

Rémond-Tiedrez, Isabelle; Valderas-Jaramillo, Juan Manuel; Amores, Antonio F.;
Rueda-Cantuche, José Manuel

Article

The employment content of EU exports: An application of FIGARO tables

Eurostat Review on National Accounts and Macroeconomic Indicators (EURONA)

Provided in Cooperation with:

Eurostat, Luxembourg

Suggested Citation: Rémond-Tiedrez, Isabelle; Valderas-Jaramillo, Juan Manuel; Amores, Antonio F.; Rueda-Cantuche, José Manuel (2019) : The employment content of EU exports: An application of FIGARO tables, Eurostat Review on National Accounts and Macroeconomic Indicators (EURONA), ISSN 1977-978X, Publications Office of the European Union, Luxembourg, Iss. 1, pp. 59-78

This Version is available at:

<https://hdl.handle.net/10419/309831>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

3

The employment content of EU exports: an application of FIGARO tables

ISABELLE RÉMOND-TIEDREZ ⁽¹⁾, JUAN MANUEL VALDERAS-JARAMILLO ⁽²⁾, ANTONIO F. AMORES ⁽²⁾, JOSÉ MANUEL RUEDA-CANTUCHE ⁽²⁾

Abstract: The Eurostat-JRC project 'Full International and Global Accounts for Research in Input-Output Analysis' (FIGARO) has produced experimental EU inter-country supply, use and input-output tables for the year 2010 in line with ESA 2010 methodology ⁽³⁾. This paper uses FIGARO tables to analyse the employment content of EU Member States exports. This application relies on standard Leontief modelling and combines EU inter-country input-output data and EU employment data.

The results show that 11.3 % of EU employment in 2010 was supported by EU exports to the rest of the world, which corresponded to 25.6 million jobs. This share varies from 25 % in Luxembourg to around 7 % in Greece, Portugal and Spain.

Keywords: input-output analysis; employment; national accounts; exports

JEL codes: C67, E24, F19

⁽¹⁾ Eurostat, Unit C.5: Integrated global accounts and balance of payments.

⁽²⁾ Joint Research Centre, European Commission.

⁽³⁾ See: <https://ec.europa.eu/eurostat/web/experimental-statistics/figaro>.

1. Introduction

Employment and trade policies are major pillars of the Europe 2020 strategy ^(*). In an era of globalisation and digital transformation, providing evidence on the relationship between employment and trade at a European level is vital for supporting the Europe 2020 strategy.

One approach for providing these new insights is through the new European Union (EU) inter-country supply, use and input-output tables, combined with data on number of persons employed. These supply, use and input-output tables are produced by a project run jointly by Eurostat and the European Commission's Joint Research Centre (JRC) called 'full international and global accounts for research in input-output analysis' (FIGARO).

The results show that the exports of the EU to the rest of the world supported nearly 25.6 million jobs in 2010, representing 11.3 % of the EU's total employment. Of these jobs, 21.3 million (9.4 % of EU-28 employment) were in EU enterprises engaged in direct exports to the rest of world but 4.3 million (1.9 % of EU employment) were in upstream enterprises supporting EU exporters.

These and other results are provided in this article with the aim to provide the reader with an example of the type of detailed product/industry analysis that can be done with FIGARO tables, not only for understanding the link of one specific industry in a specific EU Member State with respect to its trade with other EU Member States and with the rest of the world but also for helping EU policymakers to monitor the economic and social gains of international trade and global value chains.

In this paper, the approach for measuring the employment content of EU Member States exports draws on well-established literature concerning input-output analysis with multiple regions. Models for calculating indicators related to EU exports to the rest of the world have been widely used to explore the impact of trade on different economies (Miller and Blair (2009); Johnson and Noguera (2012, 2017); Koopman, Wang and Wei (2014); Timmer et al. (2014); Arto et al. (2015); Los, Timmer and de Vries (2015) and Los and Timmer (2018)). This article applies a modified version of the above literature based on Arto et al. (2015) for EU Member States, leading to a multi-country specification whereby EU exports include exports for final uses to EU Member States only and exports (both for intermediate and for final uses) to non-member countries. This avoids problems of endogeneity since only EU exports of intermediate goods and services to EU Member States are included in the Leontief inverse matrix.

Section 2 describes the data sources used in this analysis, while Section 3 outlines the basic methodology. Section 4 presents the results and Section 5 provides conclusions.

