania | 0.3 | 0.4 | 0.0 | 0.0 |
| Luxembourg | 16.5 | 18.0 | 0.1 | 0.1 |
| Malta | 8.0 | 10.0 | 0.0 | 0.0 |
| Netherlands | 1.3 | 1.8 | 1.0 | 1.3 |
| Poland | 0.6 | 0.7 | 0.2 | 0.3 |
| Portugal | 0.7 | 0.9 | 0.1 | 0.1 |
| Romania | 0.4 | 0.5 | 0.0 | 0.0 |
| Slovakia | 0.3 | 0.4 | 0.1 | 0.1 |
| Slovenia | 0.4 | 0.6 | 0.0 | 0.0 |
| Spain | 0.5 | 0.9 | 0.3 | 0.5 |
| Sweden | 1.1 | 1.8 | 0.3 | 0.4 |
| EU | 1.1 | 1.8 | 7.4 | 10.0 |

Source: Calculations on WIOD data.

Table B.3: Decomposition of GVC-related UK exports to EU by sector

| | Total | <i>of which:</i> Foreign Content | | <i>of which:</i> Domestic Content | |
|--------------------------------|-------|--|---|---|---|
| | | | <i>of which:</i> Foreign Content from EU | | <i>of which:</i> Reflection to UK |
| Crop and animal productions | 44.0 | 19.1 | 8.9 | 24.8 | 6.9 |
| Forestry and logging | 60.8 | 30.2 | 14.6 | 30.6 | 8.8 |
| Fishing and aquaculture | 36.6 | 23.4 | 8.0 | 13.2 | 3.2 |
| Mining and quarrying | 44.9 | 14.7 | 5.1 | 30.2 | 4.4 |
| Food products and beverages | 35.4 | 20.1 | 10.0 | 15.3 | 4.9 |
| Textiles and wearing apparel | 30.2 | 18.0 | 8.4 | 12.2 | 1.6 |
| Wood and products of wood | 45.4 | 27.0 | 14.6 | 18.4 | 4.4 |
| Paper products | 47.8 | 24.6 | 13.4 | 23.1 | 4.9 |
| Printing and recorded media | 37.5 | 18.9 | 10.2 | 18.7 | 3.2 |
| Coke and petroleum | 67.7 | 47.7 | 12.6 | 20.0 | 2.0 |
| Chemical products | 56.9 | 34.7 | 17.8 | 22.2 | 2.6 |
| Pharmaceutical products | 23.7 | 16.4 | 9.3 | 7.3 | 1.1 |
| Rubber and plastics | 46.7 | 25.8 | 13.7 | 20.9 | 3.1 |
| Mineral products | 39.2 | 25.8 | 11.4 | 13.3 | 1.9 |
| Basic metals | 67.0 | 41.0 | 14.9 | 26.0 | 2.8 |
| Fabricated metal products | 41.6 | 21.7 | 8.9 | 19.9 | 2.7 |
| Computer and optical products | 43.0 | 28.6 | 11.0 | 14.4 | 1.7 |
| Electrical equipment | 46.1 | 30.6 | 14.0 | 15.6 | 1.9 |
| Machinery and equipment | 42.0 | 27.3 | 13.1 | 14.8 | 1.7 |
| Motor vehicles | 46.4 | 37.4 | 20.4 | 9.0 | 1.2 |
| Other transport equipment | 61.4 | 33.4 | 10.7 | 28.0 | 2.8 |
| Furniture; other manufacturing | 29.8 | 19.8 | 9.0 | 10.0 | 2.0 |

Note: Percentage of total exports (both GVC-related and not). Source: Calculations on WIOD data.

Table B.4: Decomposition of GVC-related EU exports to UK by sector

| | Total | | | | |
|--------------------------------|-------|--|---|---|---|
| | | <i>of which:</i> Foreign Content | <i>of which:</i> Foreign Content from UK | <i>of which:</i> Domestic Content | <i>of which:</i> Reflection to EU |
| Crop and animal productions | 36.4 | 29.6 | 5.7 | 6.8 | 2.2 |
| Forestry and logging | 29.9 | 15.5 | 3.2 | 14.4 | 4.7 |
| Fishing and aquaculture | 35.0 | 20.9 | 3.3 | 14.1 | 5.0 |
| Mining and quarrying | 35.4 | 7.9 | 0.8 | 27.5 | 8.5 |
| Food products and beverages | 28.1 | 24.7 | 4.3 | 3.4 | 0.8 |
| Textiles and wearing apparel | 24.3 | 18.1 | 1.7 | 6.2 | 1.9 |
| Wood and products of wood | 32.9 | 16.1 | 2.1 | 16.8 | 5.2 |
| Paper products | 38.0 | 15.4 | 1.7 | 22.6 | 7.6 |
| Printing and recorded media | 40.6 | 23.2 | 2.4 | 17.4 | 5.6 |
| Coke and petroleum | 63.2 | 49.1 | 3.8 | 14.1 | 3.9 |
| Chemical products | 53.5 | 25.1 | 2.5 | 28.4 | 9.6 |
| Pharmaceutical products | 26.1 | 18.1 | 1.7 | 8.0 | 2.8 |
| Rubber and plastics | 40.9 | 18.2 | 2.2 | 22.7 | 7.4 |
| Mineral products | 32.7 | 17.5 | 1.9 | 15.2 | 4.7 |
| Basic metals | 68.4 | 24.7 | 2.4 | 43.8 | 11.0 |
| Fabricated metal products | 40.2 | 14.7 | 1.7 | 25.4 | 7.0 |
| Computer and optical products | 43.1 | 29.4 | 1.9 | 13.7 | 4.1 |
| Electrical equipment | 36.4 | 17.3 | 1.6 | 19.1 | 5.8 |
| Machinery and equipment | 34.7 | 15.8 | 1.5 | 18.8 | 5.3 |
| Motor vehicles | 29.7 | 16.7 | 1.7 | 13.0 | 3.9 |
| Other transport equipment | 31.1 | 21.2 | 2.4 | 9.9 | 1.3 |
| Furniture; other manufacturing | 20.4 | 13.5 | 1.5 | 6.9 | 1.9 |

