US trade policy in numbers: how exposed is the EU?

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Abstract

Amid lingering uncertainty on future US trade policies towards the EU, this study provides a preliminary assessment of the implications of a change in US trade tariffs for the EU, with a particular focus on Italy. By examining detailed trade flows and matching over 5.000 products to effective tariffs, the work quantifies – both at the aggregate and sectoral level – actual average tariffs on trade in final goods and intermediates between the European Union and the US. Although US goods' tariffs are generally lower than those imposed by partners, this asymmetry is not as marked for the EU. In addition, this study evaluates the direct and indirect exposure of the EU's and its major countries' GDP to alternative scenarios of US tariff hikes. By exploiting the methodology for value-added accounting of trade flows developed in Borin and Mancini (2019), the paper finds that a change in US tariffs would affect around 2.8 per cent of total EU GDP. The EU GDP potentially affected by US tariffs only on automotive imports would be 0.4 per cent. The overall Italian exposure would be just below, 0.3 per cent, around 10 per cent in terms of the value-added produced in the motor vehicles sector.

Contents

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1. Introduction and main results

In 2018 following a sequence of radical changes in US trade policy, implemented and announced by the Trump administration, and the threat of retaliation by the other countries, trade policy uncertainty increased substantially. This discontinuity comes after at least two decades of stability: tariffs had remained relatively stable globally, and trade liberalizations had progressed only within Preferential Trade Agreements (PTAs). However, the US response was not completely unexpected: negotiations at multilateral trading tables had failed to trigger renewed impetus for tariff reductions, comparable to the one recorded in the post-World War II period. Furthermore, the failure of the post-Doha round in 2008, the slowdown in liberalisation of services trade and, more recently, the increasing use of non-tariff barriers, were all telling signals of a crisis in the making.

The Trump administration used this impasse to unilaterally address the misgivings which had long been discussed about the functioning of the multilateral trading system. On the one hand, the persistently large US external imbalance was used as proof of bias against the US in the functioning of the WTO and pre-existing free trade agreements. On the other, the high bilateral trade deficit *vis-à-vis* China was purported as resulting from unfair trade practices, in particular forced intellectual property transfers from multinational companies investing in China, and from the use of state subsidies and extensive non-tariff barriers.

The US adopted a three-pronged strategy. The first entailed a unilateral increase in tariffs on steel, aluminium, washing machines and solar panels targeting a wide range of countries. [2] By invoking in an unprecedented manner a WTO security clause, this move constituted a clear threat to the multilateral trading system at large, raising serious concerns among the US's historical trading partners like Japan and the EU, more so after the US administration threatened to impose a 25 per cent tariff also on all imports of autos and parts. Second, the US administration increased tariff rates on a subset of goods imports from China, and threatened a much more extensive action. These moves were justified on the basis of several domestic trade laws. Third, it renegotiated the US participation in the North American Free Trade agreement with Mexico and Canada which had been in place since 1994. Under the new agreement (USMCA) Canada and Mexico will be shielded from any new auto tariffs.

In July 2018 President Trump and European Commission President Jean-Claude Juncker announced the beginning of negotiations to reduce tariffs and other barriers to US-EU trade in industrial goods, excluding cars. Specifically, the US would not impose tariffs on European cars as long as negotiations are ongoing, while the EU would try to increase imports of US liquefied natural gas and soybeans. However, future US moves on tariffs would depend on the outcome of negotiations with the EU. Nevertheless, the investigation of the US Trade Representative (USTR) into auto tariffs concluded that there was a national security case for actions to adjust automotive imports. On these findings, last May President Trump gave to the USTR 180 days, ending 13 November, to pursue negotiations with trading partners, including the EU, before taking any action.[3] If the US were to move forward with the tariffs on auto

[2] Considering the antidumping/countervailing duties already imposed on a number of specific products and countries, the tariffs introduced in 2018 on steel, aluminium, washing machines, and solar panels hit about 3 per cent of total US imports (Bown and Zhang, 2019).

[3] It is hard to predict how the negotiations will turn out: the two sides have published conflicting directives, with the U.S. demanding the inclusion of agriculture in the talks and the EU categorically excluding it. The EU has also rejected voluntary export restrictions, such as quotas, that the U.S. could use to mitigate the alleged threat from car imports, given their inconsistency with WTO rules and the difficulty of the allocation among EU countries of any export quota.

vehicles, proportional retaliation from the EU is likely to follow. It remains unclear how far the Trump administration will go toward raising tariffs and which strategy it will use.

This study estimates the relative tariff rates at aggregate, sectorial and country level that are currently levied on trade flows between the two areas. Moreover, the study quantifies the exposure to US tariffs of EU countries under three scenarios of US tariffs on all imports from the EU only, on all imports from anywhere and on auto imports from anywhere. The exposure is measured as the share of a country's GDP that could be affected by US tariffs both directly - through the country's export to the US - and indirectly - through other countries' exports to the US - taking into account the global value chain structure. These estimates provide interesting insights on the consequences of alternative scenarios of future EU-US trade relationships.

First, we document a wide asymmetry between the levels of the tariffs applied by the US and its trade partners: US goods' tariffs are generally lower than those imposed by partners. This asymmetry is not as marked for the EU, with the notable exception of the automotive sector where indeed tariff rates levied on EU vehicles imported in the US are (at 2.5 per cent) one-fourth of those imposed on US cars entering the EU (10 per cent). Given the specialization of German exports in the automotive sector, if the US administration were to quadruple its tariffs to those levied by the EU on US cars, the average duty rate on total German exports to the US would rise from 1.5 to 3.0 per cent. An increase of the US tariff on cars to 25 per cent would instead imply a rise of the average tariff on German products up to 6 per cent.

Second, by taking into account the sectoral composition of bilateral US-EU trade and the EU countries' participation in regional value chains, we calculate that, on average, a change in US tariffs hitting all EU imports would potentially affect around 2.3 per cent of total EU GDP, one fifth of this being exposed indirectly through the exports of other EU countries. The share of Italy's GDP that could be harmed by an escalation of US tariffs on EU imports is around 2.0 per cent, below Germany's (3.1 per cent). In the second scenario, featuring US tariffs on all imports, the overall exposure for EU countries would be obviously higher (2.8 per cent), since in this case the indirect exposure is determined not only by the EU economies' participation in regional value chain but also by their overall integration in global value chains, that is, by their value added embedded in all other countries' exports to the US. The exposure for Italy is only marginally higher than in the first scenario. In the third scenario, envisaging an increase of US tariffs only on automotive imports, the EU GDP potentially affected would be 0.4 per cent. Germany is the most exposed economy (at around 1 per cent of its GDP) whereas the Italian exposure would be just below the EU average (0.3 per cent of total Italian GDP, around 10 per cent in terms of the value-added produced in the motor vehicles sector). There is, however, some heterogeneity in the channels through which the individual countries would be affected, reflecting their different production linkages within the EU: Germany's exposure is mostly direct, while the other EU economies - including Italy - rely heavily on European value chains to export to the US.

The paper is organized as follows. In section 2 we explain the methodology and describe the data we use to calculate the average tariffs. In section 3 we present the US bilateral tariffs on trade with its major trade partners and in section 4 we focus on tariffs on trade flows between US and EU at the sector level. In section 5 we describe the US trade with each EU member states. Section 6 presents the accounting framework and the methodology used to assess the exposure of the EU countries in terms of GDP to a change in the US tariffs. The results are reported in Section 7. Section 8 presents some concluding remarks.

2. Measuring Effectively Applied Tariffs with the US

We calculate the average tariffs on trade flows between the US and other commercial partners by using information on the Effectively Applied Tariffs from the WTO-IDB database provided by the World Integrated Trade Solution (WITS) software. In WITS the Effectively Applied Tariffs is defined as the lowest available tariff: if a preferential tariff exists, it is used, otherwise the Most Favoured Nation (MFN) tariff is adopted. We compute average tariffs using as weights the import values at the product level defined according to the Harmonized System Nomenclature (HS). Data and methodology to calculate average tariffs are described in Appendix B.

Different average tariffs among areas or countries depend on different duty schedules due to specific bilateral agreements or on a distinct set of tariff-free products. Moreover, they reflect the composition of trade flows with, in general, higher tariffs levied on final products than on intermediates. Although trade-weighted tariff averages can provide important information on the exposure of a country's exports to potential changes in the tariff policy of another country, these figures should be treated with caution. Trade-weighted averages can be affected by an endogeneity bias, as the import values used as weights depend on the tariffs themselves. That is, a high tariff rate for a certain product may reduce the import value for that product, lowering its 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.