(*) See: https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester/framework/europe-2020-strategy_en.

2. Sources for employment, input-output accounting and trade data

To compute and analyse the employment content of EU trade, we require two data inputs: employment data and an inter-country input-output table (IC-IOT). Both relate to the year 2010.

A. Employment data

In this paper, the data on employment ⁽⁶⁾ for each EU Member State at the level of 64 industries (based on NACE Rev. 2) are expressed in numbers of persons employed ⁽⁶⁾. These data are collected via the European system of accounts (ESA 2010) transmission programme and are available on Eurostat's website ⁽⁷⁾.

Table 1: Employment and exports (balanced view) to non-member countries, 2010

	Employment (thousand of persons)	Exports to non-member countries (million EUR)
EU-28	225 676.6	1 917 658.6
Belgium	4 474.0	79 958.2
Bulgaria	3 603.9	7 854.8
Czechia	5 057.2	17 951.9
Denmark	2 786.0	53 442.6
Germany	41 020.0	477 747.4
Estonia	552.5	3 622.4
Ireland	1 882.7	20 384.4
Greece	4 705.5	88 142.8
Spain	19 639.5	38 022.0
France	26 886.0	283 418.3
Croatia	1 697.8	21 313.6
Italy	24 765.7	72 058.8
Cyprus	405.6	3 068.5
Latvia	843.5	21 898.6
Lithuania	1 246.8	169 456.8
Luxembourg	359.6	6 579.3
Hungary	3 969.3	3 571.7
Malta	163.8	3 321.2
Netherlands	8 778.0	3 232.1
Austria	4 098.3	40 779.5
Poland	15 369.1	121 219.1
Portugal	4 871.3	34 304.1
Romania	9 156.1	13 319.7
Slovenia	962.1	79 597.4
Slovakia	2 169.8	5 959.5
Finland	2 483.8	223 970.7
Sweden	4 502.0	14 238.3
United Kingdom	29 226.9	9 224.8

Source: Eurostat (online data code: [nama_10_a64_e](#)) and own calculations

⁽⁶⁾ As one referee notes, the employment data used do not distinguish between exporting enterprises (more productive) and non-exporting enterprises (less productive), thus leading to an implicit upward bias in the estimation of the employment effects of EU exports to the rest of the world.

⁽⁶⁾ The dataset on employment content in exports disseminated alongside FIGARO tables was based on the product-by-product EU inter-country input-output table. For this paper, we decided, however, to compile the employment content in exports using the industry-by-industry EU inter-country input-output table. The dataset for this paper is not published but is available upon request from the authors.

⁽⁷⁾ See: table [nama_10_a64_e](#) on Eurostat's website.

In some cases where data are missing or under confidentiality restrictions, imputations use non-publicly available data (from other tables of the ESA 2010) such as value added ratios. Table 1 presents the level of total employment estimated for each EU Member State for 2010. In the EU-28, 225.7 million persons were employed in 2010. The balanced view of trade (see Section C below) shows trade flows from the EU-28 to non-member countries of EUR 1 918 billion in 2010.

B. Input-output data

The underlying input-output tables used in this analysis draw on national supply and use tables for the 28 EU Member States and for the United States, for the reference year 2010. FIGARO tables do not represent the rest of the world as fully-fledged supply and use matrices but just as export and import vectors. The EU inter-country supply, use and input-output tables depict the production and consumption of products (for intermediate and final use) by industries and economic agents in a number of countries and across trading partners (Rémond-Tiedrez and Rueda-Cantuche (2019)) with information for 29 economies and 64 industries (see Annex B for details).

C. Trade data

Cross-country interactions in FIGARO tables are based on a balanced view of trade in goods — made at the 6-digit level of the harmonised system (HS) ⁽⁸⁾ — and a balanced view of trade in services — following the extended balance of payments services classification (EBOPS). Both balanced views of trade are converted to the classification of products by activity (CPA), as used in European national accounts; Eurostat's RAMON website ⁽⁹⁾ publishes correspondence tables. However, for the compilation of FIGARO tables, some EU Member States provided additional data that were used to improve the general correspondence table, mostly on multiple correspondence cases.