Note: Percentage of total exports (both GVC-related and not). Source: Calculations on WIOD data.

Table B.5: Trade linkages between the UK and the EU Member States

| | UK EXPORTS | | | EU EXPORTS | | |
|-------------|------------|------------------------------|------------------------------|------------|------------------------------|------------------------------|
| | direct | through Factory Europe | trough other countries | direct | through Factory Europe | trough other countries |
| Austria | 52.2 | 38.2 | 9.5 | 55.1 | 37.7 | 7.2 |
| Belgium | 76.6 | 17.9 | 5.5 | 78.6 | 18.0 | 3.4 |
| Bulgaria | 64.2 | 25.7 | 10.1 | 59.5 | 28.4 | 12.0 |
| Croatia | 64.2 | 26.3 | 9.5 | 63.9 | 26.0 | 10.1 |
| Cyprus | 83.2 | 13.1 | 3.8 | 46.7 | 48.5 | 4.8 |
| Czeck Rep. | 62.2 | 29.9 | 7.9 | 64.1 | 33.1 | 2.8 |
| Denmark | 78.5 | 15.7 | 5.8 | 82.6 | 12.2 | 5.2 |
| Estonia | 68.1 | 25.3 | 6.5 | 59.7 | 30.8 | 9.5 |
| Finland | 72.5 | 21.3 | 6.1 | 66.6 | 25.8 | 7.6 |
| France | 80.0 | 14.6 | 5.5 | 82.7 | 13.6 | 3.7 |
| Germany | 71.9 | 20.9 | 7.2 | 79.7 | 15.9 | 4.5 |
| Greece | 68.3 | 21.4 | 10.3 | 72.8 | 11.3 | 15.9 |
| Hungary | 63.4 | 28.2 | 8.4 | 66.0 | 30.7 | 3.3 |
| Ireland | 92.9 | 3.9 | 3.2 | 92.7 | 3.9 | 3.4 |
| Italy | 72.3 | 20.5 | 7.2 | 79.3 | 16.2 | 4.5 |
| Latvia | 67.4 | 25.4 | 7.2 | 72.5 | 20.2 | 7.3 |
| Lithuania | 61.8 | 26.1 | 12.2 | 65.1 | 24.3 | 10.6 |
| Luxembourg | 85.7 | 10.5 | 3.8 | 55.5 | 35.8 | 8.8 |
| Malta | 81.7 | 15.7 | 2.6 | 96.4 | 2.8 | 0.8 |
| Netherlands | 78.7 | 15.1 | 6.2 | 75.1 | 21.9 | 3.0 |
| Poland | 69.8 | 23.5 | 6.7 | 72.9 | 24.1 | 3.1 |
| Portugal | 71.4 | 22.4 | 6.2 | 76.0 | 17.4 | 6.6 |
| Romania | 58.0 | 31.7 | 10.3 | 59.7 | 32.2 | 8.1 |
| Slovakia | 48.0 | 38.0 | 14.0 | 78.8 | 19.2 | 2.0 |
| Slovenia | 50.7 | 35.0 | 14.3 | 50.6 | 42.2 | 7.2 |
| Spain | 70.5 | 20.9 | 8.6 | 80.2 | 14.8 | 5.1 |
| Sweden | 76.0 | 18.9 | 5.1 | 69.1 | 22.3 | 8.5 |
| EU | 75.5 | 18.1 | 6.4 | 78.4 | 17.2 | 4.4 |

Note: Percentage of value added exports (both GVC-related and not). Source: Calculations on WIOD data.