Therefore, our metrics could be defined as an import-weighted average of the "applied" product-level tariff rates. It is lower than the "unweighted average of MFN rates" that instead represents a measure of the price of entry to a country's market because it does not incorporate preferential tariff rates from existing preferential trade agreement (PTA) and does not reflect the bias toward lower tariffs on more heavily imported goods.

We limit our analysis to non-agricultural products because agricultural goods are frequently levied by "quantity or weight based tariffs" (applied as a charge per unit quantity or by weight) and "tariff rate quotas" (imports below a specified quantity are charged at a lower tariff and imports above that quantity at a higher one). For these goods the estimation of the *ad valorem* tariffs (measured as percentage of the value of the good imported) needs further assumptions.

3. The US and its major trade partners

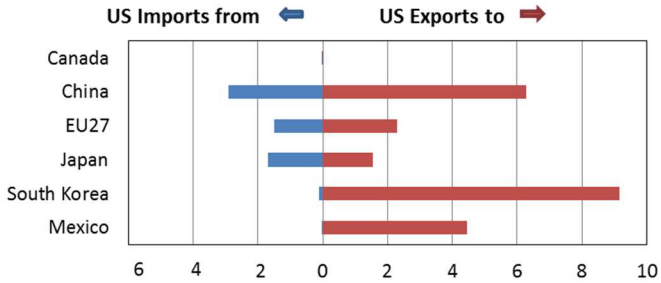
Figure 1 illustrates the average tariff rates imposed on non-agricultural products imported by the US from its main commercial partners and, vice versa, on the US exports towards its partners based on the bilateral effectively applied tariffs. These averages are elaborated on the tariff schedules applied by countries in 2016; the only exceptions are China and Mexico for which the latest years available are respectively 2015 and 2017.

It is apparent that the US tariffs are in most cases substantially lower than the corresponding tariff applied by its partners. This asymmetrical US tariff policy can be partly explained by historical reasons. Indeed the United States has been committed for more than half a century to maintaining an open market (Irwin, 2017). Tariffs on goods shipped from the EU, the second US largest supplier, average 1.5 per cent. Even the average tariff imposed at the onset of the US-China trade war on products imported from China, the first exporter to the US market, turns out to be rather low, at 3 per cent. Tariff-free trade with Mexico and Canada has been made possible by NAFTA, which progressively eliminated all duties and quantitative restrictions, with the exception of those on a limited number of agricultural products. The average US tariff on imports from Japan, a country whose specific bilateral trade issues are

currently being addressed after the US president withdrew from the Trans-Pacific Partnership (TTP), is 1.7 per cent.

Figure 1 –Tariffs on non-agricultural products traded by main US partners in 2016

(in percentage)



Source: Elaborations on WTO-IDB database. For China and Mexico data refer respectively to 2015 and 2017.

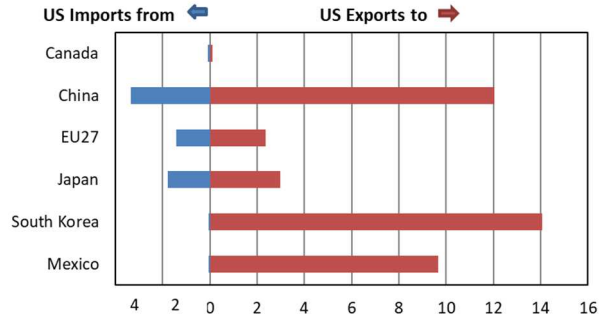
Turning to US exports towards its main partners, the tariff variability is larger, with a rather high average level levied by China (6.7 per cent) and a low one by Japan (1.6 per cent). The figure shows distinctly that before the US trade policy turn the potential for the US to increase tariffs in response to China's relatively protectionist trade policy was considerable.[4] As to the EU, the first export market for the US, the estimated average tariff is 2.2 per cent. Regarding South Korea, which is currently the sixth largest US trading partner, the duties on US exports are still high, but on a downward trend, despite the trade agreement entered into force in 2012.

In order to evaluate the extent to which tariffs affect both consumers and producers in the US and in its main trade partners, we disentangle the statistics shown in figure 1 into their end-use detail.[5] Figures 2a and 2b display the average bilateral tariffs that, according to our estimates, are applied to US imports (exports) from (to) the main commercial partners, with the detail for final use and intermediates.

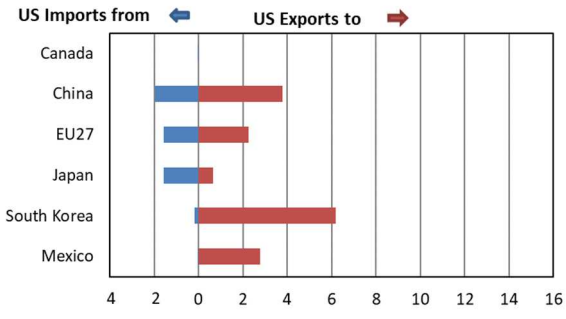
Figure 2 –Tariffs on non-agricultural products traded by main US partners by end-use

(in percentage)

(a) Final goods



(b) Intermediates



Source: Elaborations on WTO-IDB database.

Looking at US exports, it is clear that products for final consumption face much higher tariffs than components. This holds in particular for US sales to China. Considering the US

[4] Since the beginning of 2018 there has been a significant and progressive increase of the US tariffs on Chinese imports and, vice versa, of the Chinese ones on the US products. This process is still ongoing. Bown (2019) has estimated that, in less than two years, the US has increased the average tariff on Chinese imports above 24 percent, from an average of only 3 per cent. On the other side, the China's average tariff applied to US exports will increase to 25.9 percent on December 2019 after the China's latest response to Trump's actions, the re-application of massive tariffs on US autos and parts announced in August, will take place.

[5] More than half of the goods targeted by the 2018 US tariffs were intermediate inputs (see Bown and Zhang, 2019). It is worthwhile noticing that over the last 20 years countries have generally lowered their tariffs on imported parts and components to improve the competitiveness of their firms. The Trump administration has departed significantly from this approach.

import side, in general the difference in tariffs applied to final goods and intermediates is less pronounced and, symmetrically with exports, is more accentuated for products imported from China.

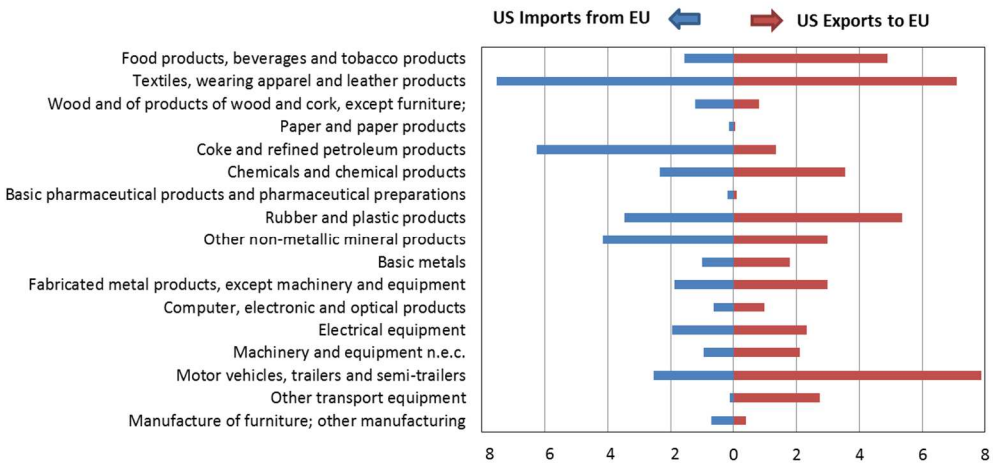
It is important to highlight that the share of final goods on total US imports is higher than the corresponding share on exports: for example, more than half of the imports from Europe and Japan are goods for final consumption whereas, on the other side, such goods account for just one third of total US exports to these two areas. This discrepancy reflects the internationalization approach of US firms and, in particular, of US multinationals, which tend to enter foreign markets by establishing their own plants rather than by exporting. Regarding trade with China, the discrepancy between US imports and exports in terms of the share of final goods is even wider: almost 70 per cent of products imported by the US are final, vs. about one-third of goods exported. The large share of components exported to China is related to the peculiar role of China as a processing economy in global value chains.

