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Shield the US from Imports!

GDP Impacts on Finland and Other European Union Member States

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Table of Contents

	Abstract	2
	Tiivistelmä	2
	Executive summary	**3**
1	**Background**	**4**
2	**Data and methodology**	**5**
3	**The value-added trade to the US**	**8**
	3.1 Total direct and indirect value-added trade	8
	3.2 The importance of different trade routes to the US.	11
	3.3 The value added exports: The US vs. China	16
4	**The value-added impacts of raising tariffs**	**18**
5	**Conclusions**	**20**
	References	21
	Appendix	22

Shield the US from Imports! – GDP impacts on Finland and other European Union member states

Abstract

We analyze the value-added impacts of rising (United States) US protectionism on Finland and other European Union (EU) member states. The president of the US has proposed tariff increases, particularly on imports from Mexico and China to the US, while the threat of protectionism also involves more direct tariffs against EU exports to the US. We apply a measurement framework for the decomposition of value-added trade to the US grounded on hypothetical extraction, a mathematical technique based on an input-output representation of the global economy. Our results show that trade to the US continues to be an important source of the value added for Finland as well as the majority of the EU, even during the temporary slowdown of trade during the Great Recession. For many countries, trade to the US represents over 10% of the value added from exports to all countries. We find that a large majority of the value added for both Finland and the EU goes directly as intermediate or final goods and services to the US. Much less value added is generated via other countries through either their intermediate or direct final exports to the US. The other most important trade channel is through Germany. We investigate the effect of the trade barriers in several counterfactual scenarios. Using standard export elasticity estimates, we find that the value added generated by Finland and other EU countries through Mexico and China to the US would decline drastically if the US launched tariff rises on imports from Mexico and China to the US. The impacts would be significantly worse if the US raised tariff rates on direct imports from EU countries.

Key words: Global value chain, GVC, tax, tariff, customs, border, GDP, impact, indirect

JEL: F13, F14, F23, L23

Sulkeeko USA ovet nostamalla tulleja? – vaikutukset Suomeen ja Eurooppaan

Tiivistelmä

Tutkimuksessa analysoidaan USA-viennin merkitystä ja USA:n tuontitullien nousun vaikutuksia Suomeen ja muihin EU-maihin. USA:n presidentti on ehdottanut isoja tullien tai tariffien nostoja koskien erityisesti tuontia Kiinasta ja Meksikosta, mutta myös mahdollisesti tuontia EU:sta. Analyyseissä käytetään kansainvälistä panos-tuotos (WIOD) aineistoa. Mahdollisten tullikorotusten vaikutuksia analysoidaan poissulkemismenetelmällä (hypothetical extraction) käyttäen useita eri skenaarioita korotusten suuruudesta. Tulosten mukaan Suomen suora ja epäsuora vienti USA:han luo Suomeen arvonlisää, jonka arvo vastaa peräti 10 % kaikesta viennin tuomasta arvonlisästä. Suurin osa tästä tulee suorasta viennistä. Epäsuorista kanavista tärkein kulkee Saksan kautta. Ehdotetut Meksikoa ja Kiinaa koskevat tullikorostukset vähentäisivät rajusti näiden kautta kulkevaa Suomesta ja muista EU-maista lähtöisin olevaa arvonlisää. EU-maista kovimman iskun kärsisivät Irlanti, Saksa ja Luxemburg. Arvonlisän lasku olisi vielä selvästi suurempaa, mikäli tullikorotukset koskisivat suoraa tuontia EU-maista USA:han.

Asiasanat: Arvoketjut, arvonlisä, yritys, tulli, vienti, bkt, vaikutus, tariffi

JEL: F13, F14, F23, L23

Executive summary

In this study, we analyze the impact of potential tariff rises on imports (especially from China and Mexico to the US) on third countries. To take into account the indirect exports of Finland and other countries via China and Mexico to the US, we use an international input-output dataset, namely the World Input-Output Database (WIOD). Furthermore, we revisit the effects of higher tariffs against EU exports to the US more generally. We apply a measurement framework for the decomposition of value-added trade to the US grounded on hypothetical extraction, a mathematical technique based on an input-output representation of the global economy (Los, Timmer and de Vries 2016; Timmer et al. 2016).

We obtained four main results.

First, we find that the total-value added content of gross exports from Finland, including both direct and indirect exports, to the US constituted $6.7 billion in 2014. During 2000–2008, the value added of Finnish exports to the US increased from $4.7 billion to $6.7 billion. The following years witnessed a downward trend and a recovery by 2014. Indirect and direct exports to the US from all EU countries in 2014 generated as much as $460 billion value added for member countries, representing 10% of the value added of exports for all countries. In terms of changes in value added for the entire EU area with the US over time, the value-added trade pattern of the EU has been very similar as in Finland.

A breakdown by country reveals interesting differences between EU member states. As much as $128 billion is generated in Germany, followed by the United Kingdom (UK) with $85 billion and Italy with $43 billion. When the importance of US trade is measured in relative terms, the most dependent EU countries are Ireland and the UK. The US accounts for as much as 15% of the value added generated from Irish and the UK exports to all countries. US trade is also important for Finland, Italy (11%) and Germany (11%), but it is not as important for countries such as Luxembourg (3%) and Malta (3%).

Second, we analyze the value-added exports to the US in more detail by investigating the alternative (indirect) trade routes through which value added is generated. We find that a large majority of the Finnish value added goes directly as intermediate or final goods and services to the US. Much less value added is generated via other countries to the US. For Finland, the most important indirect trade channel is through Germany for which trade constitutes $0.14–0.3 billion, depending on the calculation method applied.

In terms of value-added exports from the entire EU area to the US, extracting Germany's direct exports to the US would decrease the EU's value added by a total of $114.1 billion. The second largest effect would be caused by extracting the UK's direct exports, totaling $71.9 billion. We also decompose value-added trade by the producer of final goods and find that almost half of the EU's total value added attributed to US trade is generated by producing US-made final goods. Thus, EU countries export intermediates to the US where final production is done. Other important final producers are Germany, the UK, Italy and France, which together constitute roughly 25% of the exported value added.

Regarding the trade routes that are at the greatest risk of facing higher trade barriers, we find that for Finland, the route via China to the US is more important than the route via Mexico

when measured by the total value-added exports associated with the trade route. Perhaps surprisingly, for the entire EU area, the Mexican route is more important than the Chinese route to the US. After the financial crisis, the Mexican route became increasingly more important, exceeding its pre-crisis level. The most recent results show that EU countries create $10.4 billion of the value added, which passes through Mexico to the US. The route via China to the US is slightly less important, generating $7.3 billion the value added in the EU area.

Third, we investigate the effect of the trade barriers in several counterfactual scenarios. Using standard export elasticity estimates, we find that the value added generated by Finland and other EU countries through Mexico and China to the US would decline drastically if the US launches tariff increases on imports from Mexico and China to the US, as the US president has proposed. Finland would lose $210 million of the value added, accounting for 0.09% of the Finnish GDP. For the entire EU, the biggest negative impacts relative to the GDP would hit Ireland (0.14%), Germany (0.13%), and Luxembourg (0.11%).

Fourth, if the US raised tariff rates on direct imports from EU countries, the impacts would be significantly worse. Based on the optimistic scenario (5%-points increase in tariff rates), the EU would lose $38 billion of the value added (0.21% of the GDP), while in the pessimistic scenario, an increase to 15% in tariff rates would cause a decline of $99 billion of the value added, accounting for 0.53% of the EU's GDP. For Finland, these negative impacts would amount to $530 million (0.23%) and $1.37 billion (0.58%), respectively.

1 Background

"I will bring jobs back from China. I will bring jobs back from Japan. I will bring jobs back from Mexico," Donald Trump tweeted on February 6, 2016. Later, he suggested tariffs on imports from China, and in December 2016, he mentioned a 35% tariff on cars made by US companies in Mexico. In the interconnected world, these tariffs would not only affect China, Mexico, and the US but also other countries. These impacts arise from global value chains (GVCs) that link economies with each other. For instance, in the first step, Finnish companies produce goods and services that are exported to Sweden. In the second step, Swedish companies use these as intermediates in their own goods, which, in turn, are exported to China where the final assembly is made. In the final step, China exports these goods to the US. Thus, the gross imports of the US from China consist of value added from not only China but also Finland, Sweden, and Germany.