Table B.6: EU imports from the UK by sector

| | final | tariff inter- med. | total | share final | inter- med. |
|--------------------------------|-------|--------------------------|-------|----------------|----------------|
| Crop and animal productions | 9.8 | 1.7 | 3.7 | 0.39 | 1.14 |
| Forestry and logging | 4.0 | 0.1 | 0.6 | 0.01 | 0.05 |
| Fishing and aquaculture | 9.5 | 2.8 | 4.9 | 0.17 | 0.37 |
| Mining and quarrying | 0.0 | 0.0 | 0.0 | 0.32 | 7.36 |
| Food products and beverages | 13.5 | 7.4 | 11.1 | 6.04 | 3.78 |
| Textiles and wearing apparel | 10.5 | 6.4 | 8.8 | 1.56 | 1.18 |
| Wood and products of wood | 1.3 | 4.1 | 3.7 | 0.03 | 0.23 |
| Paper products | 0.6 | 0.1 | 0.2 | 0.24 | 0.91 |
| Printing and recorded media | 0.0 | 0.6 | 0.4 | 0.15 | 0.30 |
| Coke and petroleum | 0.0 | 2.4 | 2.0 | 0.90 | 4.11 |
| Chemical products | 2.5 | 4.4 | 4.0 | 2.08 | 8.90 |
| Pharmaceutical products | 0.0 | 0.4 | 0.1 | 4.45 | 2.77 |
| Rubber and plastics | 6.0 | 5.2 | 5.3 | 0.55 | 3.37 |
| Mineral products | 9.4 | 3.0 | 4.0 | 0.17 | 1.01 |
| Basic metals | 0.0 | 1.7 | 1.6 | 0.09 | 6.09 |
| Fabricated metal products | 3.4 | 2.8 | 2.9 | 0.45 | 1.37 |
| Computer and optical products | 1.4 | 0.9 | 1.2 | 3.33 | 3.63 |
| Electrical equipment | 2.7 | 2.3 | 2.5 | 1.20 | 2.65 |
| Machinery and equipment | 1.6 | 2.1 | 1.9 | 4.23 | 4.32 |
| Motor vehicles | 10.0 | 4.5 | 8.2 | 7.90 | 3.66 |
| Other transport equipment | 3.7 | 2.8 | 3.0 | 0.87 | 4.22 |
| Furniture; other manufacturing | 1.3 | 1.0 | 1.2 | 2.08 | 1.36 |
| TOTAL MANUFACTURING | 5.8 | 2.8 | 3.9 | 37.21 | 62.79 |

Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

Table B.7: UK imports from the EU by sector

| | final | tariff inter- med. | total | share final | inter- med. |
|--------------------------------|-------|--------------------------|-------|----------------|----------------|
| Crop and animal productions | 7.8 | 1.0 | 5.5 | 2.24 | 1.14 |
| Forestry and logging | 10.4 | 0.2 | 1.5 | 0.01 | 0.05 |
| Fishing and aquaculture | 10.0 | 4.2 | 6.3 | 0.01 | 0.02 |
| Mining and quarrying | 0.0 | 0.0 | 0.0 | 0.02 | 1.20 |
| Food products and beverages | 18.7 | 11.2 | 17.6 | 11.74 | 1.86 |
| Textiles and wearing apparel | 9.9 | 6.2 | 9.2 | 2.79 | 0.70 |
| Wood and products of wood | 1.6 | 2.2 | 2.2 | 0.06 | 1.08 |
| Paper products | 1.6 | 0.0 | 0.2 | 0.31 | 2.00 |
| Printing and recorded media | 0.0 | 0.3 | 0.2 | 0.03 | 0.08 |
| Coke and petroleum | 0.0 | 2.4 | 1.8 | 1.08 | 3.52 |
| Chemical products | 2.3 | 4.8 | 4.4 | 1.48 | 6.75 |
| Pharmaceutical products | 0.0 | 0.7 | 0.4 | 2.38 | 4.99 |
| Rubber and plastics | 5.8 | 5.3 | 5.4 | 0.56 | 2.76 |
| Mineral products | 10.1 | 3.1 | 3.7 | 0.12 | 1.19 |
| Basic metals | 0.0 | 2.2 | 2.0 | 0.25 | 2.56 |
| Fabricated metal products | 3.1 | 2.8 | 2.9 | 0.94 | 2.02 |
| Computer and optical products | 2.5 | 1.4 | 1.8 | 2.50 | 4.23 |
| Electrical equipment | 2.7 | 2.5 | 2.6 | 1.31 | 2.59 |
| Machinery and equipment | 1.7 | 1.9 | 1.8 | 4.36 | 3.73 |
| Motor vehicles | 10.0 | 5.9 | 8.6 | 11.56 | 5.83 |
| Other transport equipment | 5.2 | 3.0 | 4.8 | 3.85 | 0.90 |
| Furniture; other manufacturing | 1.5 | 1.3 | 1.5 | 2.51 | 0.69 |
| TOTAL MANUFACTURING | 8.6 | 3.2 | 5.9 | 50.10 | 49.90 |

Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

Table B.8: UK imports from the EU by country

| | final | tariff inter- med. | total | share final | inter- med. |
|-------------|-------|--------------------------|-------|----------------|----------------|
| Austria | 5.9 | 3.1 | 4.3 | 0.62 | 0.82 |
| Belgium | 8.9 | 3.8 | 6.2 | 3.12 | 3.51 |
| Bulgaria | 6.4 | 3.6 | 4.8 | 0.06 | 0.07 |
| Croatia | 16.9 | 2.8 | 7.8 | 0.02 | 0.05 |
| Cyprus | 12.3 | 1.5 | 9.9 | 0.02 | 0.01 |
| Czeck Rep. | 7.7 | 2.5 | 5.2 | 1.03 | 1.01 |
| Denmark | 9.6 | 1.5 | 5.8 | 1.13 | 1.02 |
| Estonia | 2.3 | 1.7 | 1.8 | 0.02 | 0.07 |
| Finland | 1.5 | 1.9 | 1.8 | 0.32 | 0.98 |
| France | 6.7 | 3.8 | 5.3 | 6.11 | 5.81 |
| Germany | 7.5 | 3.0 | 5.2 | 14.97 | 14.99 |
| Greece | 6.5 | 3.5 | 5.0 | 0.09 | 0.10 |
| Hungary | 6.3 | 3.3 | 4.6 | 0.51 | 0.66 |
| Ireland | 17.4 | 4.4 | 12.8 | 6.04 | 3.36 |
| Italy | 6.9 | 3.4 | 5.4 | 4.94 | 3.89 |
| Latvia | 4.5 | 1.4 | 1.8 | 0.02 | 0.11 |
| Lithuania | 6.0 | 3.2 | 4.2 | 0.15 | 0.27 |
| Luxembourg | 4.8 | 2.2 | 2.7 | 0.02 | 0.07 |
| Malta | 3.9 | 2.2 | 3.0 | 0.01 | 0.01 |
| Netherlands | 7.5 | 2.8 | 4.5 | 3.15 | 5.62 |
| Poland | 7.8 | 3.1 | 5.5 | 1.71 | 1.66 |
| Portugal | 9.3 | 3.7 | 6.8 | 0.51 | 0.41 |
| Romania | 8.9 | 3.0 | 6.3 | 0.27 | 0.21 |
| Slovakia | 10.1 | 3.4 | 8.4 | 0.64 | 0.21 |
| Slovenia | 3.8 | 2.8 | 3.2 | 0.06 | 0.09 |
| Spain | 8.6 | 4.0 | 6.6 | 3.49 | 2.62 |
| Sweden | 3.2 | 2.2 | 2.5 | 1.08 | 2.27 |
| EU | 8.6 | 3.2 | 5.9 | 50.10 | 49.90 |

Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

Table B.9: EU imports from the UK by country

| | final | tariff inter- med. | total | share final | inter- med. |
|-------------|-------|--------------------------|-------|----------------|----------------|
| Austria | 5.1 | 3.8 | 4.3 | 0.52 | 0.77 |
| Belgium | 6.3 | 3.0 | 4.1 | 2.29 | 4.32 |
| Bulgaria | 4.1 | 3.5 | 3.8 | 0.16 | 0.13 |
| Croatia | 4.0 | 3.5 | 3.8 | 0.07 | 0.04 |
| Cyprus | 9.2 | 2.5 | 8.0 | 0.26 | 0.06 |
| Czeck Rep. | 4.3 | 2.9 | 3.4 | 0.43 | 0.93 |
| Denmark | 4.2 | 2.8 | 3.2 | 0.77 | 1.65 |
| Estonia | 2.8 | 3.1 | 2.9 | 0.13 | 0.07 |
| Finland | 5.8 | 2.2 | 3.6 | 0.53 | 0.87 |
| France | 5.8 | 2.4 | 3.6 | 5.04 | 8.97 |
| Germany | 5.0 | 2.6 | 3.4 | 7.93 | 15.72 |
| Greece | 5.8 | 1.8 | 4.7 | 0.59 | 0.25 |
| Hungary | 7.0 | 2.5 | 3.9 | 0.25 | 0.53 |
| Ireland | 6.7 | 4.0 | 5.0 | 4.67 | 7.82 |
| Italy | 6.1 | 2.3 | 3.7 | 2.50 | 4.36 |
| Latvia | 4.3 | 3.0 | 3.8 | 0.11 | 0.07 |
| Lithuania | 4.9 | 3.3 | 4.2 | 0.15 | 0.12 |
| Luxembourg | 5.7 | 3.7 | 4.0 | 0.05 | 0.31 |
| Malta | 8.1 | 2.2 | 5.3 | 0.11 | 0.10 |
| Netherlands | 7.3 | 3.1 | 4.6 | 3.25 | 5.99 |
| Poland | 4.1 | 3.1 | 3.6 | 1.52 | 1.63 |
| Portugal | 5.9 | 2.3 | 4.1 | 0.53 | 0.52 |
| Romania | 3.1 | 3.7 | 3.5 | 0.25 | 0.37 |
| Slovakia | 3.8 | 3.1 | 3.3 | 0.13 | 0.24 |
| Slovenia | 4.8 | 3.6 | 4.1 | 0.07 | 0.10 |
| Spain | 5.9 | 1.8 | 3.7 | 3.22 | 3.90 |
| Sweden | 5.5 | 2.0 | 3.3 | 1.69 | 2.96 |
| EU | 5.8 | 2.8 | 3.9 | 37.21 | 62.79 |

Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

Table B.10: Tariff magnification effect - cumulated tariffs on goods.

EU imports from the UK

| | simple tariff | cumulated tariff | difference in p.p. |
|--------------------------------|------------------|---------------------|-----------------------|
| Crop and animal productions | 1.69 | 2.00 | 0.31 |
| Forestry and logging | 0.06 | 0.43 | 0.37 |
| Fishing and aquaculture | 2.78 | 3.03 | 0.25 |
| Mining and quarrying | 0.00 | 0.09 | 0.09 |
| Food products and beverages | 7.44 | 7.79 | 0.35 |
| Textiles and wearing apparel | 6.39 | 6.75 | 0.36 |
| Wood and products of wood | 4.08 | 4.47 | 0.39 |
| Paper products | 0.05 | 0.31 | 0.26 |
| Printing and recorded media | 0.61 | 0.83 | 0.22 |
| Coke and petroleum | 2.44 | 2.63 | 0.19 |
| Chemical products | 4.40 | 5.22 | 0.82 |
| Pharmaceutical products | 0.38 | 0.49 | 0.11 |
| Rubber and plastics | 5.19 | 5.80 | 0.61 |
| Mineral products | 3.04 | 3.37 | 0.33 |
| Basic metals | 1.67 | 2.03 | 0.36 |
| Fabricated metal products | 2.76 | 3.01 | 0.25 |
| Computer and optical products | 0.94 | 1.17 | 0.23 |
| Electrical equipment | 2.33 | 2.74 | 0.41 |
| Machinery and equipment | 2.09 | 2.45 | 0.36 |
| Motor vehicles | 4.52 | 5.46 | 0.94 |
| Other transport equipment | 2.83 | 3.10 | 0.27 |
| Furniture; other manufacturing | 1.02 | 1.27 | 0.26 |
| TOTAL MANUFACTURING | 2.76 | 3.15 | 0.40 |

Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

Table B.11: Tariff magnification effect - cumulated tariffs on goods.