4. Tariffs in EU-US trade by sector

An escalation of protectionism in the trade relationships between the US and the EU would introduce tariff and non-tariff measures that would increase the costs of trade for both areas. A description of the trade links is the first step for an evaluation of these costs. The second step is to analyze the major exporting (importing) sectors to (from) the US, because tariffs and non-tariff barriers are strongly differentiated both at the product level and by type of good, final or intermediate. For these reasons, in this paragraph we focus on the measurement of trade flows (updated to 2018) and tariffs according to the sector and the characteristics of goods (final or intermediate).

Figure 3 shows the weighted average bilateral tariffs that are currently applied between the EU and the US on traded goods at the sector level. If we consider 5 per cent as the threshold above which nominal tariffs do matter, it is clear that US tariffs on EU products protect substantially two sectors: 'textile, wearing apparel and leather products' and 'coke and refined petroleum'. Both sectors account for a relatively small share of EU sales of manufacturing goods to the US (respectively 2.5 and 3.5 per cent; table 1).

Figure 3 - Actual average tariffs on US-EU manufacturing trade flows by sector
(as a percentage of flows)



Source: Elaborations on WTO-IDB database and Eurostat for sector shares. Tariff schedules refer to year 2016.

Looking at US exports, we find that the EU maintains quite a high level of tariff barriers on a larger number of industries ('food, beverage and tobacco', 'textile, wearing apparel and leather products', 'rubber and plastic products' and 'motor vehicles, trailers and semi-trailers').

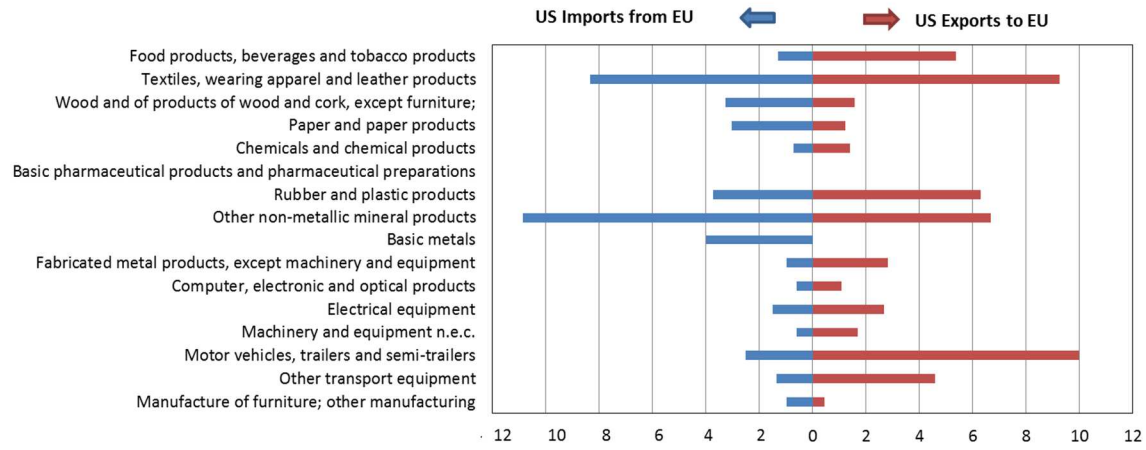
The share of these four sectors on total EU imports from the US is almost 10 per cent (table 2). In the motor vehicles sector, there is a wide asymmetry of duties between the two areas. In general, tariffs applied by the US on imported vehicles are indeed lower than the ones imposed by its main trade partners. This asymmetry has provided the rationale for the US administration's decision to launch the USTR investigation on car tariffs. Together with pharmaceuticals and machinery, motor vehicles (mainly car and car parts) represent the largest exporting sector to the US for the European manufacturing industry, with a share of more than 13 per cent.

Focusing on the category of goods for final consumption, the tariff levied by the US on vehicles imported from the EU is 2.5 per cent, whereas that imposed on US cars sold to the EU market is 10 per cent (figure 4.a). In 2018 the EU exported vehicles to the US for about 38 billion (about 22 per cent of total exports of manufacturing goods for final consumption to the US); of these, more than half (about 21 billions) originated from Germany (33 per cent of German exports to the US).

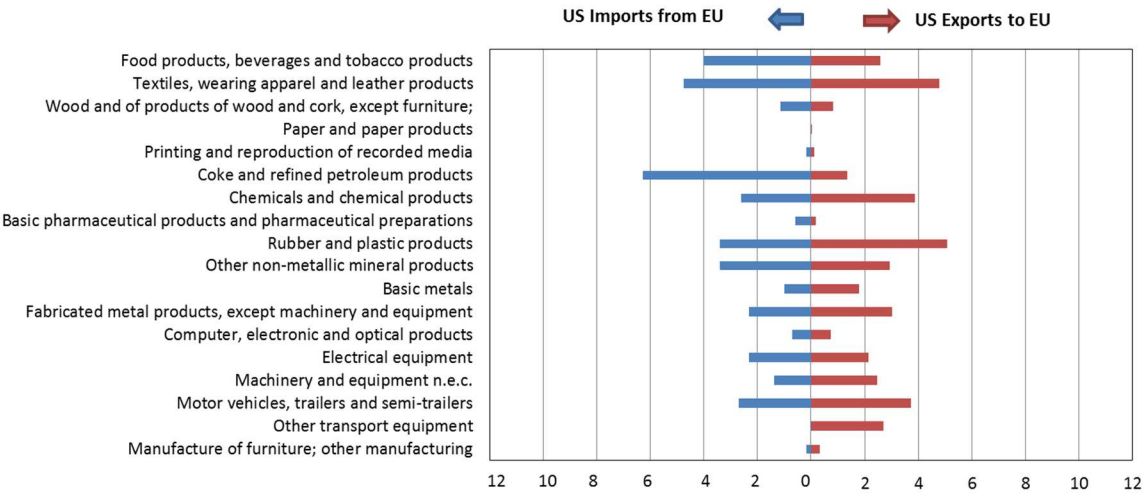
Figure 4 - Actual average tariffs on final and intermediate US-EU manufacturing trade by sector

(as a percentage of flows)

(a) Final goods



(b) Intermediates



Source: Elaborations on WTO-IDB database and Eurostat for sector shares. Tariff schedules refer to year 2016.

Therefore, amongst EU countries, Germany would be by far the most strongly affected by the potential introduction of a higher US tariff on car imports. However, given that Germany is the central hub of the European automotive production network, the effective exposure of other EU economies could be also significant, especially for those, such as Central and Eastern European countries, which are intensively involved in the upstream activities of the automotive production chains. For this reason, in order to evaluate the potential indirect effects that a change in tariff policy, in particular on cars, could have on EU economies, in section 7 we propose an exercise that traces the major EU countries' value added that reaches the US indirectly, embedded in the exports of other European economies.

Table 1 - EU manufacturing exports to the US by sector and end-use category

(millions of euro and percentages)

Sector	for final consupmtion	intermediates	Total	Total sector shares
Food products, beverages and tobacco products	18.382	1.975	20.357	5,3
Textiles, w earing apparel and leather products	7.790	2.015	9.805	2,5
Wood and of products of w ood and cork, except furniture;	53	1.763	1.816	0,5
Paper and paper products	557	2.454	3.012	0,8
Coke and refined petroleum products	-	13.449	13.449	3,5
Chemicals and chemical products	4.067	27.731	31.799	8,2
Basic pharmaceutical products and pharmaceutical preparations	28.029	36.179	64.208	16,6
Rubber and plastic products	2.306	5.302	7.608	2,0
Other non-metallic mineral products	508	4.423	4.930	1,3
Basic metals	0	12.872	12.873	3,3
Fabricated metal products, except machinery and equipment	2.499	6.965	9.463	2,4
Computer, electronic and optical products	22.595	7.797	30.393	7,9
Electrical equipment	6.377	9.836	16.214	4,2
Machinery and equipment n.e.c.	31.134	23.344	54.478	14,1
Motor vehicles, trailers and semi-trailers	38.647	12.751	51.399	13,3
Other transport equipment	10.700	22.808	33.509	8,7
Manufacture of furniture; other manufacturing	18.820	2.409	21.229	5,5
Total	**192.465**	**194.088**	**386.553**	**100,0**

Source: Elaborations on Eurostat. (1) Data refer to year 2018.