Thus, bilateral tariffs currently have potential impacts on multiple economies, but these impacts are not observable by using bilateral trade flows published by national statistical authorities. Traditionally, economic analyses have focused on bilateral effects, such as the impact of domestic import tariffs on domestic companies and industries, especially to assess the impact of trade policies, testing the firm-level predictions of the so-called "new" trade theory, which has its origins in the seminal work of Melitz (2003). Recently, some studies have also reported on the impacts more extensively, including external effects on a wider group of countries and industries, which might be large and also surprising. The results by Kuhn and Viegelahn (2017), for example, suggest that manufacturing trade barriers have a greater impact on service jobs than on production jobs in the manufacturing industry.

The recent study by Vandenbussche et al. (2017) used an approach close to ours, but the authors focused on employment rather than the value added. Based on the WIOD, the results suggest that tariff increases by the US would have non-negligible employment effects on European countries. For the EU, estimated job losses vary between 50,000 and 240,000, depending on the US tariff rate scenario. Furthermore, the export value would also decrease significantly, varying between 5% and 24%.

In this study, our aim is to analyze the impact of potential tariff increases (from China and Mexico to the US) on third countries. To take into account the indirect exports of Finland and other countries via China and Mexico to the US, we will use the WIOD. Furthermore, we revisit the effects of higher tariffs against EU exports to the US more generally.

2 Data and methodology

In our analysis, we use the 2016 release of the WIOD database (Timmer et al. 2015, 2016). The data comprises sector-level World Input-Output Tables (WIOTs) with underlying data for 44 countries and 56 sectors, which serves as a model for the rest of the world for the period 2000–2014.[1] Together, the countries cover more than 85% of the world GDP (at current exchange rates). WIOTs are built based on National Accounts data, which are extended by means of disaggregating imports by country of origin and using categories to generate international supply and use tables (Timmer et al. 2016).

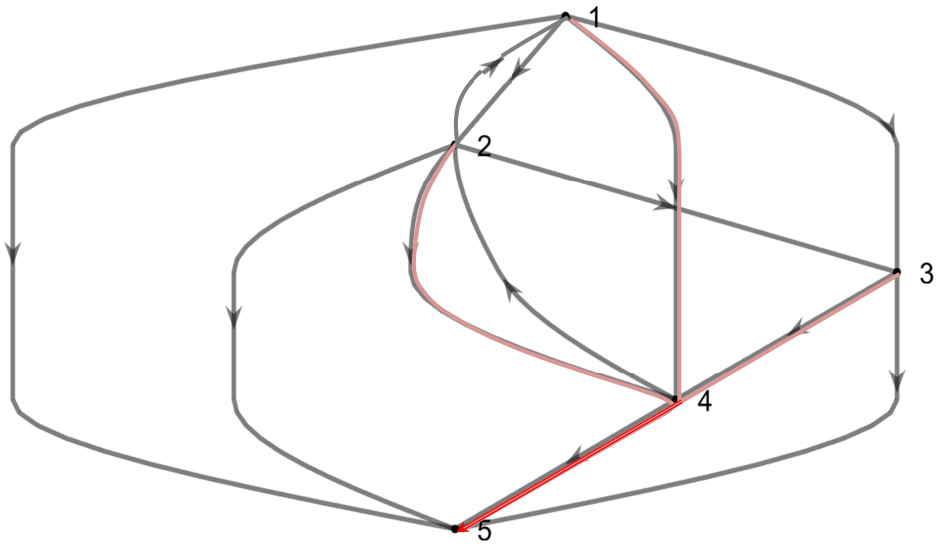
We apply a measurement framework for the decomposition of value-added trade to the US grounded on hypothetical extraction, a parsimonious mathematical technique based on an input-output representation of the global economy (Los, Timmer and de Vries 2016). This approach has a clear economic intuition and can be easily applied to the data. It compares the actual GDP in a country with a hypothetical GDP in cases where there are no production activities related to exporting. The difference is defined as the domestic value added in exports.

It is useful to illustrate the exclusion of direct trade linkages between two countries or regions with a simplified example (Figure 2.1). It illustrates the value-added trade of countries 1–4 to country 5 (the US) with nodes marking the countries. An edge marks a direct trade relationship between two countries, and the associated arrow marks the direction of the trade. The trade may include both final and intermediate goods and services; thus, the figure illustrates value chains by linking several countries. For example, country 1 exports intermediate goods to country 2, which uses it to produce another intermediate good that is exported via country 3 to country 5 as a part of the final product. This type of value chain has three stages. Even our simple exercise illustrates how complex the system of value chains can be. In principle, the example includes a limitless number of value chains with a different number of stages, due to the link from country 4 back to country 2. Thus, countries may contribute value added to a vast number of potential value chains and trade patterns, and the key challenge of global value chain (GVC) analysis is accounting for the total value added included in them (the value-added trade).

[1] The countries have been chosen by considering both the data availability of sufficient quality and the desire to cover a major part of the world economy. They include 27 EU countries and 15 other major countries. Data for the 56 sectors are classified according to the International Standard Industrial Classification Revision 4 (ISIC Rev. 4). The tables adhere to the 2008 version of the System of National Accounts (SNA). The dataset provides World Input-Output Tables (WIOTs) in current prices, denoted in millions of dollars (Timmer et al. 2016).

In this example, the direct trade link from country 4 to country 5 is excluded (dark-red edge). As a result, the direct and last mile of trade from country 4 to country 5 stops. Despite the direct trade ending, country 4 can still trade with country 5 via indirect trade (via country 2). Typically, we allow such trade to be unaffected when direct trade barriers are raised. However, the exclusion of direct trade from country 4 to country 5 also has indirect trade effects. In particular, all trade routes and value chains that include exporting first from countries 1–3 to country 4 and then to country 5 are blocked (the light-red edges). Ultimately, the affected, indirect trade includes all exporting countries through the potentially limitless number of value chains that have these linkages.

Figure 2.1 The illustration of the hypothetical extraction method



We next formally represent the exclusion method. Similarly to Los, Timmer and de Vries (2016), we partition the global input-output table such that we have a country *s* and a region *r* containing all other countries *c* in the world, and construct a matrix **A** as follows:

$$\boldsymbol{A} = \begin{bmatrix} \boldsymbol{A_{ss}} & \boldsymbol{A_{sr}} \\ \boldsymbol{A_{rs}} & \boldsymbol{A_{rr}} \end{bmatrix}$$

A contains the input coefficients a_{ij}, which give the value units of intermediate goods from industry *i* required to produce one value unit of gross output in industry *j*. $\boldsymbol{A_{ss}}$ represents the domestically purchased requirements of industries in country *s*, while $\boldsymbol{A_{sr}}$ gives the requirements by industries in *r* of products bought from industries in *s*. For the final demand block, we can similarly write:

$$\boldsymbol{y} = \begin{bmatrix} \boldsymbol{y_{ss}} & \boldsymbol{y_{sr}} \\ \boldsymbol{y_{rs}} & \boldsymbol{y_{rr}} \end{bmatrix}$$

in which the vectors $\boldsymbol{y_{ss}}$ and $\boldsymbol{y_{sr}}$ represent the values of flows from industries in country *s* to all domestic final users and to final users in *r*.

For any country *c,* the ratios of the value added to gross output in industries in country *c* are contained in a row vector $\boldsymbol{v}_c$. The length of this vector equals the numbers of industries in *s* and *r* (with *r* containing multiple countries), with value-added ratios for industries in *c* as elements ($\bar{v}_c$) and zeros elsewhere: $\boldsymbol{v}_c = [\mathbf{0}\ \bar{\boldsymbol{v}}_c\ \mathbf{0}]$. The actual value added in country *c* ($\boldsymbol{GDP}_c$) then equals:

$$\boldsymbol{GDP_c = v_c(I - A)^{-1}Y * i}$$

in which **i** is a column vector where all elements are unity, implying that it sums the two elements in each of the rows of the matrix **Y**. The element $(\boldsymbol{I - A})^{-1}$ is the well-known Leontief inverse, in which **I** is the identity matrix of appropriate dimensions. The expression is the key to account for the complexity of the trade patterns. In particular, $\boldsymbol{GDP}_c$ can be interpreted as the limiting value of the infinitely long sum of value-added contributions with the number of stages ranging from 1 to ∞.