3. Methodology

FIGARO inter-country input-output tables (IC-IOTs) depict, in monetary units, the transactions between industries and final users across a set of 29 countries: the EU Member States and the United States, as well as the rest of the world (as an import vector). Next, the model is described using the case of three countries and n industries. Table 2 below depicts a simple three country illustration ⁽¹⁰⁾.

⁽⁸⁾ See: <https://unstats.un.org/unsd/tradekb/Knowledgebase/50018/Harmonized-Commodity-Description-and-Coding-Systems-HS>.

⁽⁹⁾ See: https://ec.europa.eu/eurostat/ramon/relation/index.cfm?TargetUrl=LST_REL&StrLanguageCode=EN&IntCurrentPage=8.

⁽¹⁰⁾ Bold-faced lower-case letters are used to indicate vectors, bold-faced capital letters indicate matrices, and italic lower-case letters indicate scalars (including elements of a vector or matrix). Subscripts indicate industries and superscripts indicate countries. Vectors are columns by definition, row vectors are obtained by transposition, denoted by a prime (for example, \mathbf{x}'). Diagonal matrices are denoted by Λ (for example, \mathbf{X}).

Table 2: Three country inter-country input-output table

Countries	Intermediate use			Final demand			Gross output
	1	2	3	1	2	3	
1	\mathbf{z}^{11}	\mathbf{z}^{12}	\mathbf{z}^{13}	\mathbf{f}^{11}	\mathbf{f}^{12}	\mathbf{f}^{13}	\mathbf{x}^1
2	\mathbf{z}^{21}	\mathbf{z}^{22}	\mathbf{z}^{23}	\mathbf{f}^{21}	\mathbf{f}^{22}	\mathbf{f}^{23}	\mathbf{x}^2
3	\mathbf{z}^{31}	\mathbf{z}^{32}	\mathbf{z}^{33}	\mathbf{f}^{31}	\mathbf{f}^{32}	\mathbf{f}^{33}	\mathbf{x}^3
Primary inputs	$(\mathbf{w}^1)'$	$(\mathbf{w}^2)'$	$(\mathbf{w}^3)'$				
Total inputs	$(\mathbf{x}^1)'$	$(\mathbf{x}^2)'$	$(\mathbf{x}^3)'$				

Where:

\mathbf{z}^{rs} is an $(n \times n)$ matrix of intermediate inputs going from country r to country s ; and \mathbf{z}_{ij}^{rs} represents the sales of industry i in country r to industry j in country s .

\mathbf{f}^{rs} is a column vector $(n \times 1)$ of final demand (in other words, the sum of private consumption, government consumption and investments) of country s for goods and services produced in country r ; and \mathbf{f}_i^{rs} indicates the final demand in country s of commodities produced by industry i of country r ; and $\mathbf{f}^r = \sum_s \mathbf{f}^{rs}$ is the column vector of final demand for commodities produced in country r from all countries.

\mathbf{x}^r is a column vector $(n \times 1)$ containing country r 's output of industries; and \mathbf{x}_i^r denotes industry i 's output in country r .

\mathbf{w}^r is a column vector $(n \times 1)$ containing country r 's primary inputs (value added, labour and capital use, other taxes on production, etc.) by industry; and \mathbf{w}_i^r denotes industry i 's primary inputs in country r .

The relation between \mathbf{x} , \mathbf{Z} and \mathbf{f} can be shown as $\mathbf{x} = \mathbf{Z}\mathbf{i} + \mathbf{f}$, where \mathbf{i} is a column summation vector.

Along with these elements, in order to undertake the analysis, data on employment by country and industry are also required.

We can define the column vector \mathbf{Em}^r , to denote employment (for example, in thousands of persons) in country r , whose element \mathbf{Em}_i^r represents industry i 's employment in country r .

From Table 2, we can define a technical coefficients matrix as $\mathbf{A}^{rs} = \mathbf{Z}^{rs}(\hat{\mathbf{x}}^s)^{-1}$, where $(\hat{\mathbf{x}}^s)^{-1}$ designates the inverse of the diagonal matrix of total outputs in country s .

With these elements, the standard input-output model is defined as $\mathbf{x} = \mathbf{Ax} + \mathbf{f}$ whose solution is $\mathbf{x} = \mathbf{Lf}$, where $\mathbf{L} = (\mathbf{I} - \mathbf{A})^{-1}$ represents the Leontief matrix and $\mathbf{L} = (\mathbf{I} - \mathbf{A})^{-1}$ the Leontief inverse matrix.