Table 2 - EU manufacturing imports from the US by sector and end-use category

(millions of euro and percentages)

Sector	for final consupmtion	intermediates	Total	Total sector shares
Food products, beverages and tobacco products	4.001	1.310	5.310	2,3
Textiles, w earing apparel and leather products	910	915	1.825	0,8
Wood and of products of w ood and cork, except furniture;	8	603	611	0,3
Paper and paper products	215	2.276	2.589	1,1
Coke and refined petroleum products	-	8.797	8.797	3,8
Chemicals and chemical products	2.743	21.620	24.363	10,5
Basic pharmaceutical products and pharmaceutical preparations	10.281	19.084	29.364	12,6
Rubber and plastic products	1.636	3.426	5.062	2,2
Other non-metallic mineral products	36	2.626	2.663	1,1
Basic metals	0	11.956	11.956	5,1
Fabricated metal products, except machinery and equipment	977	3.470	4.447	1,9
Computer, electronic and optical products	18.235	7.159	25.394	10,9
Electrical equipment	3.224	5.813	9.037	3,9
Machinery and equipment n.e.c.	11.392	12.756	24.148	10,4
Motor vehicles, trailers and semi-trailers	5.867	4.366	10.233	4,4
Other transport equipment	15.692	36.422	52.114	22,4
Manufacture of furniture; other manufacturing	13.006	1.250	14.256	6,1
Total	**88.224**	**143.857**	**232.179**	**100,0**

Source: Elaborations on Eurostat. (1) Data refer to year 2018.

5. Tariffs and trade links between EU members and US

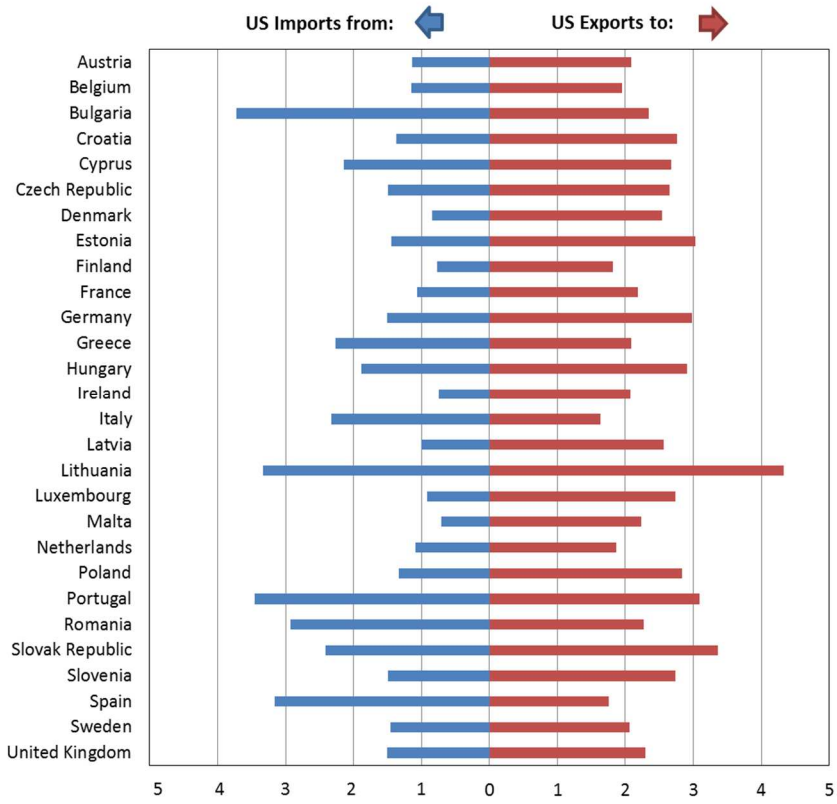
Figure 5 displays the average tariffs that are applied to trade between the US and each EU member State. Since the duty schedule is obviously identical for all member States, the differences across countries simply reflect a different product composition of their exports (imports) to (from) the US market.

As already mentioned, the average duty imposed by the US on imports of manufacturing goods from the EU is 1.5 per cent. The tariff rate levied on German products is in line with the EU average (1.5 per cent), whereas for Italian and French products it is respectively above and below (2.3 and 1.1 per cent). The relatively high average tariff for Italy's exports is due to its specialization in 'textile, wearing apparel and leather products'; German exports, instead, benefit from the low tariff currently imposed on cars.

Given the sectoral composition of German exports in 2018, if the US administration increased the rate on car imports (now 2.5 per cent) to the level applied by the EU to US cars (10 per cent), the average duty on total German exports would rise to 3 per cent; an increase of the US tariff to 25 per cent, as threatened by the US administration, would raise the average tariff to 6 per cent. In absolute terms, EU exports of non-agricultural products to the US face tariffs for about 5.3 billion euros. The highest burden is on German exporters (around 1.7 billion); Italy also faces a relatively high burden (0.9 billion) whereas for France and Spain the amount is lower (0.4 billion).

Figure 5 –Actual average tariffs on manufacturing trade between EU member states and the US

(as a percentage of flows)



Source: Elaborations on WTO-IDB database and, for US exports to single EU countries, from UN ComTrade.

Tables A.1-A.4 in Appendix A show in greater detail goods trade flows between the US and individual EU member States by sector and by type of product (final consumption and intermediates). Beside motor vehicles, other relevant sectors for German exports are

pharmaceuticals, mechanics and the computer industry, all of them characterized by a very low level of tariffs. Italy's exports of final goods to the US are essentially concentrated in "machinery", "textile, wearing apparel and leather goods", "food products, beverages and tobacco products" and "motor vehicles". On "textile, wearing apparel and leather goods" the duties imposed by the US are rather high (8.8 per cent). For France the largest exporting sector to the US is the "other transport equipment", essentially exports of the aircraft industry.

6. Exposure to US tariffs: a value-added trade analysis

To shed some light on the potential implications of a change in US tariffs – either broad-based or concentrated in the automotive sector - we assess the exposure of individual EU countries in terms of the amount of their GDP that might be affected by the new tariffs, i.e. the value-added that crosses the US border.[6] To quantify the exposure in terms of 'net' production, we depart from the analysis of gross trade and switch to the analysis of trade in value-added. Thus, we take into account the fact that a relevant amount of intermediate goods is shipped to the US indirectly, after being processed by third countries through global value chains (GVC).

The question we address is the following: "what fraction of EU countries' GDP would be potentially affected by US tariffs?". Operationally, to provide an answer we need: 1) statistical tools that are able to trace the supply and demand linkages between all the economies, i. e. Input-Output tables and 2) an analytical framework suited to disentangle trade in value-added. We exploit the World Input-Output Database[7] (Timmer et al., 2015) and the accounting framework proposed by Borin and Mancini (2019). The former combines national Input-Output data with detailed trade statistics to trace cross-country and cross-sector interconnections; the latter builds up a methodology suited to trace a country's value added imported by the US either directly or indirectly through other countries – and thus, potentially subject to US tariffs.

We start from a general ICIO model where K countries (those within the EU, the US, and the other G countries) produce N goods (or services), corresponding to N different sectors.[8] The production requires a certain amount of intermediate inputs purchased in the domestic market or imported from abroad. Then each sector contributes with a given amount of value added to produce the gross output, which can be used as intermediate inputs or it can be sold as a final product. This production system is recorded in the ICIO tables, that can be described with the scheme reported in figure 6.

Figure 6 – A scheme of the ICIO model

Outputs / Inputs		Intermediate Use				Final Demand				Total Output
		EU	US	⋯	G	EU	US	⋯	G	
Intermediate Inputs	EU	$\mathbf{Z}_{EUEU}$	$\mathbf{Z}_{EUUS}$	⋯	$\mathbf{Z}_{EUG}$	$\mathbf{Y}_{EUEU}$	$\mathbf{Y}_{EUUS}$	⋯	$\mathbf{Y}_{EUG}$	$\mathbf{X}_{EU}$
	US	$\mathbf{Z}_{USEU}$	$\mathbf{Z}_{USUS}$	⋯	$\mathbf{Z}_{USG}$	$\mathbf{Y}_{USEU}$	$\mathbf{Y}_{USUS}$	⋯	$\mathbf{Y}_{USG}$	$\mathbf{X}_{US}$
	⋮	⋮	⋮	⋱	⋮	⋮	⋮	⋱	⋮	⋮
	G	$\mathbf{Z}_{GEU}$	$\mathbf{Z}_{GUS}$	⋯	$\mathbf{Z}_{GG}$	$\mathbf{Y}_{G1}$	$\mathbf{Y}_{G2}$	⋯	$\mathbf{Y}_{GG}$	$\mathbf{X}_{G}$
Value-added		$\mathbf{Va}_{EU}$	$\mathbf{Va}_{US}$	⋯	$\mathbf{Va}_{G}$					
Total input		$(\mathbf{X}_{EU})'$	$(\mathbf{X}_{US})'$	⋯	$(\mathbf{X}_{G})'$					

[6] See Chen et al. (2018) for an alternative strategy to quantify the GDP exposure. In particular, they assess the exposure of EU regions to Brexit.