What amount of domestic value added should be attributed to exports to *s* from the region *r*? To measure this we create a hypothetical world in which *r (*or its member country *c)* does not export anything to *s*, while leaving the rest of the economic structure of the world unaffected (an analogy of the exclusion of trade from country 4 to country 5 in our example). In the case of a region *r*, blocks from $\boldsymbol{A}_{rs}$ that represent trade from *r* are set to zero. We define the matrices $\boldsymbol{A}^*$ and $\boldsymbol{Y}^*$ as:

$$\boldsymbol{A}^* = \begin{bmatrix} \boldsymbol{A_{ss}} & \boldsymbol{A_{sr}} \\ \mathbf{0} & \boldsymbol{A_{rr}} \end{bmatrix}$$

and

$$\boldsymbol{Y}^* = \begin{bmatrix} \boldsymbol{y_{ss}} & \boldsymbol{y_{sr}} \\ \mathbf{0} & \boldsymbol{y_{rr}} \end{bmatrix}$$

The hypothetical GDP in *c* can be obtained by post-multiplying the hypothetical Leontief inverse with the hypothetical final demand as:

$$\boldsymbol{GDP_r^* = v_r(I - A^*)^{-1}Y^* * i}$$

Following the logic of hypothetical extraction, the domestic value added in exports to country *s* can be derived as the difference in the GDP in the actual and hypothetical situation:

$$\boldsymbol{\Delta VA_r = GDP_r - GDP_r^*}$$

$\boldsymbol{\Delta VA_r}$ correctly measures the indirect and direct effects on the value chains and trade routes that follow from the exclusion of the direct trade linkage for region r.

More generally, the effects can be allocated to any single country, including the importing country *s* via indirect trade. In this paper, we are interested in the following counterfactual measurements for individual countries:

– The total value added of country *c* in all trade from region r to country *s*. In that case, we use $\boldsymbol{A}^* = \begin{bmatrix} \boldsymbol{A_{ss}} & \boldsymbol{A_{sr}} \\ \mathbf{0} & \boldsymbol{A_{rr}} \end{bmatrix}$ and $\boldsymbol{Y}^* = \begin{bmatrix} \boldsymbol{y_{ss}} & \boldsymbol{y_{sr}} \\ \mathbf{0} & \boldsymbol{y_{rr}} \end{bmatrix}$, and the corresponding measure is $\boldsymbol{\Delta VA_c^{total}}$ with the value added vector $\boldsymbol{v}_c$ entering $\boldsymbol{GDP_c^*}$;

– The direct value added of country *c* in the trade to country *s*. In that case, we use $\boldsymbol{A}^{\star} = \begin{bmatrix} \boldsymbol{A_{ss}} & \boldsymbol{A_{sr}} \\ \boldsymbol{A_{rs}^{a_{cs}=0}} & \boldsymbol{A_{rr}} \end{bmatrix}$ and $\boldsymbol{Y}^{*} = \begin{bmatrix} \boldsymbol{y_{ss}} & \boldsymbol{y_{sr}} \\ \boldsymbol{y_{rs}^{y_{cs}=0}} & \boldsymbol{y_{rr}} \end{bmatrix}$, and the corresponding measure is denoted as $\boldsymbol{\Delta VA_c^{direct}}$ with the value added vector $\boldsymbol{v}_c$ entering $\boldsymbol{GDP_c^{*}}$; and

– The indirect value added of country *c* via the exports of country *k* to *s*. In that case, we use $\boldsymbol{A}^{*} = \begin{bmatrix} \boldsymbol{A_{ss}} & \boldsymbol{A_{sr}} \\ \boldsymbol{A_{rs}^{a_{ks}=0}} & \boldsymbol{A_{rr}} \end{bmatrix}$ and $\boldsymbol{Y}^{*} = \begin{bmatrix} \boldsymbol{y_{ss}} & \boldsymbol{y_{sr}} \\ \boldsymbol{y_{rs}^{y_{ks}=0}} & \boldsymbol{y_{rr}} \end{bmatrix}$, and the corresponding measure is $\boldsymbol{\Delta VA_c^{via\,k}}$ with the value added vector $\boldsymbol{v}_c$ entering $\boldsymbol{GDP_c^{*}}$.

3 The value-added trade to the US

3.1 Total direct and indirect value-added trade

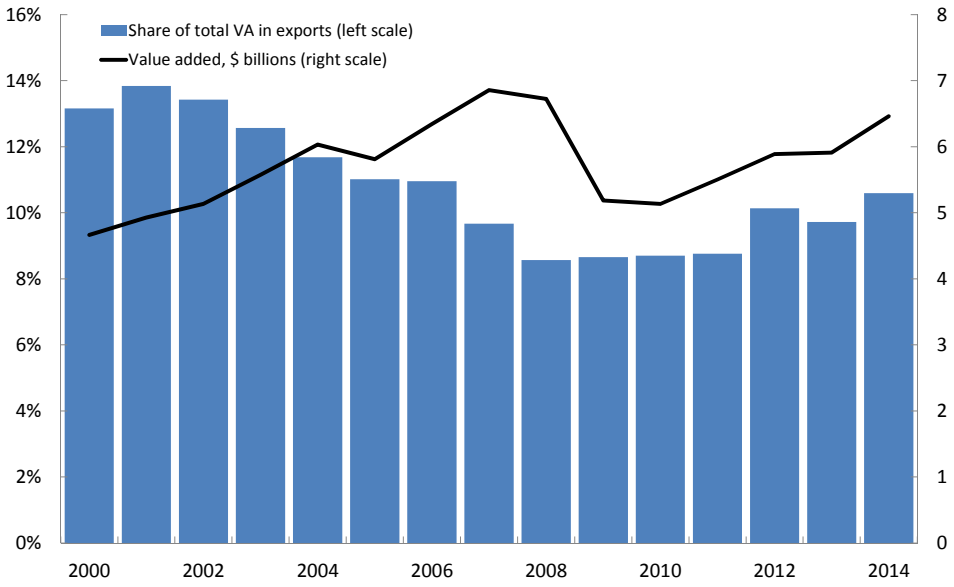
Traditional trade statistics reported by national statistical authorities only report bilateral trade flows. In the GVC world, however, an increasing number of goods and services are produced in long and geographically fragmented value chains. Often, this means that companies buy their inputs from multiple countries, do their own value-added activities, and export their output again to third countries that use them as intermediates, which, in turn, export more finalized output to other countries. As a result, the direct exports' destination does not necessarily equal the ultimate destination country. We use the term "indirect" trade to describe trade that originates from country *c*, goes to country k, and is re-exported directly or through multiple countries to country *s*.

To solve the total value added of the US trade, we calculate the hypothetical GDP in case there are no production activities related to direct exports from any country to the US, and compare it to the actual GDP. The difference is defined as the total value-added content of gross exports to the US ($\boldsymbol{\Delta VA_c^{total}}$).

For Finland, the total value-added content of gross exports to the US, including both direct and indirect, constituted $6.7 billion in 2014. During 2000–2008, the value added of Finnish exports to the US increased from $4.7 billion to $6.7 billion. The following years witnessed a downward trend and a recovery at the end of the period (Figure 3.1).

In relative terms, the total significance of US trade for the Finnish economy increased in the early 2000s, reaching 15.2% of the value added of all Finnish exports in 2000. Since then, this figure has decreased. Currently (based on the most recent year in Figure 3.1), US trade accounts for 10.6% of the total Finnish value added generated from exports. As mentioned earlier, these figures take into account the value added of Finnish indirect exports, such as when Finland exports intermediate goods to Sweden where the final assembly is made, and then the finalized products are exported to the US. In other words, the domestic value added of exported Finnish intermediates to Sweden is included in our figures, but the value added created in Sweden is, naturally, excluded.