Similarly, employment coefficients are calculated as $\mathbf{d}^r = (\hat{\mathbf{x}}^r)^{-1} \mathbf{Em}^r$. Employment coefficients represent employment intensity per unit of output. Total employment can therefore be obtained as $\mathbf{d}'\mathbf{x} = \mathbf{d}'\mathbf{Lf}$.

Embodied effects

While **Em'** reflects the direct employment involved in the production of a particular product it only tells part of the story with regards to the links between employment and production, and, in turn, employment and trade. To fully understand the impact on overall employment requires an estimate of the upstream jobs engaged in providing intermediate goods and services for the production of a particular product, not just those involved in the industry associated with the product itself. And of course, in order to differentiate between EU (intra-EU) and non-EU (extra-EU) trade we need to distinguish between these two regions.

In a three country case, assuming that countries 1 and 2 are members of the EU, and country 3 is the rest of the world ⁽¹⁾, we can redefine the components of the IC-IOT framework for the EU as:

$$\mathbf{Z}^{\text{EU}} = \begin{bmatrix} \mathbf{Z}^{11} & \mathbf{Z}^{12} \\ \mathbf{Z}^{21} & \mathbf{Z}^{22} \end{bmatrix} \quad \mathbf{f}^{\text{EU}} = \begin{bmatrix} \mathbf{f}^{11} + \mathbf{f}^{12} + \mathbf{e}^{13} \\ \mathbf{f}^{21} + \mathbf{f}^{22} + \mathbf{e}^{23} \end{bmatrix} = \begin{bmatrix} \mathbf{f}^1 \\ \mathbf{f}^2 \end{bmatrix}$$

$$\mathbf{x}^{\text{EU}} = \begin{bmatrix} \mathbf{x}^1 \\ \mathbf{x}^2 \end{bmatrix} \quad \mathbf{Em}^{\text{EU}} = \begin{bmatrix} \mathbf{Em}^1 \\ \mathbf{Em}^2 \end{bmatrix} \quad \mathbf{d}^{\text{EU}} = \begin{bmatrix} \mathbf{d}^1 \\ \mathbf{d}^2 \end{bmatrix}$$

where $\mathbf{e}^{rs} = \mathbf{f}^{rs} + \mathbf{Z}^{rs}\mathbf{i}$ are exports from EU Member State r to the non-member country s . With these elements, we can obtain the employment generated in the EU due to the exports to non-member countries by applying the following formula:

$$\mathbf{Em}_{\text{exEU}}^{\text{EU}} = (\mathbf{d}^{\text{EU}})' \mathbf{L}^{\text{EU}} \mathbf{e}^{\text{EU}} = (\mathbf{d}^1)' \mathbf{L}^{11} \mathbf{e}^{13} + (\mathbf{d}^1)' \mathbf{L}^{12} \mathbf{e}^{23} + (\mathbf{d}^2)' \mathbf{L}^{21} \mathbf{e}^{13} + (\mathbf{d}^2)' \mathbf{L}^{22} \mathbf{e}^{23}$$

where $(\mathbf{d}^r)' \mathbf{L}^{rs} \mathbf{e}^{st}$ is the employment supported in EU Member State r due to the exports of another EU Member State s to a non-member country t .

The employment supported by EU exports to non-member countries comprises two different types of effect: domestic effects and spillovers. Domestic effects refer to the employment in a given EU Member State supported by its own exports to the rest of the world. Spillovers refer to the employment in a given Member State that is supported by the exports of another Member State to the rest of the world. Besides, domestic effects can be split up into direct effects on the exporting industry itself and indirect effects ⁽²⁾ on other domestic industries that supply intermediate inputs to the exporting industry (in other words, employment in domestic upstream industries).

The interpretation of results will focus on the 28 EU Member States for the year 2010; therefore no results are presented for the United States economy.

⁽¹⁾ Without loss of generality, in FIGARO tables this is a single vector instead of a matrix.

⁽²⁾ To some extent, spillovers could also be thought as indirect effects occurring in other countries.