[7] We consider the last WIOD table available, that is 2014. We expect the results to be stable across time as the relations highlighted in this section are structural and do not exhibit high time variation.

[8] This section follows Borin and Mancini (2016) and Borin and Mancini (2019). See these works for further details.

where $\mathbf{Z}_{sr}$ is the $N\times N$ matrix of intermediate inputs produced in country s and used in country r; $\mathbf{Y}_{sr}$ is the $N\times 1$ vector of final goods and services completed in country s and absorbed in country r; $\mathbf{X}_s$ is the $N\times 1$ vector of gross output produced in country s; and $\mathbf{Va}_s$ is the $N\times 1$ vector of value added generated in country s.[9] Gross output consists of final goods, consumed at home or exported, and intermediate goods used for domestic productions or exported:

$$\mathbf{X}_s = \sum_{r}^{G}(\mathbf{A}_{sr}\mathbf{X}_r + \mathbf{Y}_{sr}), \tag{1}$$

where $\mathbf{A}_{sr}$ is the $N\times N$ matrix of coefficients for intermediate inputs produced in s and used in the production of r, which is obtained dividing the elements in each column of intermediate matrix $\mathbf{Z}_{sr}$ by the corresponding total gross output of the sector.[10]
Then, we can derive the basic relationship between gross output and final demand:

$$\mathbf{X} = (\mathbf{I}-\mathbf{A})^{-1}\mathbf{Y} = \mathbf{BY},$$

where the $\mathbf{B}$ matrix is $KN \times KN$ global Leontief inverse matrix in a ICIO setting; its element $\mathbf{B}_{sr}$ is the $N\times N$ block that denotes how much of country's s gross output of a certain good is required to produce one unit of country r's final production.

The direct value added share in each unit of gross output produced by country s is equal to one minus the sum of the direct intermediate input shares of all the domestic and foreign suppliers:

$$\mathbf{V}_s = \mathbf{u}_N(\mathbf{I} - \sum_{r}^{G}\mathbf{A}_{rs})$$

where $\mathbf{u}_N$ is the $1\times N$ unit row vector.
Then we can define the direct domestic value added matrix for all countries as follows:

$$\mathbf{V} = \begin{bmatrix} \mathbf{V}_1 & \mathbf{0} & \Lambda & \mathbf{0} \\ \mathbf{0} & \mathbf{V}_2 & \Lambda & \mathbf{0} \\ \mathrm{M} & \mathrm{M} & \mathrm{O} & \mathrm{M} \\ \mathbf{0} & \mathbf{0} & \Lambda & \mathbf{V}_G \end{bmatrix},$$

and multiply it by the Leontief inverse $\mathbf{B}$ to get the overall $K \times KN$ value added share matrix as $\mathbf{VB}$. In particular, the $\mathbf{V}_s\mathbf{B}_{sr}$ vector reports the shares of total value added generated in country s that is embedded in county r's sectors of final production.

Pre-multiply the gross exports vector to the US, $\mathbf{E_{sUS}}$, with the value added share $\mathbf{V}_s\mathbf{B}_{ss}$, we obtain the value of the goods and services originated in country *s* embodied in country *s* exports to the US. Then, pre-multiplying $\mathbf{E}_{jUS}$ with $\sum_{j\neq s}\mathbf{V}_s\mathbf{B}_{sj}$ we obtain the value of the goods and services produced in country *s* embodied in other *j* countries exports to the US. However, since the goal is to trace the value-added exposed to tariffs, the strategy described above is not

[9] Note that EU countries are not collapsed into a single EU region but instead are kept separately to avoid losing heterogeneity in the Input Output.

[10] For example, to produce one unit of gross output, sector i of country r uses a constant amount $a_{i,j}^{sr}$ of intermediate input j produced in country s, which is equal to $a_{i,j}^{sr} = z_{i,j}^{sr} / x_j^r$.

accurate since items produced in country *s* could be exported several times along the production process, i.e. they are double counted in exports.

In order to separate value added from double counting, we need to modify the matrix of technical coefficients **A** and re-compute a different version of the global Leontief, which excludes the possibility of double counting. Following Borin and Mancini (2019), the correct way to separate double counting from value-added depends on the specific empirical question.

We consider three scenarios, in which the US impose higher tariffs on: 1) all imports from the EU only; 2) all imports from anywhere; 3) auto imports from anywhere. In each scenario we will need a different accounting perspective to single out double counting.

In the first scenario, we use a bilateral perspective since we want to measure the value added of a EU country which, at any point in time, passes through a trade flow from the EU to the US, i.e. the one hit by the tariff. Double counting is given by inputs crossing more than once the EU-US border. Thus, it can be excluded setting to zero the direct requirements of intermediate inputs from any EU country to the US ($\mathrm{A_{EUUS}} = 0$):

$$\mathbf{A^{\boldsymbol{EUUS}}} = \begin{bmatrix} \mathrm{A_{EUEU}} & 0 & \cdots & \mathrm{A_{EUG}} \\ \mathrm{A_{USEU}} & \mathrm{A_{USUS}} & \cdots & \mathrm{A_{USG}} \\ \vdots & \vdots & \ddots & \vdots \\ \mathrm{A_{GEU}} & \mathrm{A_{GUS}} & \cdots & \mathrm{A_{GG}} \end{bmatrix},$$

and then the new global Leontief is computed accordingly, $\mathbf{B^{\boldsymbol{EUUS}}} = (\boldsymbol{I} - \mathbf{A^{\boldsymbol{EUUS}}})^{-1}$.

With this device, we obtain the directly exposed GDP, i.e. the value added produced in a EU country *s* exported to the US, i.e. facing a direct tariff:

$$\mathbf{V_s B_{ss}^{\boldsymbol{EUUS}} E_{\boldsymbol{sUS}}},$$

and the indirect exposure, i.e. the value added produced in a EU country *s* exported to the US by another EU country, thus facing an indirect tariff:

$$\sum_{\substack{j \epsilon \boldsymbol{EU} \\ j \neq s}} \mathbf{V_s B_{sj}^{\boldsymbol{EUUS}} E_{\boldsymbol{jUS}}}.$$

In the second scenario, we want to assess the value added of a EU country which, at any point in time, is imported by the US from any country, thus potentially subject to tariffs (importer perspective). Here, double counting is originated from inputs that are imported by the US more than once. To avoid it, we set to zero the direct requirements of intermediate inputs from any country to the US ($\mathrm{A_{EUUS}} = \mathrm{A_{GUS}} = 0$):

$$\mathbf{A^{\boldsymbol{US}}} = \begin{bmatrix} \mathrm{A_{EUEU}} & 0 & \cdots & \mathrm{A_{EUG}} \\ \mathrm{A_{USEU}} & \mathrm{A_{USUS}} & \cdots & \mathrm{A_{USG}} \\ \vdots & \vdots & \ddots & \vdots \\ \mathrm{A_{GEU}} & 0 & \cdots & \mathrm{A_{GG}} \end{bmatrix}.$$

and then $\mathbf{B^{\boldsymbol{US}}} = (\boldsymbol{I} - \mathbf{A^{\boldsymbol{US}}})^{-1}$ is computed.