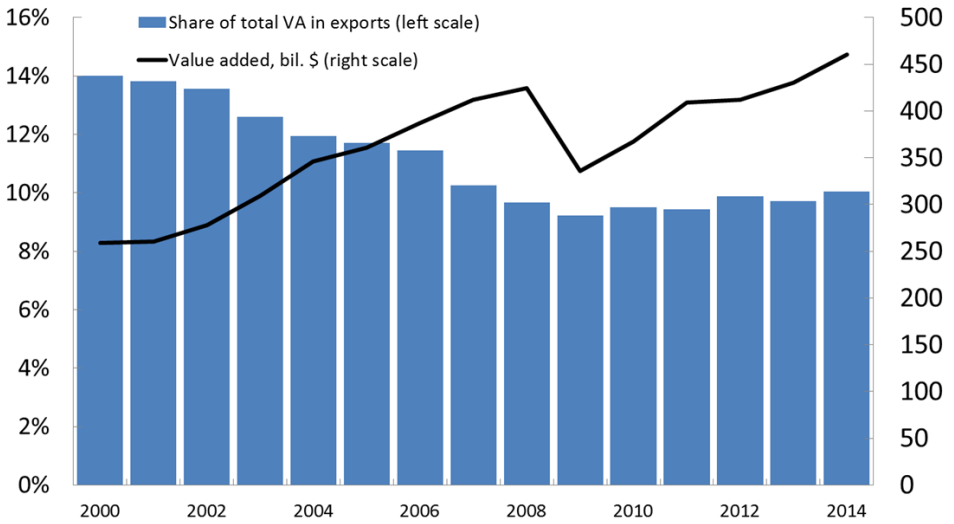
Figure 3.1 Value added of Finnish total direct and indirect exports to the US ($ billions and %)



Note: The Finnish value added in production of the Finnish intermediate and final goods that are directly or indirectly exported to the US ($ billions) in current prices, and its share of the value added of Finnish exports to all countries.
Source: Authors' calculations based on WIOD data, 2000–2014.

The changes in value added for the entire EU area with the US have been very similar as in Finland (Figure 3.2). Thus, from this perspective, the development of Finnish trade has not differed from the EU.

Figure 3.2 Value added of EU's total direct and indirect exports to the US ($ billions and %)



Note: The EU's value added in production of the EU's intermediate and final goods that are directly or indirectly exported to the US ($ billions in current prices and its share of the value added of EU's exports to all countries).

In 2014, the exports of EU countries that went directly or indirectly to the US generated as much as $460 billion value added to member countries, representing 10% of the value added of exports to all countries.

The country breakdown, however, reveals interesting differences between EU member states (Table 3.1). As much as $128 billion is generated in Germany followed by the UK ($85 billion) and Italy ($43 billion).

When the importance of US trade is measured in relative terms (column *b* in Table 3.1), the most dependent EU countries are Ireland and the UK. The US accounts for as much as 15% of the value added generated from Irish and UK exports to all countries. US trade is also import-

Table 3.1 The value added of exports by EU countries ending up in the US ($ billions and %), 2014

	(a) *Value added of direct and indirect exports to the US, $ billions*	*(b)* *Share of total value-added exports (to all countries), %*
UK	84.6	15%
Ireland	19	15%
Germany	127.8	11%
Finland	6.5	11%
Italy	43.4	11%
France	49.6	10%
Belgium	18.1	9%
Netherlands	30.8	9%
Sweden	13.7	9%
Austria	10.3	8%
Denmark	7.9	8%
Hungary	3.7	7%
Czech Republic	4.7	6%
Spain	15.9	6%
Croatia	0.9	6%
Portugal	3.1	6%
Romania	3.1	6%
Bulgaria	1	5%
Estonia	0.5	5%
Greece	1.8	5%
Poland	8.8	5%
Slovenia	0.9	5%
Cyprus	0.3	4%
Lithuania	0.9	4%
Latvia	0.4	4%
Slovakia	1.7	4%
Luxembourg	1.3	3%
Malta	0.1	3%
Sum	460.7	
Average		7%

Source: Authors' calculations based on WIOD data.

ant for Finland, Italy (11%), and Germany (11%), but not as important for countries such as Luxembourg (3%) and Malta (3%).

3.2 The importance of different trade routes to the US

Next, we analyze the value-added exports to the US in more detail by investigating the alternative trade routes through which value added is generated. In particular, we index the trade routes by the countries that operate as: (1) the last mile exporters of the goods and services to the US; or (2) the producer of the final goods or services that are consumed in the US market. In case (1), we calculate the hypothetical GDP where there are no production activities related to direct exports from a particular country *k* to the US and compare it to the actual GDP. Using the notation of Section 2, we calculate the contributions of Finland and the EU ($\boldsymbol{\Delta VA^{via\,k}}$) and $\boldsymbol{\Delta VA^{direct}}$ as their special case.

In case (2), we instead use the *total* value-added contribution ($\boldsymbol{\Delta VA^{total}}$). We first calculate the hypothetical GDP where there are no production activities related to direct exports from *any* country to the US and compare it to the actual GDP. We then assign the changes in the value added to different final producer countries. We measure changes in the GVC matrix[2] and collect the rows of the matrix that decompose the contribution of a certain country-industry to final production within different countries.

This latter approach is particularly useful because the different scenarios in case (1) may overlap. For example, the contribution of Finland to the Chinese trade route to the US may decrease when the German trade route is also cancelled. This is the case when part of the Finnish contribution to the Chinese trade route channels through Germany. For this reason, the total contributions of the alternative scenarios that cancel trade routes one-by-one may exceed the total value-added trade. Therefore, it is also useful to decompose the *total* value-added contribution by the final producer country – a measurement that does not suffer from similar aggregation problems.

First, we consider the direct gross exports from Finland to the US. We calculate the hypothetical GDP where there are no production activities related to direct exporting and compare it to the actual GDP. The difference is defined as the direct gross VA content of gross exports ($\boldsymbol{\Delta VA_{FIN}^{direct}}$). In Figure A1 in the Appendix, we find that the value added originating directly from Finland to the US has evolved very similarly to the total value added generated in trade to the US. In 2014, if direct trade had been stopped, the value-added loss would have been $4.4 billion.[3]

[2] In this global value chain (GVC) matrix, every row is a value chain whose figures indicate the participation of industries in different countries in final production within a certain industry. The sum of these values is the value of final production in a certain country and industry.

[3] Here, we can refer to other data sources for the estimated gross export value added. In particular, the OECD collects its own trade in a value-added dataset, and its measures for gross exports are comparable to ours. OECD TiVA estimates are collected in Figure A1 in the Appendix. The results suggest that the pattern observed in the WIOD data is also evident in the OECD's dataset, although there are some differences. Most noticeable is that the TiVA dataset yields moderately larger estimates. In Figure A5, we make the same comparison for the direct VA trade from Finland to China and find that the datasets provide very similar views on the magnitude of the trade, but again, TiVA provides marginally larger numbers. It should also be noted that there are relatively large revisions in the WIOD. In particular, in the 2016 release, the value-added exports from Finland to China have been revised downward when compared to the estimates based on the last years of the 2013 release (2010, 2011).

Table 3.2 Decomposition of the Finnish value-added trade by the main (top 10) trade routes

	(a) *Finnish value added that would be lost without a country's direct intermediate and final exports to the US, $ billions*	*(b)* *The Finnish value added of the exports to the US (total $6.7 billion) by the producer of the final goods/services, top 10*
US	–	3.90
Finland	4.40	1.25
Germany	0.27	0.14
China	0.14	0.12
Canada	0.17	0.12
Mexico	0.13	0.12
UK	0.09	0.05
Ireland	0.10	0.05
Sweden	0.11	0.05
Japan	0.05	0.05

Note: In column (a) we calculate the VA contents of different trade routes by using method 1, in column (b) we use method 2. In order to interpret the figures, let us consider the role of Mexico, for example. The 6th row in column (a) implies that the absence of Mexico's intermediate and final exports to the US would decrease the Finnish value added by $0.13 billions. Respectively, in column (b) we first measure the total Finnish value added contributed to direct exports to the US from any country, and then decompose the trade by the final producer country. In the example, Finland exports $0.12 billions in intermediate products to Mexico for final assembly which are then exported to the US as final goods, as the 6th row of column (b) suggests.
Source: Authors' calculations based on WIOD data.