4. Results

The results presented here cover 28 economies and 64 industries and therefore contains a huge amount of detailed information; more than 3.2 million cells only in the part detailing intermediate consumption. At this level of granularity we have estimated, for example, that:

- around 7 600 persons employed in the motor vehicles industry (C29) of Czechia were supported by exports made from the German motor vehicles industry to non-member countries, representing 45 % of the employment in the Czech motor vehicles industry that was supported by exports of EU Member States (not only Germany) to the rest of the world.
- around 13 000 persons employed within the EU were supported by Dutch exports of water transportation services (H50) to the rest of the world, of which 10 700 persons were employed in the Netherlands — domestic employment ⁽¹³⁾.

For presentation purposes, results are aggregated to country and industry levels, separately.

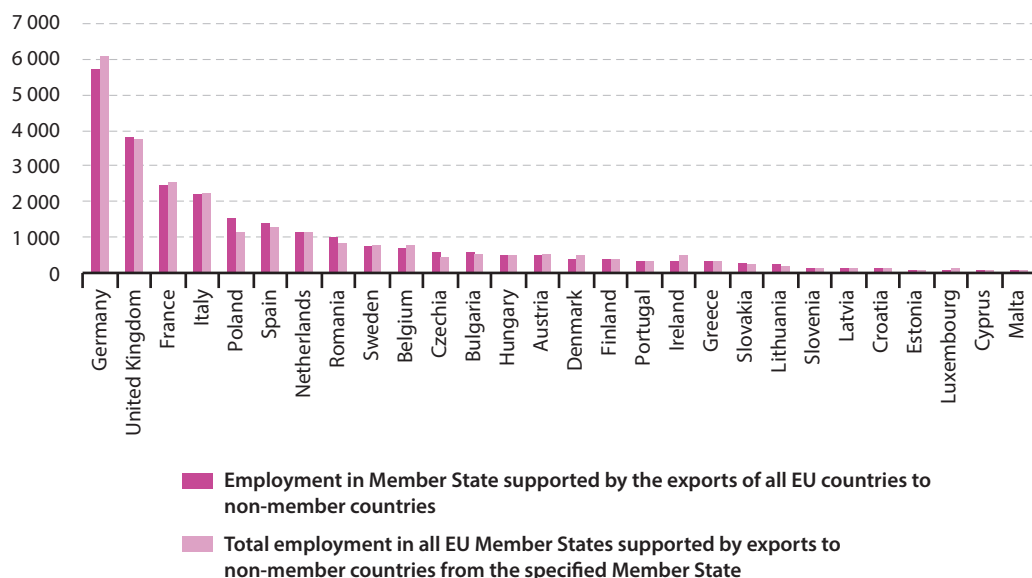
A. Country level

In 2010, EU exports to the rest of the world supported 25.6 million jobs in the EU-28 that represented 11.3 % of EU-28 employment.

More than half of the jobs in the EU-28 supported by EU exports to the rest of the world were concentrated in the following four Member States: Germany, the United Kingdom, France and Italy, which together had a total of more than 14.1 million jobs (see Figure 1), respectively 5.7 million jobs, 3.8 million, 2.5 million and 2.2 million. Similarly, more than half (14.6 million jobs) of the EU workforce whose jobs were supported by exports to the rest of the world was based on exports from one of these four Member States.

⁽¹³⁾ Absolute values result from many estimation steps coming from the compilation process used for FIGARO tables, for which a quality assessment was carried out and described in detail in Rémond-Tiedrez and Rueda-Cantuche (2019).

Figure 1: Employment supported by EU exports to non-member countries, 2010
(thousand persons)



However, relative to total employment in each of the individual EU Member States, a different picture appears (see Figure 2). EU exports to the rest of the world supported 25 % of total employment in Luxembourg. This value consists of two factors: i) exports from Luxembourg to the rest of the world supported 19.4 % of employment (domestic part) and ii) exports from the other EU Member States to the rest of the world supported 5.7 % of employment (identified as spillover received in Figure 2).

Figure 2 delineates between northern and western EU Member States on the one hand and southern and eastern Member States on the other (with some exceptions). Northern and western Member States (as well as Bulgaria, Malta and Slovenia) had employment shares supported by domestic exports that were above the EU-28 average of 9.4 %. On the contrary, in southern and eastern Member States (as well as in France and Austria) domestic exports systematically supported less than 8.5 % of total employment.

In terms of spillover effects, the top five Member States with the highest shares of their employment supported by the exports of other EU Member States were (in decreasing order): Luxembourg (5.7 %), Slovakia (4.8 %), Czechia (4.7 %), Estonia (4.1 %) and Malta (3.5 %).