Again, the EU country *s* GDP directly exposed to US tariffs on all imports from anywhere would be:

$$\mathbf{V_s B_{ss}^{\boldsymbol{US}} E_{\boldsymbol{sUS}}},$$

and the indirect exposure, i.e. the value added produced in a EU country *s* exported to the US by any other country, thus facing an indirect tariff, as:

$$\sum_{\substack{j \epsilon G \\ j \neq s}} \mathbf{V}_S \mathbf{B}_{sj}^{\boldsymbol{EUUS}} \mathbf{E}_{jUS}.$$

Lastly, in the third scenario, we quantify the value added of a EU country which, at any point in time, is imported by the US auto-motive sector from any country, thus potentially subject to auto tariff (sectoral-importer perspective). Again, double counting is originated from inputs that are imported by the US auto-motive sector more than once. This time, we set to zero the direct requirements of intermediate inputs from any country in the auto-motive sector to the US. Then, we simply substitute $\mathbf{B}^{\boldsymbol{US}}$ with $\mathbf{B}^{\boldsymbol{USauto}}$. Direct exposure will be $\mathbf{V}_S \mathbf{B}_{ss}^{\boldsymbol{USauto}} \mathbf{e}_{s(auto)US}$ and the indirect one $\sum_{\substack{j \epsilon G \\ j \neq s}} \mathbf{V}_S \mathbf{B}_{sj}^{\boldsymbol{USauto}} \mathbf{e}_{j(auto)US}$, where $\mathbf{e}_{s(auto)US}$ and $\mathbf{e}_{j(auto)US}$ are the auto-motive exports of the EU country *s* and auto-motive exports of country *j* to the US, respectively.

This approach requires some caveats. In fact, it is a static and partial-equilibrium analysis, which disregards dynamics, international spillovers and internal multiplier effects, e.g. spillovers from changes in disposable income, investment decisions, uncertainty. Nevertheless, this analysis is useful to assess the first round effect of US tariffs and its cross-country and cross-sector heterogeneity.

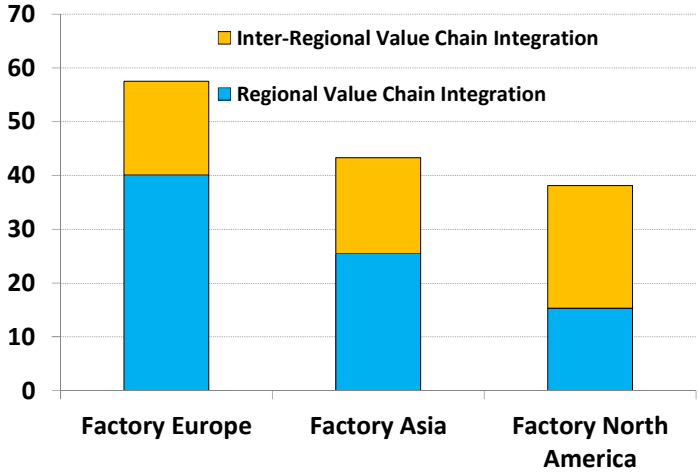
7. Exposure to US tariffs: results

EU countries are highly interconnected, and a relevant share of their production is ultimately imported by the US after being embedded in intermediate exports among EU members. For instance, if Italy exports intermediates to Germany, and Germany employs these components to produce goods imported by the US, Italian GDP will be affected by higher tariffs even in the absence of direct exports to the US. Thus, as a first step, it is useful to quantify the degree of participation of EU countries in their regional value chain.

The overall integration of a country in GVCs, measured as at the share of exports crossing at least two borders before reaching the final destination market, can be decomposed into two parts; the integration in inter-regional value chains and the integration in the regional value chain (see Borin and Mancini, 2015). In Figure 7 we report the share of exports related to total, regional and inter-regional value chains for countries that are part of the so called Factory Europe, Factory Asia and Factory North America. While the degree of inter-regional integration is similar across different regions, the higher overall integration into GVCs of European countries is driven by their higher participation in the regional chain. Indeed, around 40 per cent of EU countries' total exports are linked to the regional chain, 15 p.p. and 25 p.p. more than for countries in Factory Asia and Factory North America, respectively.

Figure 7 – Total GVC participation decomposition in regional and inter-regional integration

(share of total exports, 2015)



Source: own elaboration based on EORA.

Considering the first scenario, on average the EU GDP exposed to US tariffs is around 2.3 per cent of the total, with one fifth of this deriving from the indirect exposure through the exports of other countries of Factory Europe. For Italy, the fraction of GDP that could be hit by an escalation of US tariffs is around 2.0 per cent (see Table A.5 in Appendix), above the shares computed for France and Spain (1.7 and 1.0 per cent, respectively) but below the one for Germany (3.1 per cent). Among EU countries, Ireland is the most exposed (7.4 per cent of GDP), mainly due its strong linkages with the US in the pharmaceutical sector and in the financial and administrative services sector. Overall, the indirect exposure is sizeable and accounts for around 20 per cent of the total EU value added crossing the US border. Germany has a clear central role in Factory Europe, as around 30 per cent of the EU GDP that is indirectly exposed to tariffs is exported to the US via Germany.

In the second scenario, while the direct exposure does not change, the indirect exposure of EU countries is determined not only by their participation in the regional value chain, but also by the overall integration in global value chains. As shown in Table A.6, the EU GDP at stake increases from 2.3 to 2.8 per cent. Italian exposure is only marginally affected (+0.3 p.p. with respect to the first scenario), while Luxembourg and Ireland are the countries with the highest effect (+1.3 and +1.1 p.p. with respect to the first scenario, respectively).

In terms of sectors, Italy's industries which could be affected the most by higher US tariffs are motor vehicles, transport equipment, basic metals and chemical products: around 10 per cent of the value added produced in these sectors crosses directly or indirectly the US border (Table 5). These figures are similar to those found for Germany, while France and Spain appear less exposed in the motor vehicles and transport equipment sectors. Instead, although more than 8 per cent of the value added of the Italian sector of 'textiles, textile products, leather and footwear' is directly or indirectly imported by the US, it seems less likely the sector could be impaired by a more restrictive US trade policy. The reason is that the US demand for these Italian products, characterized by a high-quality level and already levied by significant tariffs, would be hardly affected in case of a revision of US tariffs.

Table 5 – Sectoral GDP exposure to tariffs on US imports

(share of sector GDP)

	Italy	France	Germany	Spain
Motor vehicles	11.0	4.0	12.4	5.1
Other transport equipment	10.2	8.9	9.4	2.4
Basic metals	9.3	8.5	10.0	6.2
Chemical products	9.1	11.0	12.0	7.1
Textiles and wearing apparel	8.4	7.9	4.8	3.6
Machinery and equipment	8.1	8.8	8.3	4.6
Pharmaceutical products	7.6	5.4	11.6	4.8
Fabricated metal products	7.2	4.6	7.7	4.7
Furniture; other manufacturing	6.7	5.2	6.2	2.4
Mineral products	6.2	3.0	4.5	3.8

Source: own elaboration based on WIOD.

Since the US administration has threatened to impose a 25 per cent tariff on automotive imports from any country, in the third scenario we look at the countries' GDP that could be potentially affected by auto duties, and we estimate that for the EU it is equal to 0.4 per cent of the total. However, the EU member states' exposure to US duties on automotive is very heterogeneous. More than half of the EU GDP that could be potentially affected by auto duties is produced in Germany, the most exposed economy (around 1 per cent of its GDP, Table A.7). The Italian exposure would be just below the EU average (0.3 per cent of total GDP, around 10 per cent in terms of the value-added produced in the motor vehicles sector). Germany's exposure is mostly direct (84 per cent), well above Italy's and the EU average (60 and around 40 per cent, respectively): the other EU economies rely heavily on the European value chains to export their products to the US; in particular, around half of Central and Eastern EU countries' GDP exposed to tariffs on automotive imports is embedded in German automotive exports to the US.

8. Conclusions

After at least two decades of stability, in 2018 the US trade policy has radically changed leading to the threat of retaliation by the other countries and to an increase of uncertainty about future global trade policy stance.

This study provides a preliminary assessment of the implications of a change in US trade tariffs for the EU, with a particular focus on Italy. By using detailed trade flows and information on tariffs, the analysis quantifies average tariffs on trade between the European Union and the US. The paper documents, for the period before the onset of trade tensions, a wide asymmetry between the levels of the tariffs applied by the US and its trade partners with the US tariffs generally lower than those imposed by partners. This asymmetry is not as marked for the EU, with the exception of the automotive sector where tariff rates levied on EU vehicles imported in the US are (at 2.5 per cent) one-fourth of those imposed on US cars entering the EU (10 per cent).