Table 3.3 Decomposition of the EU's value-added trade to the US by the main (top 10) trade routes

	(a) *EU's value added that would be lost without the row country's direct intermediate and final exports to the US, $ billions*	*(b)* *The EU's value added of the exports to the US (total $460 billion) by the producer of the final goods/services, top 10*
US	–	234.02
Germany	114.13	59.13
UK	71.88	28.53
Italy	37.55	20.76
France	40.39	17.09
Mexico	10.48	8.39
Ireland	20.08	8.31
Canada	10.64	7.61
Netherlands	20.66	6.63
China	7.35	6.48

Note: In column (a) we calculate the VA contents of different trade routes by using method 1, in column (b) we use method 2. In order to interpret the figures, let us consider the role of Mexico, for example. The 6th row in column (a) implies that the absence of Mexico's intermediate and final exports to the US would decrease the Finnish value added by $10.48 billions. Respectively, in column (b) we first measure the total Finnish value added contributed to direct exports to the US from any country, and then decompose the trade by the final producer country. In the example, Finland exports $8.39 billions in intermediate products to Mexico for final assembly which are then exported to the US as final goods, as the 6th row of column (b) suggests.
Source: Authors' calculations based on WIOD data.

We then consider other trade routes. The results suggest that other countries play a limited role as a trade route, a result that is not sensitive to whether it is calculated from the decomposition based on the final producer in the total trade (column *b*) or the exclusion of the direct trade of a country (column *a*) in Table 3.2. Rather, a large majority of the Finnish value added goes directly as intermediate or final goods and services to production in the US (Table 3.2, column *a*). The value added is associated with either the Finnish final product ($1.25 billion) or the final production in the US ($3.9 billion[4]). The most important other trade route is through Germany for which the trade constitutes $0.1–0.3 billion, depending on the calculation method.

We next investigate further the value-added exports from the entire EU area to the US (Table 3.3). Similarly to the Finnish case, the table isolates the value-added contribution by the countries that operate as either the last mile exporters of the goods and services to the US (column *a* in Table 3.3) or the producer of the final goods or services that are consumed in the US market (column *b* in Table 3.3).

Column *a* shows that extracting the German direct exports to the US would decrease the EU's value added by a total of $114.1 billion. The second largest effect would be caused by extracting the UK's direct exports, for a total of $71.9 billion. In terms of the producer of the final goods (column *b* in Table 3.3), almost half of the EU's total value added attributed to the US trade is generated in the production of US-made final goods. Thus, EU countries export intermediates to the US where the final production is done. Other important final producers are Germany, the UK, Italy, and France, which together constitute roughly 25% of the exported value added.

Finally, we pay special attention to the value added in trade routes that include direct exports to the US via China or Mexico, as the potential new tariffs especially concern imports from these two countries to the US. As reported in Table 3.2, in 2014, the Finnish value added exported to the US via China constituted $0.14 billion and via Mexico only $0.13 billion. For Finland, the importance of the route via China to the US has, however, significantly varied between 2000 and 2014 (Figure 3.3).

In 2000–2007, an increasing amount of Finnish value added went via China to the US. In 2007, the peak year, the value of this trade was $0.3 billion. However, by 2009, this amount drastically dropped and has not recovered to its previous level. For Finland, the route via Mexico does not reach the Chinese level but the difference is rather small. Previously, however, the difference between Chinese and Mexican routes was significantly larger, but during the past five years, the distinction has shrunk.

Contrary to Finland, for the entire EU area, the route via Mexico is more important than the Chinese route to the US (Figure 3.4).

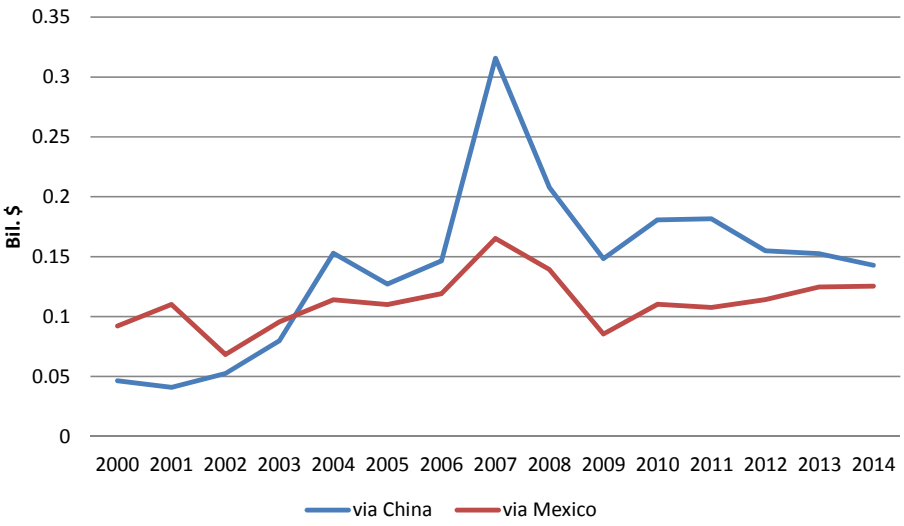
During the post-crisis period, the Mexican route to the US has become increasingly important for the EU area, exceeding the pre-crisis level. The difference between the Mexican and Chinese routes widened after the financial crisis. Surprisingly, the value added created by the EU area passing through China to the US has not reached the pre-crisis level.

[4] This $3.9 billion can be interpreted as the Finnish value added of intermediates that have been exported to the US where the final production has taken place.

Although for the entire EU region the Mexican route is more important than the Chinese route, the breakdown by EU members reveals that this does not concern all EU countries (Table 3.4).

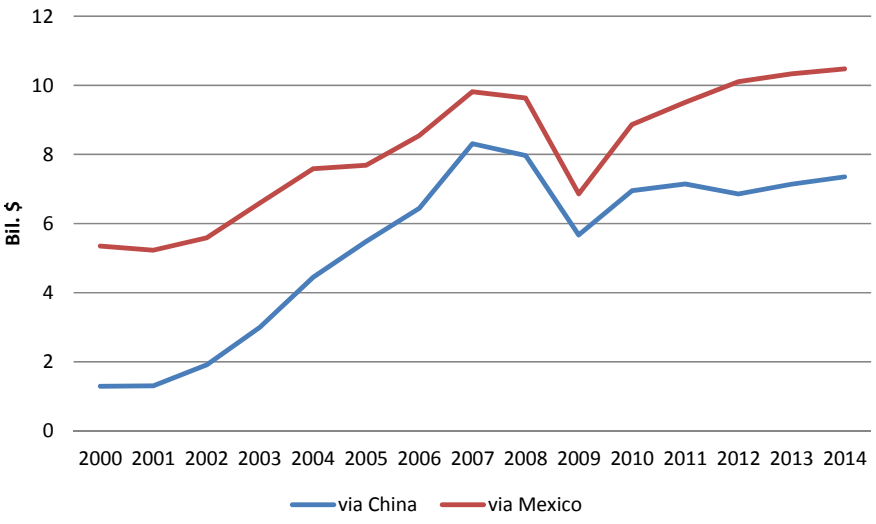
The Chinese route to the US is more important for countries such as Finland, the Netherlands, and Luxembourg, but many other countries such as Germany, France, and the UK export more to the US through Mexico than through China (Table 3.4).

Figure 3.3 Value added of Finnish exports via China and Mexico to the US, $ billions



Note: In current prices.
Source: Authors' calculations based on WIOD data.

Figure 3.4 Value added of EU's exports via China and Mexico to the US, $ billions



Note: In current prices.
Source: Authors' calculations based on WIOD data.