UK imports from the EU

| | simple tariff | cumulated tariff | difference in p.p. |
|--------------------------------|------------------|---------------------|-----------------------|
| Crop and animal productions | 0.95 | 1.12 | 0.17 |
| Forestry and logging | 0.18 | 0.25 | 0.07 |
| Fishing and aquaculture | 4.17 | 4.27 | 0.09 |
| Mining and quarrying | 0.00 | 0.01 | 0.01 |
| Food products and beverages | 11.20 | 11.36 | 0.15 |
| Textiles and wearing apparel | 6.21 | 6.25 | 0.05 |
| Wood and products of wood | 2.23 | 2.28 | 0.05 |
| Paper products | 0.02 | 0.05 | 0.03 |
| Printing and recorded media | 0.33 | 0.36 | 0.03 |
| Coke and petroleum | 2.40 | 2.45 | 0.05 |
| Chemical products | 4.83 | 4.92 | 0.09 |
| Pharmaceutical products | 0.65 | 0.68 | 0.03 |
| Rubber and plastics | 5.32 | 5.40 | 0.08 |
| Mineral products | 3.12 | 3.15 | 0.03 |
| Basic metals | 2.16 | 2.19 | 0.04 |
| Fabricated metal products | 2.77 | 2.80 | 0.03 |
| Computer and optical products | 1.42 | 1.45 | 0.03 |
| Electrical equipment | 2.50 | 2.54 | 0.04 |
| Machinery and equipment | 1.92 | 1.96 | 0.03 |
| Motor vehicles | 5.92 | 5.98 | 0.06 |
| Other transport equipment | 2.98 | 3.04 | 0.06 |
| Furniture; other manufacturing | 1.29 | 1.32 | 0.03 |
| TOTAL MANUFACTURING | 3.22 | 3.27 | 0.05 |

Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

Table B.12: Tariff magnification effect - cumulated tariffs on services

| | UK imports from the EU | EU imports from the UK |
|-------------------------------|---------------------------|---------------------------|
| Repair and installation | 0.03 | 0.23 |
| Electricity, gas and steam | 0.01 | 0.13 |
| Water collection | 0.01 | 0.08 |
| Sewerage; waste collection | 0.01 | 0.08 |
| Construction | 0.03 | 0.18 |
| Motor vehicle trade | 0.02 | 0.26 |
| Wholesale trade | 0.01 | 0.11 |
| Retail trade | 0.01 | 0.09 |
| Land transport and pipelines | 0.02 | 0.15 |
| Water transport | 0.02 | 0.07 |
| Air transport | 0.05 | 0.12 |
| Warehousing | 0.01 | 0.08 |
| Postal and courier | 0.01 | 0.11 |
| Accommod. and food service | 0.02 | 0.22 |
| Publishing activities | 0.07 | 0.09 |
| Picture, video and TV | 0.01 | 0.08 |
| Telecommunications | 0.01 | 0.13 |
| Computer programming | 0.01 | 0.05 |
| Financial service activities | 0.01 | 0.04 |
| Insurance and pension fund | 0.01 | 0.05 |
| Auxiliary services | 0.02 | 0.05 |
| Real estate activities | 0.00 | 0.03 |
| Legal and accounting | 0.01 | 0.04 |
| Architectural and engineering | 0.01 | 0.05 |
| Scientific research | 0.01 | 0.08 |
| Advertising | 0.01 | 0.06 |
| Other professional activities | 0.01 | 0.06 |
| Administrative activities | 0.01 | 0.10 |
| Public administration | 0.01 | 0.08 |
| Education | 0.00 | 0.05 |
| Human health; Social work | 0.01 | 0.11 |
| Other service activities | 0.01 | 0.06 |
| Other activities | 0.00 | 0.00 |
| TOTAL SERVICES | 0.01 | 0.08 |

Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

Table B.13: Tariff magnification effect - cumulated tariffs by country

| | UK imports of goods | | | Goods imports from the UK | | |
|-------------|------------------------|------------------|--------------------|------------------------------|------------------|--------------------|
| | simple tariff | cumul. tariff | differ. in p.p. | simple tariff | cumul. tariff | differ. in p.p. |
| Austria | 3.1 | 3.1 | 0.04 | 3.8 | 4.3 | 0.56 |
| Belgium | 3.8 | 3.9 | 0.08 | 3.0 | 3.4 | 0.42 |
| Bulgaria | 3.6 | 3.7 | 0.02 | 3.5 | 3.9 | 0.46 |
| Croatia | 2.8 | 2.8 | 0.01 | 3.5 | 4.0 | 0.53 |
| Cyprus | 1.5 | 1.5 | 0.03 | 2.5 | 2.8 | 0.33 |
| Czech Rep. | 2.5 | 2.6 | 0.04 | 2.9 | 3.4 | 0.45 |
| Denmark | 1.5 | 1.5 | 0.03 | 2.8 | 3.1 | 0.35 |
| Estonia | 1.7 | 1.7 | 0.02 | 3.1 | 3.5 | 0.45 |
| Finland | 1.9 | 1.9 | 0.03 | 2.2 | 2.6 | 0.38 |
| France | 3.8 | 3.9 | 0.04 | 2.4 | 2.8 | 0.38 |
| Germany | 3.0 | 3.0 | 0.04 | 2.6 | 3.0 | 0.42 |
| Greece | 3.5 | 3.6 | 0.01 | 1.8 | 2.1 | 0.29 |
| Hungary | 3.3 | 3.3 | 0.03 | 2.5 | 2.9 | 0.41 |
| Ireland | 4.4 | 4.7 | 0.22 | 4.0 | 4.3 | 0.36 |
| Italy | 3.4 | 3.4 | 0.03 | 2.3 | 2.7 | 0.40 |
| Latvia | 1.4 | 1.5 | 0.01 | 3.0 | 3.3 | 0.35 |
| Lithuania | 3.2 | 3.2 | 0.02 | 3.3 | 3.8 | 0.45 |
| Luxembourg | 2.2 | 2.2 | 0.05 | 3.7 | 4.1 | 0.40 |
| Malta | 2.2 | 2.3 | 0.07 | 2.2 | 2.5 | 0.35 |
| Netherlands | 2.8 | 2.8 | 0.08 | 3.1 | 3.5 | 0.42 |
| Poland | 3.1 | 3.1 | 0.03 | 3.1 | 3.5 | 0.43 |
| Portugal | 3.7 | 3.8 | 0.03 | 2.3 | 2.7 | 0.39 |
| Romania | 3.0 | 3.0 | 0.03 | 3.7 | 4.2 | 0.48 |
| Slovakia | 3.4 | 3.4 | 0.03 | 3.1 | 3.5 | 0.48 |
| Slovenia | 2.8 | 2.9 | 0.03 | 3.6 | 4.0 | 0.41 |
| Spain | 4.0 | 4.0 | 0.03 | 1.8 | 2.2 | 0.34 |
| Sweden | 2.2 | 2.3 | 0.03 | 2.0 | 2.4 | 0.34 |
| EU | 3.2 | 3.3 | 0.05 | 2.8 | 3.2 | 0.40 |

Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

Table B.14: Tariff magnification effect - cumulated tariffs to third countries

| | UK exports | UK imports | EU exports | EU imports |
|-------------------|---------------|---------------|---------------|---------------|
| Australia | 0.45 | 0.00 | 0.04 | 0.00 |
| Brazil | 0.44 | 0.00 | 0.04 | 0.00 |
| Canada | 0.32 | 0.00 | 0.04 | 0.00 |
| Chile | 0.46 | 0.01 | 0.04 | 0.02 |
| China | 0.37 | 0.00 | 0.04 | 0.00 |
| India | 0.36 | 0.01 | 0.04 | 0.00 |
| Indonesia | 0.43 | 0.00 | 0.04 | 0.00 |
| Japan | 0.36 | 0.00 | 0.04 | 0.00 |
| Mexico | 0.48 | 0.00 | 0.05 | 0.00 |
| Norway | 0.33 | 0.00 | 0.04 | 0.01 |
| Russia | 0.54 | 0.00 | 0.04 | 0.00 |
| South Korea | 0.26 | 0.00 | 0.04 | 0.00 |
| Taiwan | 0.39 | 0.00 | 0.04 | 0.00 |
| Turkey | 0.53 | 0.01 | 0.04 | 0.01 |
| USA | 0.39 | 0.00 | 0.05 | 0.00 |
| Rest of the world | 0.29 | 0.00 | 0.04 | 0.00 |

Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

Table B.15: Cost increase due to manufacturing inputs: by country

| | without GVC | with GVC | share of indirect costs |
|-------------------|-------------|----------|----------------------------|
| United Kingdom | 0.64 | 0.86 | 25.72 |
| Austria | 0.02 | 0.06 | 55.35 |
| Belgium | 0.09 | 0.14 | 36.62 |
| Bulgaria | 0.02 | 0.04 | 50.60 |
| Cyprus | 0.04 | 0.06 | 36.18 |
| Czech Rep. | 0.03 | 0.06 | 55.77 |
| Germany | 0.04 | 0.08 | 48.59 |
| Denmark | 0.07 | 0.10 | 37.20 |
| Spain | 0.02 | 0.04 | 57.44 |
| Estonia | 0.02 | 0.05 | 52.44 |
| Finland | 0.02 | 0.05 | 55.04 |
| France | 0.04 | 0.07 | 47.38 |
| Greece | 0.01 | 0.02 | 54.01 |
| Croatia | 0.01 | 0.03 | 60.47 |
| Hungary | 0.02 | 0.05 | 58.73 |
| Ireland | 0.83 | 0.96 | 14.07 |
| Italy | 0.02 | 0.04 | 58.56 |
| Lithuania | 0.03 | 0.05 | 44.87 |
| Luxembourg | 0.14 | 0.20 | 28.81 |
| Latvia | 0.02 | 0.04 | 47.79 |
| Malta | 0.08 | 0.12 | 34.38 |
| Netherlands | 0.08 | 0.12 | 35.56 |
| Poland | 0.02 | 0.05 | 55.73 |
| Portugal | 0.02 | 0.04 | 55.70 |
| Romania | 0.02 | 0.04 | 50.64 |
| Slovakia | 0.01 | 0.04 | 65.93 |
| Slovenia | 0.02 | 0.05 | 52.16 |
| Sweden | 0.05 | 0.09 | 43.14 |
| EU | 0.04 | 0.08 | 44.06 |
| Australia | 0.00 | 0.01 | 100.00 |
| Brazil | 0.00 | 0.00 | 100.00 |
| Canada | 0.00 | 0.01 | 100.00 |
| Chile | 0.00 | 0.03 | 100.00 |
| China | 0.00 | 0.00 | 100.00 |
| Indonesia | 0.00 | 0.00 | 100.00 |
| India | 0.00 | 0.00 | 100.00 |
| Japan | 0.00 | 0.00 | 100.00 |
| South Korea | 0.00 | 0.00 | 100.00 |
| Mexico | 0.00 | 0.00 | 100.00 |
| Norway | 0.00 | 0.03 | 100.00 |
| Russia | 0.00 | 0.01 | 100.00 |
| Turkey | 0.00 | 0.01 | 100.00 |
| Taiwan | 0.00 | 0.00 | 100.00 |
| USA | 0.00 | 0.01 | 100.00 |
| Rest of the world | 0.00 | 0.01 | 100.00 |

Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

Table B.16: Cost increase due to manufacturing inputs: by sector

| | United Kingdom | | | European Union | | |
|--------------------------------|----------------|-------------|-------------------------------|----------------|-------------|-------------------------------|
| | without GVC | with GVC | share of indirect costs | without GVC | with GVC | share of indirect costs |
| Crop and animal productions | 0.1 | 0.4 | 73.12 | 0.0 | 0.0 | 76.55 |
| Forestry and logging | 0.0 | 0.3 | 94.37 | 0.0 | 0.0 | 98.83 |
| Fishing and aquaculture | 0.2 | 0.3 | 50.64 | 0.1 | 0.2 | 20.23 |
| Mining and quarrying | 0.0 | 0.0 | 99.79 | 0.0 | 0.0 | 99.68 |
| Food products and beverages | 0.6 | 0.9 | 36.19 | 0.1 | 0.1 | 26.96 |
| Textiles and wearing apparel | 0.9 | 1.2 | 21.05 | 0.1 | 0.1 | 25.30 |
| Wood and products of wood | 0.5 | 0.8 | 37.48 | 0.0 | 0.0 | 64.59 |
| Paper products | 0.0 | 0.2 | 97.42 | 0.0 | 0.0 | 98.50 |
| Printing and recorded media | 0.0 | 0.2 | 97.45 | 0.0 | 0.0 | 87.60 |
| Coke and petroleum | 0.6 | 0.7 | 10.47 | 0.0 | 0.1 | 46.65 |
| Chemical products | 1.8 | 2.2 | 18.74 | 0.1 | 0.2 | 41.52 |
| Pharmaceutical products | 0.3 | 0.3 | 15.46 | 0.0 | 0.0 | 63.36 |
| Rubber and plastics | 1.1 | 1.5 | 29.23 | 0.1 | 0.1 | 41.58 |
| Mineral products | 0.4 | 0.6 | 42.95 | 0.0 | 0.0 | 51.00 |
| Basic metals | 0.7 | 0.7 | 4.81 | 0.0 | 0.1 | 53.65 |
| Fabricated metal products | 0.3 | 0.5 | 40.92 | 0.0 | 0.0 | 67.76 |
| Computer and optical products | 0.4 | 0.4 | 15.08 | 0.0 | 0.0 | 46.32 |
| Electrical equipment | 0.9 | 1.1 | 13.95 | 0.0 | 0.1 | 43.24 |
| Machinery and equipment | 0.6 | 0.8 | 22.13 | 0.0 | 0.1 | 43.73 |
| Motor vehicles | 2.5 | 3.0 | 14.77 | 0.1 | 0.1 | 46.26 |
| Other transport equipment | 0.4 | 0.5 | 15.27 | 0.2 | 0.2 | 25.56 |
| Furniture; other manufacturing | 0.2 | 0.4 | 56.79 | 0.0 | 0.1 | 59.27 |

Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

Table B.17: Cumulated tariffs at origin by country: UK exports

| | value of direct tariff | value of indirect tariff | share of indirect tariff on total |
|-------------|------------------------------|--------------------------------|--|
| Austria | 37.9 | 24.8 | 0.40 |
| Belgium | 167.4 | 45.4 | 0.21 |
| Bulgaria | 6.0 | 2.7 | 0.31 |
| Croatia | 2.0 | 1.9 | 0.49 |
| Cyprus | 1.8 | 0.5 | 0.20 |
| Czech Rep. | 35.6 | 20.0 | 0.36 |
| Denmark | 60.6 | 14.7 | 0.20 |
| Estonia | 2.8 | 1.9 | 0.40 |
| Finland | 25.0 | 10.4 | 0.29 |
| France | 284.4 | 83.5 | 0.23 |
| Germany | 526.1 | 167.3 | 0.24 |
| Greece | 5.7 | 3.2 | 0.36 |
| Hungary | 17.2 | 14.0 | 0.45 |
| Ireland | 407.4 | 7.1 | 0.02 |
| Italy | 132.9 | 57.1 | 0.30 |
| Latvia | 2.5 | 1.2 | 0.32 |
| Lithuania | 5.2 | 2.0 | 0.28 |
| Luxembourg | 15.2 | 5.5 | 0.27 |
| Malta | 2.7 | 0.9 | 0.25 |
| Netherlands | 242.2 | 45.0 | 0.16 |
| Poland | 65.5 | 28.5 | 0.30 |
| Portugal | 15.6 | 8.0 | 0.34 |
| Romania | 18.1 | 8.0 | 0.31 |
| Slovakia | 9.7 | 9.8 | 0.50 |
| Slovenia | 4.6 | 2.7 | 0.37 |
| Spain | 93.5 | 36.6 | 0.28 |
| Sweden | 78.7 | 18.2 | 0.19 |
| EU total | 2266.4 | 620.8 | 0.22 |