The paper evaluates also the direct and indirect exposure of the EU's and its main countries' GDP to alternative scenarios of US tariff hikes. By following the methodology for value-added accounting of trade flows in Borin and Mancini (2019), we calculate that, on average, a change in US tariffs hitting all EU imports would potentially affect around 2.3 per cent of EU GDP, one fifth of this being exposed to tariffs only indirectly, through the exports of other EU countries to the US. The share of Italy's GDP that could be harmed by an escalation of US tariffs on EU imports is around 2.0 per cent, below Germany's (3.1 per cent). In the second scenario, featuring US tariffs on imports from anywhere, the overall exposure of EU

countries would be higher (2.8 per cent). In this case the indirect exposure of EU to the US is determined not only by the regional integration the EU countries but also by their overall integration in global value chains. Finally, the paper finds that that the EU GDP affected by a possible decision by the US to impose tariffs only on automotive imports would be 0.4 per cent. Germany is the most exposed economy (at around 1 per cent of its GDP) whereas the total Italian exposure, which includes the indirect exposure by through other countries especially Germany, would be just below the EU average (0.3 per cent). This Italian exposure accounts for around 10 per cent of the value-added produced in the motor vehicles sector.

Appendix A - Tables

Table A.1 - 20 most relevant EU country-sector export flows of final goods to the US

(millions of euros and percentages on sectors' flow)

Country	Sector	Exports	Average Effectively Tariff Applied
Germany	Motor vehicles, trailers and semi-trailers	21.294	2,5
Germany	Machinery and equipment n.e.c.	11.839	0,8
Germany	Basic pharmaceutical products and pharmaceutical preparations	9.670	0,0
United Kingdom	Motor vehicles, trailers and semi-trailers	8.256	2,5
Germany	Computer, electronic and optical products	8.002	0,7
Ireland	Basic pharmaceutical products and pharmaceutical preparations	5.344	0,0
Ireland	Furniture; other manufacturing	4.838	0,1
Italy	Machinery and equipment n.e.c.	4.771	0,8
France	Other transport equipment	4.538	0,0
France	Food products, beverages and tobacco products	4.123	0,6
Belgium	Basic pharmaceutical products and pharmaceutical preparations	3.970	0,0
Italy	Food products, beverages and tobacco products	3.935	1,0
Italy	Motor vehicles, trailers and semi-trailers	3.926	2,5
United Kingdom	Machinery and equipment n.e.c.	3.777	0,3
France	Basic pharmaceutical products and pharmaceutical preparations	3.469	0,0
Italy	Textiles, w earing apparel and leather products	3.222	8,4
United Kingdom	Computer, electronic and optical products	3.036	0,7
Germany	Furniture; other manufacturing	3.022	0,2
Italy	Furniture; other manufacturing	2.886	2,3
Germany	Other transport equipment	2.793	1,8

Source: Elaborations on WTO-IDB database and Eurostat for trade flows. Trade data refer to year 2018.

Table A.2 - 20 most relevant EU country-sector export flows of intermediates to the US

(millions of euros and percentages on sectors' flow)

Country	Sector	Exports	Average Effectively Tariff Applied
Ireland	Basic pharmaceutical products and pharmaceutical preparations	15.751	0,9
Germany	Machinery and equipment n.e.c.	8.246	1,5
Germany	Motor vehicles, trailers and semi-trailers	7.604	1,7
Ireland	Chemicals and chemical products	7.051	2,0
France	Other transport equipment	6.326	0,0
Germany	Chemicals and chemical products	6.209	2,8
United Kingdom	Other transport equipment	6.082	0,0
United Kingdom	Basic pharmaceutical products and pharmaceutical preparations	4.632	0,5
Belgium	Basic pharmaceutical products and pharmaceutical preparations	4.320	0,0
Germany	Electrical equipment	4.296	2,2
Germany	Basic metals	4.262	1,2
Germany	Basic pharmaceutical products and pharmaceutical preparations	4.177	0,4
United Kingdom	Chemicals and chemical products	3.494	3,1
Italy	Machinery and equipment n.e.c.	3.106	1,4
Germany	Other transport equipment	3.048	0,0
Netherland	Basic pharmaceutical products and pharmaceutical preparations	2.947	0,2
Netherland	Chemicals and chemical products	2.747	2,4
Netherland	Coke and refined petroleum products	2.633	6,2

Source: Elaborations on WTO-IDB database and Eurostat for trade flows. Trade data refer to year 2018.

Table A.3 - 20 most relevant US-sector export flows of final goods to the EU countries

(millions of dollars and share of sectors' flow)

Country	Sector	Exports	Average Effectively Tariff Applied
Ireland	Other transport equipment	7.301	2,7
Belgium	Basic pharmaceutical products and pharmaceutical preparations	4.507	0,0
Germany	Computer, electronic and optical products	4.392	1,2
Netherlands	Furniture; other manufacturing	4.302	0,2
Germany	Motor vehicles, trailers and semi-trailers	4.229	10,0
Netherlands	Computer, electronic and optical products	4.030	0,6
United Kingdom	Computer, electronic and optical products	3.469	1,6
Germany	Machinery and equipment n.e.c.	2.576	1,8
United Kingdom	Machinery and equipment n.e.c.	2.455	2,0
Germany	Furniture; other manufacturing	2.331	0,4
United Kingdom	Other transport equipment	2.113	2,7
Belgium	Furniture; other manufacturing	1.854	0,1
United Kingdom	Furniture; other manufacturing	1.548	1,0
France	Computer, electronic and optical products	1.518	1,2
United Kingdom	Basic pharmaceutical products and pharmaceutical preparations	1.481	0,0
Netherlands	Basic pharmaceutical products and pharmaceutical preparations	1.417	0,0
Netherlands	Machinery and equipment n.e.c.	1.329	1,2
Belgium	Machinery and equipment n.e.c.	1.308	1,5
France	Machinery and equipment n.e.c.	1.094	1,6
France	Other transport equipment	1.030	2,7

Source: Elaborations on WTO-IDB database and Eurostat for trade flows. Trade data refer to year 2018.

Table A.4 - 20 most relevant US-sector export flows of intermediates goods to the EU countries

(millions of dollars and share of sectors' flow)

Country	Sector	Exports	Average Effectively Tariff Applied
United Kingdom	Other transport equipment	12.141	2,7
France	Other transport equipment	9.791	2,7
Germany	Other transport equipment	7.300	2,7
United Kingdom	Basic metals	6.740	0,7
Belgium	Chemicals and chemical products	6.337	3,9
Netherlands	Chemicals and chemical products	3.677	3,4
Germany	Chemicals and chemical products	3.457	4,0
Germany	Basic pharmaceutical products and pharmaceutical preparations	3.087	0,2
Netherlands	Basic pharmaceutical products and pharmaceutical preparations	2.842	0,2
Italy	Basic pharmaceutical products and pharmaceutical preparations	2.840	0,1
United Kingdom	Machinery and equipment n.e.c.	2.711	2,6
Germany	Machinery and equipment n.e.c.	2.643	2,4
Belgium	Basic pharmaceutical products and pharmaceutical preparations	2.440	0,1
Ireland	Basic pharmaceutical products and pharmaceutical preparations	2.298	0,1
United Kingdom	Chemicals and chemical products	2.229	4,5
Netherlands	Other transport equipment	2.146	2,7
France	Coke and refined petroleum products	2.020	1,5
Netherlands	Computer, electronic and optical products	1.989	0,9
Germany	Computer, electronic and optical products	1.941	0,6
Netherlands	Machinery and equipment n.e.c.	1.907	1,5

Source: Elaborations on WTO-IDB database and Eurostat for trade flows. Trade data refer to year 2018.

Table A.5 – Exposure to US tariffs on EU imports

	GDP exposed to US-EU tariffs (share of countries total GDP)	Direct and indirect exposure (share of total GDP exposed to US tariffs)			
		Direct	Indirect through other EU countries	Total exposure	*of which: thourgh Germany*
Austria	2.1	69.7	30.3	100	*17.2*
Belgium	3.3	79.3	20.7	100	*7.1*
Bulgaria	1.3	61.6	38.4	100	*11.2*
Cyprus	0.6	50.7	49.3	100	*7.0*
Czech Republic	2.1	51.7	48.3	100	*25.5*
Germany	3.1	88.1	11.9	100	
Denmark	2.1	81.8	18.2	100	*5.2*
Spain	1.0	76.0	24.0	100	*6.9*
Estonia	1.5	62.8	37.2	100	*6.3*
Finland	2.3	82.6	17.4	100	*5.1*
France	1.7	82.3	17.7	100	*5.7*
Greece	0.4	70.4	29.6	100	*7.4*
Croatia	1.3	68.6	31.4	100	*8.9*
Hungary	2.7	67.5	32.5	100	*16.2*
Ireland	7.4	93.9	6.1	100	*1.2*
Italy	**2.0**	**85.5**	**14.5**	**100**	***5.7***
Lithuania	1.5	70.4	29.6	100	*8.2*
Luxembourg	1.0	12.6	87.4	100	*23.3*
Latvia	0.9	53.0	47.0	100	*9.4*
Malta	0.9	49.0	51.0	100	*6.3*
Netherlands	3.2	67.9	32.1	100	*11.2*
Poland	1.4	52.1	47.9	100	*23.0*
Portugal	1.1	75.1	24.9	100	*6.2*
Romania	1.3	60.2	39.8	100	*16.5*
Slovakia	1.5	45.4	54.6	100	*25.0*
Slovenia	1.5	46.9	53.1	100	*21.3*
Sweden	2.1	79.6	20.4	100	*5.8*
United Kingdom	2.7	90.4	9.6	100	*2.4*

Source: own elaboration based on WIOD.