Table 3.4 The value added exports via China and Mexico to the US by EU countries (2014)

	(a) Value added of exports via China to the US, $ millions	*(b) % of the value added of exports to the US*	*(c) Value added of exports via Mexico to the US, $ millions*	*(d) % of the value added of exports to the US*
Austria	196	2%	271	3%
Belgium	276	2%	290	2%
Bulgaria	33	4%	22	3%
Cyprus	7	3%	6	2%
Czech Republic	93	2%	157	4%
Germany	2 439	2%	3 527	3%
Denmark	154	2%	154	2%
Spain	282	2%	800	6%
Estonia	11	2%	14	3%
Finland	143	2%	125	2%
France	826	2%	1 103	2%
UK	887	1%	1 027	1%
Greece	63	4%	43	3%
Hungary	54	2%	111	3%
Ireland	160	1%	275	2%
Italy	490	1%	1 111	3%
Lithuania	22	3%	15	2%
Luxembourg	47	4%	35	3%
Latvia	11	3%	7	2%
Malta	3	3%	4	3%
Netherlands	532	2%	522	2%
Poland	163	2%	262	3%
Portugal	63	2%	88	3%
Slovakia	32	2%	45	3%
Slovenia	18	2%	28	3%
Sweden	266	2%	332	3%
Sum of EU countries	7 268		10 375	
Average of EU countries		2.3%		2.7%

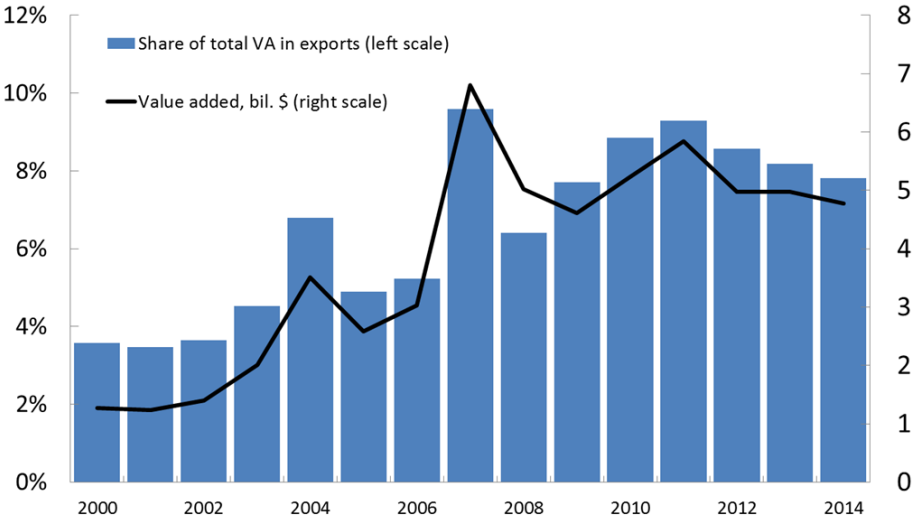
Source: Authors' calculations based on WIOD data.

The relative importance of this China route to the US ranges between 1% and 4% of the total value added that the US exports generate (column *b* in Table 3.4). For Bulgaria, Greece, and Luxembourg the route via China to the US is more important than for the UK, Ireland and Italy. On average, the Chinese route to the US accounts for 2.3% of the value added generated by exports to the US. The role of Mexico as a route to the US accounts for, on average, 2.7% of the value added generated by exports to the US (column *d* in Table 3.4). In relative terms, the Mexico route is the most important for Spain (6%) and the Czech Republic (4%) and the least important for the UK (1%).

3.3 The value added exports: The US vs. China

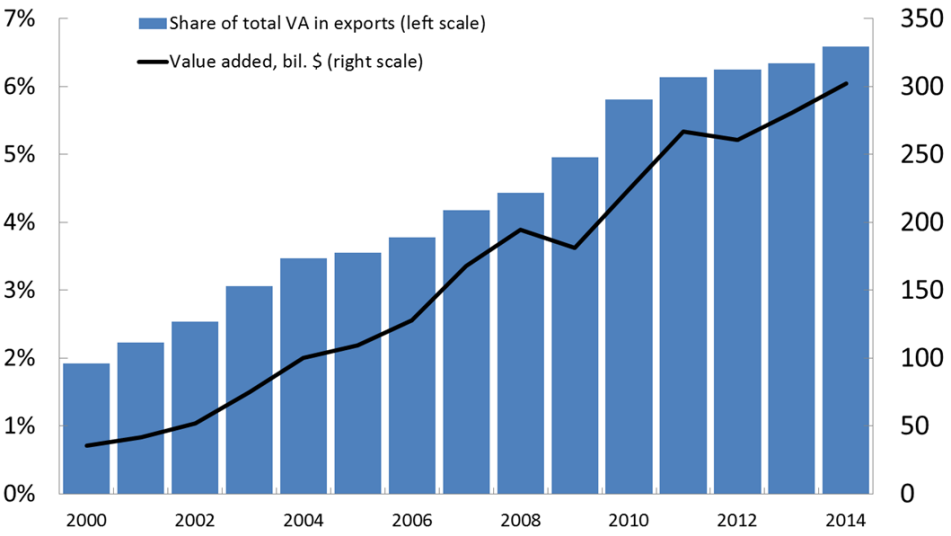
It is useful to relate the US trade developments to another large trade partner of the EU, China. To solve the total value added of the Chinese trade, we use the same method as in the case of the US (see Section 3.1). Thus, we calculate the hypothetical GDP where there are no production activities related to direct exports from any country to China and compare it to the actual GDP. The difference is defined as the total VA content of gross exports to China (ΔVA_c^{total}).

Figure 3.5 Value added of Finnish total direct and indirect exports to China ($ billions and %)



Note: The Finnish value added in production of all intermediate and final goods that are directly or indirectly exported to China.

Figure 3.6 Value added of EU countries' total direct and indirect exports to China ($ billions and %)



Note: The EU value added in production of all intermediate and final goods that are directly or indirectly exported to China.

For Finland, it is noticeable how the total value-added content of gross exports to China varied considerably after 2000 (Figure 3.5). During 2000–2008, the value added of Finnish exports to China increased sharply (Figure 3.5). The value added peaked in 2007 at $6.8 billion, an amount that was almost equal to the US trade value. However, the value added generated by exports to China has decreased since then, and in 2014, it was $4.8 billion. Thus, Finland has experienced opposite development post-crisis compared to exports to the US (Figure 3.1).

For the EU in total, the share of Chinese trade has increased rather steadily throughout the period of 2000–2014, both in absolute and relative terms (Figure 3.6). In 2014, the EU countries created as much as $302.1 billion value added, which was exported to China. This exceeds eight-fold the corresponding amount in 2000. In addition to absolute growth, the increasing importance of China as an export destination also shows in relative terms. Whereas in 2000 the value-added exports from the EU to China represented only 13.7% of the value-added exports to the US, in 2014, the ratio had risen to 65.6%.

Finally, we briefly address the value-added contributions of different EU countries to the Chinese trade. Table 3.5 isolates the value-added contribution by the countries that operate as either the last mile exporters of the goods and services to China (column *a* in Table 3.5) or the producer of the final goods or services that are consumed in the Chinese market (column *b* in Table 3.5).

The list of top 10 countries arranged by the importance of their contribution as a final producer are quite similar to the US trade (see column *b* in Table 3.3). Specifically, 50% of the trade is

Table 3.5 Decomposition of the EU's value-added trade to China by the main (top 10) trade routes

	(a) *EU's value added that would be lost without the row country's direct intermediate and final exports to the US, $ billions*	*(b)* *The EU's value added of the exports to China (total $302.1 billion) by the producer of the final goods/services, top 10*
China	–	150.3
Germany	103.5	56.2
UK	22.3	12.3
France	24.4	12.0
Italy	15.5	9.9
US	3.1	4.9
Netherlands	10.9	4.1
Sweden	6.3	3.1
South Korea	6.2	3.0
Denmark	5.8	2.8

Note: In column (a) we calculate the VA contents of different trade routes by using method 1, in column (b) we use method 2. In order to interpret the figures, let us consider the role of South Korea, for example. The 9th row in column (a) implies that the absence of South Korea's intermediate and final exports to the US would decrease the Finnish value added by $6.2 billions. Respectively, in column (b) we first measure the total Finnish value added contributed to direct exports to the US from any country, and then decompose the trade by the final producer country. In the example, Finland exports $3.0 billions in intermediate products to South Korea for final assembly which are then exported to the US as final goods, as the 9th row of column (b) suggests.
Source: Authors' calculations based on WIOD data.

associated with the production of the domestic final goods by China. In other words, approximately half of the EU's exports to China are intermediates that are used in final production in China. In addition to these intermediates, EU countries also export final products (and services) to China. The most important producers of these final products are Germany, the UK, Italy, and France, which together constitute roughly 25% of the total.

4 The value-added impacts of raising tariffs

Finally, we analyze value-added losses due to potential tariff rises imposed by the US. Our analyses concern the impact of potential tariff rises on imports from China and Mexico to the US. Furthermore, the threat of protectionism involves the possibility of higher tariffs against EU exports to the US more generally.