Note: EU Total is the sum of the Member States. Tariff values in millions of current US dollars. Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

Table B.18: Cumulated tariffs at destination by country: EU exports

| | value of direct tariff | value of indirect tariff | share of indirect tariff on total |
|-------------|------------------------------|--------------------------------|--|
| Austria | 70.8 | 56.7 | 0.44 |
| Belgium | 374.5 | 120.7 | 0.24 |
| Bulgaria | 7.4 | 6.0 | 0.45 |
| Croatia | 3.5 | 3.4 | 0.49 |
| Cyprus | 0.2 | 0.8 | 0.79 |
| Czech Rep. | 70.9 | 49.8 | 0.41 |
| Denmark | 43.1 | 24.4 | 0.36 |
| Estonia | 3.2 | 2.9 | 0.47 |
| Finland | 52.3 | 20.6 | 0.28 |
| France | 621.9 | 170.7 | 0.22 |
| Germany | 1248.1 | 357.3 | 0.22 |
| Greece | 9.7 | 4.7 | 0.32 |
| Hungary | 60.2 | 31.0 | 0.34 |
| Ireland | 417.0 | 21.9 | 0.05 |
| Italy | 371.7 | 116.2 | 0.24 |
| Latvia | 4.5 | 2.3 | 0.34 |
| Lithuania | 24.4 | 5.8 | 0.19 |
| Luxembourg | 4.4 | 16.1 | 0.78 |
| Malta | 0.9 | 1.2 | 0.56 |
| Netherlands | 432.3 | 197.1 | 0.31 |
| Poland | 144.1 | 69.6 | 0.33 |
| Portugal | 43.1 | 17.3 | 0.29 |
| Romania | 17.5 | 16.3 | 0.48 |
| Slovakia | 19.6 | 21.1 | 0.52 |
| Slovenia | 6.9 | 7.4 | 0.52 |
| Spain | 293.1 | 72.4 | 0.20 |
| Sweden | 142.0 | 46.4 | 0.25 |
| EU total | 4487.4 | 1459.8 | 0.25 |

Note: EU Total is the sum of the Member States. Tariff values in millions of current US dollars. Source: Calculations on WTO-IDB database and ITC Market Access Map for tariffs, and Comtrade and WIOD for trade.

C List of countries and sectors

We consider all the countries included in the WIOD database:

- **European Union (EU):** Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.
- **United Kingdom (UK).**
- **Rest of World:** Australia, Brazil, Canada, Chile, China, India, Indonesia, Japan, Mexico, Norway, Poland, Romania, Russia, South Korea, Sweden, Turkey, Taiwan, USA, Rest of the World.

Table C.19: List of WIOD sectors: Manufacturing

| Code | Description |
|---------|--------------------------------|
| A01 | Crop and animal productions |
| A02 | Forestry and logging |
| A03 | Fishing and aquaculture |
| B | Mining and quarrying |
| C10-C12 | Food products and beverages |
| C13-C15 | Textiles and wearing apparel |
| C16 | Wood and products of wood |
| C17 | Paper products |
| C18 | Printing and recorded media |
| C19 | Coke and petroleum |
| C20 | Chemical products |
| C21 | Pharmaceutical products |
| C22 | Rubber and plastics |
| C23 | Mineral products |
| C24 | Basic metals |
| C25 | Fabricated metal products |
| C26 | Computer and optical products |
| C27 | Electrical equipment |
| C28 | Machinery and equipment |
| C29 | Motor vehicles |
| C30 | Other transport equipment |
| C31-C32 | Furniture; other manufacturing |

Table C.20: List of WIOD sectors: Services

| Code | Description |
|---------|--------------------------------|
| C33 | Repair and installation |
| D35 | Electricity, gas and steam |
| E36 | Water collection |
| E37-E39 | Sewerage; waste collection |
| F | Construction |
| G45 | Motor vehicle trade |
| G46 | Wholesale trade |
| G47 | Retail trade |
| H49 | Land transport and pipelines |
| H50 | Water transport |
| H51 | Air transport |
| H52 | Warehousing |
| H53 | Postal and courier |
| I | Accommodation and food service |
| J58 | Publishing activities |
| J59-J60 | Picture, video and TV |
| J61 | Telecommunications |
| J62-J63 | Computer programming |
| K64 | Financial service activities |
| K65 | Insurance and pension fund |
| K66 | Auxiliary services |
| L68 | Real estate activities |
| M69-M70 | Legal and accounting |
| M71 | Architectural and engineering |
| M72 | Scientific research |
| M73 | Advertising |
| M74-M75 | Other professional activities |
| N | Administrative activities |
| O84 | Public administration |
| P85 | Education |
| Q | Human health and social work |
| R-S | Other service activities |