Table A.6 – Exposure to US tariffs

	GDP exposed to US tariffs (share of countries total GDP)	Direct and indirect exposure (share of total GDP exposed to US tariffs)			
		Direct	Indirect through other countries	Total exposure	*of which: thourgh Germany*
Austria	2.7	56.0	44.0	100	*13.8*
Belgium	3.9	67.2	32.8	100	*6.0*
Bulgaria	2.0	39.6	60.4	100	*7.2*
Cyprus	1.3	23.4	76.6	100	*3.2*
Czech Republic	2.6	42.4	57.6	100	*20.9*
Germany	3.7	75.0	25.0	100	
Denmark	2.6	65.9	34.1	100	*4.2*
Spain	1.3	55.7	44.3	100	*5.0*
Estonia	2.2	44.0	56.0	100	*4.4*
Finland	2.8	68.0	32.0	100	*4.2*
France	2.0	68.8	31.2	100	*4.8*
Greece	0.9	33.4	66.6	100	*3.5*
Croatia	1.8	47.2	52.8	100	*6.1*
Hungary	3.2	56.9	43.1	100	*13.7*
Ireland	8.5	81.7	18.3	100	*1.1*
Italy	**2.3**	**73.4**	**26.6**	**100**	***4.9***
Lithuania	2.3	46.6	53.4	100	*5.4*
Luxembourg	2.3	5.5	94.5	100	*10.2*
Latvia	1.5	32.2	67.8	100	*5.7*
Malta	1.4	31.7	68.3	100	*4.1*
Netherlands	3.9	56.3	43.7	100	*9.3*
Poland	1.8	40.8	59.2	100	*17.9*
Portugal	1.6	52.7	47.3	100	*4.4*
Romania	1.8	42.9	57.1	100	*11.7*
Slovakia	2.0	35.6	64.4	100	*19.6*
Slovenia	2.1	34.2	65.8	100	*15.5*
Sweden	2.7	62.9	37.1	100	*4.6*
United Kingdom	3.2	76.2	23.8	100	*2.0*

Source: own elaboration based on WIOD.

Table A.7 – Exposure to US tariffs on the automotive sector

	GDP exposed to US tariffs (share of countries total GDP)	Direct and indirect exposure (share of total GDP exposed to US tariffs)			
		Direct	Indirect through other countries	Total exposure	*of which: thourgh Germany*
Austria	0.5	46.9	53.1	100.0	*31.4*
Belgium	0.2	21.4	78.6	100.0	*34.2*
Bulgaria	0.2	10.7	89.3	100.0	*36.1*
Cyprus	0.1	0.0	100.0	100.0	*26.0*
Czech Republic	0.5	13.1	86.9	100.0	*52.4*
Germany	0.9	84.4	15.6	100.0	
Denmark	0.1	4.5	95.5	100.0	*34.0*
Spain	0.2	45.6	54.4	100.0	*17.9*
Estonia	0.1	6.0	94.0	100.0	*27.5*
Finland	0.1	9.5	90.5	100.0	*29.2*
France	0.1	17.4	82.6	100.0	*30.7*
Greece	0.0	0.5	99.5	100.0	*23.9*
Croatia	0.1	3.0	97.0	100.0	*37.3*
Hungary	0.8	51.4	48.6	100.0	*30.2*
Ireland	0.1	3.6	96.4	100.0	*20.7*
Italy	**0.3**	**60.3**	**39.7**	**100.0**	***16.9***
Lithuania	0.1	0.3	99.7	100.0	*37.2*
Luxembourg	0.2	0.5	99.5	100.0	*42.2*
Latvia	0.1	1.0	99.0	100.0	*33.5*
Malta	0.1	2.9	97.1	100.0	*24.4*
Netherlands	0.2	4.3	95.7	100.0	*47.0*
Poland	0.3	8.3	91.7	100.0	*52.3*
Portugal	0.1	18.7	81.3	100.0	*26.0*
Romania	0.2	19.5	80.5	100.0	*42.0*
Slovakia	0.6	46.8	53.2	100.0	*33.4*
Slovenia	0.3	9.5	90.5	100.0	*47.3*
Sweden	0.3	51.8	48.2	100.0	*16.1*
United Kingdom	0.2	66.2	33.8	100.0	*10.2*

Source: own elaboration based on WIOD.

Appendix B – The methodology to compute average tariffs.

This paragraph describes the data sources and the procedures that have been used to construct a framework of *ad-valorem* tariffs for both final and intermediate trade at the ISIC Rev. 4 classification, a framework suitable to be combined with the WIOD Input-Output database.

The data

We obtain the average tariffs that would be imposed on goods imported by US from its main trade partner, including the European Union, (and vice versa) by using information from the WTO-IDB database on the Effectively Applied Tariffs (AHS). The AHS is defined as the lowest available tariff: if a preferential tariff exists, it is used, otherwise the Most Favoured Nation (MFN) tariff is adopted. Data have been retrieved through the WITS, a platform developed by the World Bank that gives access to information on trade and tariffs compiled by various international organizations (https://wits.worldbank.org/) and refer to year 2016, with the exception of data for China and Mexico for which the latest years available are respectively 2015 and 2017. The WTO-IDB database provides *ad-valorem* tariffs (i.e. charged as a percentage of the value of the good imported) for almost 5,000 product lines defined according to a 6-digits HS Combined classification.

These *ad-valorem* tariff data are matched with trade statistics for year 2015 from the UN ComTrade database available on the same WITS platform, which contains annual bilateral trade flows at the HS 2012-6 digits classification.

From the HS 2012 to the ISIC Rev.4 classification

We construct our dataset of applied tariffs and bilateral good flows, classified according to both their end-use category and ISIC Rev. 4 industry classification, though a process that requires many steps.

First of all, we assign to each product-level applied tariff and its corresponding bilateral flow a classification according to their final and intermediate use. To this aim, we use the correspondence table between the HS (2012 Revision) 6-digit commodities and the BEC classification. In general, these correspondences provide a clear mapping to classify trade according the to its end-use category.

Next steps present some complications.

We transpose our data from the Harmonized System 2012 (HS 2012) to the Central Product Classification, Version 2.1 (CPC Ver. 2.1) by using a correspondence table from Ramon (http://ec.europa.eu/eurostat/ramon/relations/index.cfm?TargetUrl=LST_REL). The reason for this step is that a direct correspondence table from the HS 2012 classification to the ISIC Rev. 4 is not available. Having said this, it is necessary to clarify that the correspondence among the HS 2012 and the CPC 2.1 sectors is not univocal.

In the simple case when to one HS 2012 sector correspond many CPC 2.1 sectors, we split in equal shares the import values to the different CPC 2.1 sectors attributing them the same *ad-valorem* AHS tariff and the same end-use category. In the opposite case when to different HS 2012 sectors corresponds only a CPC 2.1 sector (this is the case for about 500 observations), we sum the HS 2012 tariff and import values that correspond to the same CPC 2.1 sector and attribute to it the prevailing (in terms of number of HS 2012 sectors) end-use category.

Finally, we convert data from the CPC 2.1 to the ISIC Rev. 4 classification. Even in this case when to one CPC 2.1 sector correspond many different ISIC groups, we split in equal shares the import values to the different ISIC Rev. 4 groups attributing them the same ad

valorem MNF tariff and the same end-use category. In the case when many CPC 2.1 sectors correspond to just a single ISIC 4 sector, we calculate the value of tariff and imports of that sector as the sum of tariffs and imports of the corresponding CPC 2.1 sectors by end-use category.

Finally, tariff and import values are aggregated from the ISIC classification at 4 digits (238 sectors) to the 3 digits one (32 sectors) and the average tariff are calculated.

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