Currently, the US tariff on China's imports across all sectors is, on average, 3%. The corresponding tariff for Mexico's imports is, on average, 0.1%. The US tariff on imports from the EU is 2.1%. In his speeches and Twitter posts, Donald Trump has proposed various tariff rates for imports from Mexico and China. For Mexico, rates such as 20%[5] and 35%[6] have been presented, and for China, the rate of 45% has been proposed.[7] For the EU, Vandenbussche et al. (2017) propose two scenarios – a modest increase scenario with a 5%-points tariff increase and a pessimistic scenario in which tariffs are raised to 15%. The latter builds on the assumption that the US government would use the full capacity of the Trade Act of 1974. It stipulates that the president of the US can increase tariffs up to 15% for a period of 150 days against countries with large balance-of-payments surpluses (Trade Act of 1974: Section 122[8]).

These rates are used in our analyses (Table 3.6). Furthermore, we employ trade elasticity estimates reported in the earlier literature to calculate how intensively trade flows react to an increase of import tariffs. In particular, following Vandenbussche et al. (2017), we assume that each 1% increase in the tariff rate decreases exports by -2%. They argue that this trade elasticity can be regarded as a prudent one with many products and sectors displaying higher trade elasticities.

The impacts of tariff rises concerning imports from Mexico and China to the US are rather modest (Column *a* in Table 3.6). Based on our results, the entire EU area would lose a total of $13.5 billion value added, representing approximately 0.07% of the EU's total GDP. In relative terms, the greatest negative impacts would be actualized in Ireland and Germany (Column *b* in Table 3.6).

Not surprisingly, negative outcomes would be significantly larger if the US increased tariffs on imports from EU countries (columns *c–f* in Table 3.6). For the EU, value-added losses vary between $38 billion and $99 billion, depending on the US tariff rate scenario. In relative terms, the most severe impacts would be seen in Ireland, Belgium, and Netherlands (columns *d* and *f)*.

5 On January 27, 2017.

6 On September 15, 2016.

7 New York Times, January 7, 2016.

8 19 U.S.C. ch.12—Trade Act of 1974.

Table 3.6 The value-added impact of potential tariff rises on imports to the US

	The value-added loss if the US import tariffs from MEX and CHN were increased to 35% and 45%, respectively		*The value-added loss if the US import tariffs from the EU were increased by 5%-points*		*The value-added loss if the US import tariffs from the EU were increased to 15%*	
	(a) $ billions	*(b) % of GDP*	*(c) $ billions*	*(d) % of GDP*	*(e) $ billions*	*(f) % of GDP*
Austria	0.35	0.09%	0.82	0.21%	2.12	0.54%
Belgium	0.43	0.09%	1.54	0.32%	3.96	0.83%
Bulgaria	0.04	0.09%	0.06	0.12%	0.16	0.32%
Cyprus	0.01	0.05%	0.01	0.06%	0.03	0.16%
Czech Republic	0.19	0.10%	0.38	0.21%	0.99	0.53%
Germany	4.52	0.13%	10.89	0.31%	28.09	0.81%
Denmark	0.24	0.08%	0.63	0.21%	1.64	0.55%
Spain	0.80	0.06%	1.16	0.09%	2.98	0.24%
Estonia	0.02	0.08%	0.04	0.15%	0.09	0.39%
Finland	0.21	0.09%	0.53	0.23%	1.37	0.58%
France	1.47	0.06%	4.15	0.16%	10.72	0.42%
UK	1.46	0.05%	7.14	0.27%	18.42	0.69%
Greece	0.08	0.04%	0.09	0.04%	0.22	0.11%
Croatia	0.03	0.05%	0.06	0.13%	0.16	0.32%
Hungary	0.12	0.11%	0.31	0.27%	0.80	0.69%
Ireland	0.33	0.14%	1.65	0.72%	4.25	1.87%
Italy	1.19	0.06%	3.73	0.19%	9.63	0.50%
Lithuania	0.03	0.07%	0.05	0.13%	0.14	0.32%
Luxembourg	0.06	0.11%	0.06	0.10%	0.15	0.25%
Latvia	0.01	0.05%	0.02	0.09%	0.06	0.23%
Malta	0.01	0.06%	0.01	0.09%	0.02	0.24%
Netherlands	0.81	0.10%	2.55	0.32%	6.59	0.83%
Poland	0.32	0.07%	0.69	0.14%	1.78	0.37%
Portugal	0.11	0.06%	0.21	0.10%	0.55	0.27%
Romania	0.12	0.07%	0.22	0.13%	0.58	0.33%
Slovakia	0.06	0.06%	0.13	0.15%	0.35	0.38%
Slovenia	0.03	0.08%	0.06	0.15%	0.17	0.39%
Sweden	0.46	0.09%	1.09	0.21%	2.80	0.55%
Sum	13.51		38.28		98.82	
Average		0.08%		0.19%		0.49%

Note: Authors' calculations based on WIOD data.

5 Conclusions

In this study, we analyzed the value-added impacts of rising US protectionism on Finland and other EU member states. The president of the US has proposed tariff increases, and in particular, on imports from Mexico and China to the US. However, in the era of GVCs, potential tariff rises impact not only these countries but also other countries. Furthermore, the threat of protectionism involves the possibility of higher tariffs against EU exports to the US more generally. To analyze the impacts of protectionism, we applied a measurement framework for the decomposition of value-added trade to the US, grounded on hypothetical extraction, a mathematical technique based on an input-output representation of the global economy (Los, Timmer and de Vries 2016; Timmer et al. 2016).

Our results showed that trade to the US continues to be an important source of value added for Finland as well as the majority of the EU countries, even when trade slowed temporarily during the Great Recession. For many EU countries, trade to the US represents over 10% of the value added of exports to all countries. Furthermore, we found that a large majority of both the Finnish and EU value added goes directly as intermediate or final goods and services to the US. Much less value added is generated via other countries to the US. For Finland, the most important other trade channel is through Germany.

We also investigated the effect of the trade barriers in several counterfactual scenarios. Using standard export elasticity estimates, we found that the value added generated by Finland and other EU countries through Mexico and China to the US would decline drastically if the US launched tariff rises on imports from Mexico and China to the US, as the US president has proposed. Finland would lose $210 million value added, accounting for 0.09% of the Finnish GDP. In the entire EU, the greatest negative impacts would hit Ireland (0.14% of the GDP), Germany (0.13% of the GDP), and Luxembourg (0.11%). The impacts would be significantly worse if the US increased tariff rates on direct imports from EU countries. Based on the optimistic scenario (5%-points increase in tariff rates), the EU would lose $38 billion value added (0.21% of the GDP), while the pessimistic scenario (increase to 15% tariff rates) would cause a decline of $99 billion value added, accounting for 0.53% of the EU's GDP. For Finland, these negative impacts would be $530 million (0.23%) and $1.37 billion (0.58%), respectively.

In addition to the trade impacts that we have analyzed in this study, tariff rises potentially affect the investment of companies currently producing goods in China or Mexico and exporting the output to the US. Companies have, however, several alternatives to change the geography of their activities. First, companies may transfer the production to the US, instead of importing from these two countries. Second, companies may also transfer the production to other countries with lower tariff rates and export from these new locations to the US.

All in all, our findings show that as a result of global fragmentation of production processes, bilateral trade barriers may potentially have large impacts not only on targeted countries but also third countries. Thus, they may result in harming economies that were not directly targeted. Among other things, these indirect negative outcomes potentially increase the probability that other countries will launch some kind of counter-measures to tariff rises.

References

Kuhn, S. and Viegelahn, C. (2017). Foreign trade barriers and jobs in global value chains. *ILO Research Paper*, No. 19, International Labour Office, Geneva, Switzerland.

Los, B., Timmer, M. P. and de Vries, G. J. (2016). "Tracing Value-Added and Double Counting in Gross Exports: Comment." *American Economic Review*, 106(7): 1958-66.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, Vol. 71, No. 6, pp. 1695–1725.

Office of the United States Trade Representative (2017). *2017 Trade Policy Agenda and 2016 Annual Report of the President of the United States on the Trade Agreements Program*. Office of the United States Trade Representative, United States.

Statistics Denmark (2008). *International Sourcing, Moving Business Functions Abroad*. Statistics Denmark, Copenhagen.

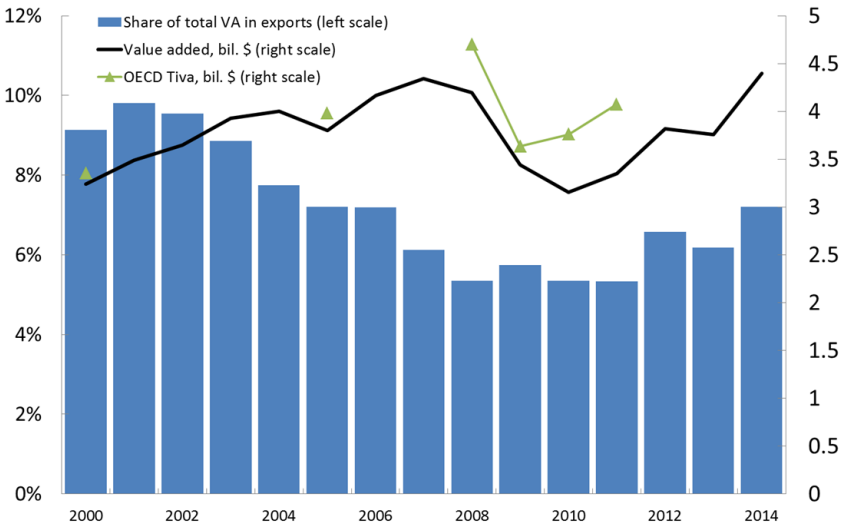
Timmer, M. P., Dietzenbacher, E., Los, B., Stehrer, R. and de Vries, G. J. (2015). An illustrated user guide to the world input–output database: The case of global automotive production. *Review of International Economics,* Vol. 23, No. 3, pp. 575–605.

Timmer, M. P., Los, B., Stehrer, R. and de Vries, G. J. (2016). An anatomy of the global trade slowdown based on the WIOD 2016 release. *GGDC Research Memorandum*, No. 162, University of Groningen, Netherlands.

Vandenbussche, H., Connell, W., Simons, W. and Zaurino, E. (2017). "America First!" What are the job losses for Belgium and Europe? *VIVES Discussion Paper*, No. 57, University of Leuven, Belgium.

Appendix

Figure A1 Value added of Finnish direct exports to the US ($ billions and %)



Note: Sources: WIOD database and the OECD's TiVA dataset.

Figure A2 Value added of EU's total direct and indirect exports to the US ($ billions and %)

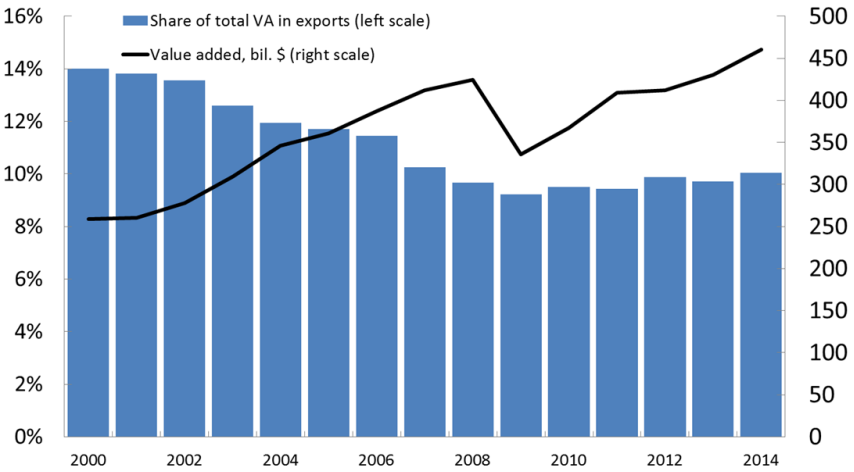
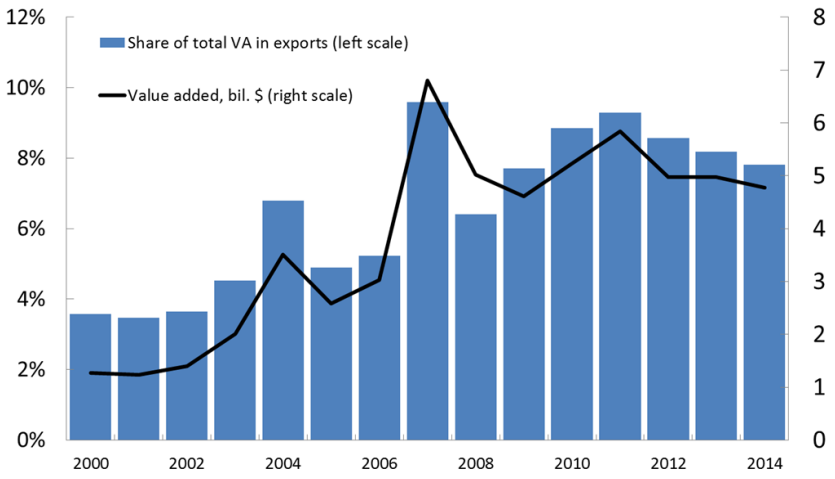
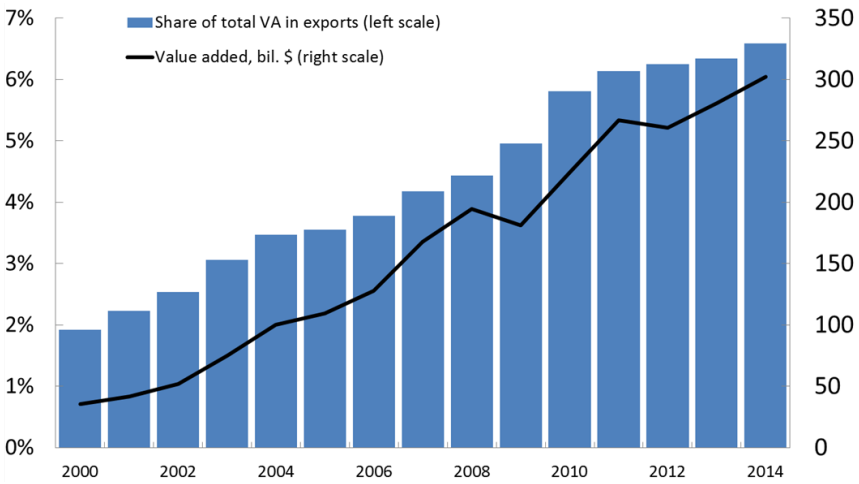


Figure A3 Value added of Finnish total direct and indirect exports to China ($ billions and %)



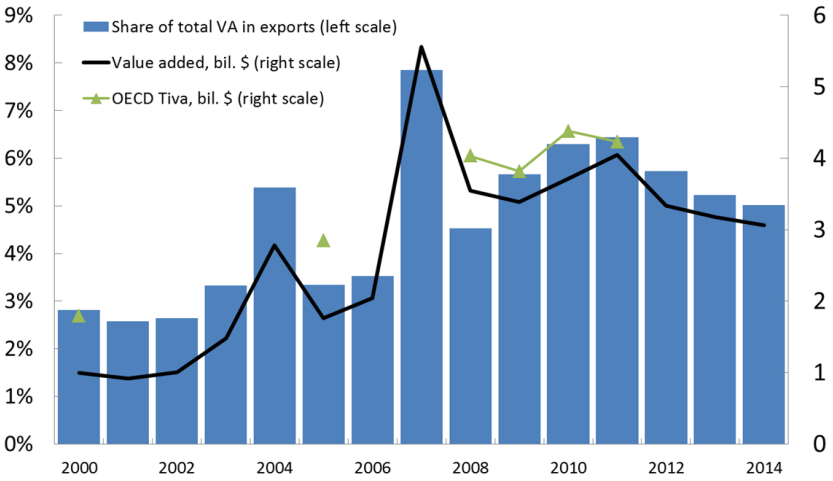
Note: The Finnish value added in production of all intermediate and final goods that are directly or indirectly exported to China.

Figure A4 Value added of EU countries' total direct and indirect exports to China ($ billions and %)



Note: The EU value added in production of all intermediate and final goods that are directly or indirectly exported to China.

Figure A5 Value added of Finnish direct exports to China ($ billions and %)



Note: Sources: WIOD database and the OECD's TiVA dataset.

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