Domestic effects can be additionally broken down into direct and indirect effects (see Section 3). The lime marker in Figure 2 indicates the share of each EU Member State's supported employment due to direct effects. The ratio of direct effects over total domestic effects was quite similar across Member States with an average of just under 60 % and values that ranged between 47 % in Cyprus and 75 % in Malta. Therefore, the remaining 40 % of domestic effects corresponded to indirect employment supported by exports of intermediate goods and services to other domestic exporting industries.

Figure 2: Employment supported by exports to non-member countries, 2010
(% of total employment)

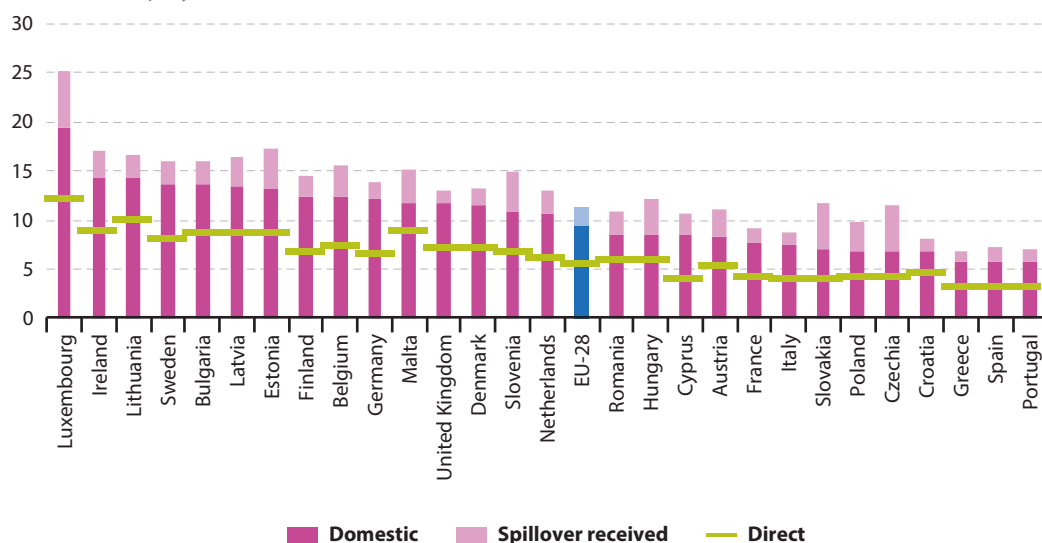


Table 3 shows (first column) how many jobs each EU Member State were supported through their exports to non-member countries (see also the light pink bars in Figure 1). The second and third columns of Table 3 split the values in the first column between domestic and spillover effects. As an example, Romanian exports to non-member countries supported 817 300 jobs across the EU, of which 780 300 were located in Romania (95.5 %) and 37 100 were located elsewhere in the EU (4.5 %). Table 3 also presents this information in terms of the domestic and spillover shares (in the fourth and fifth columns).

EU Member States with high domestic shares (and low spillover shares) were not, by definition, typically integrated into international or European supply chains, such as the cases of Romania, Bulgaria and Croatia. On the other hand, Ireland and Luxembourg had the largest shares for spillover effects indicating that a high share of the employment effects of Irish and Luxembourgish exports was typically located in other EU Member States. In particular, Irish exports to non-member countries supported 485 000 jobs across the EU, of which almost half were jobs outside the country itself.

Table 3: Employment supported by exports to non-member countries, ranked by spillover share, 2010

	Total employment in all EU Member States supported by exports to non-member countries from the specified Member State (thousand persons)	Employment supported in each Member State by its own exports — domestic supported (thousand persons)	Employment in other EU Member States supported by its own exports — spillover supported (thousand persons)	Domestic share (%)	Spillover share (%)
Romania	817.3	780.3	37.1	95.5	4.5
Bulgaria	512.8	488.6	24.2	95.3	4.7
Croatia	123.5	116.5	6.9	94.4	5.6
Latvia	122.7	113.9	8.8	92.9	7.1
Lithuania	192.7	178.3	14.4	92.5	7.5
Poland	1 155.1	1 063.4	91.7	92.1	7.9
United Kingdom	3 779.4	3 404.8	374.6	90.1	9.9
Greece	305.4	274.3	31.1	89.8	10.2
Spain	1 300.4	1 124.4	176.0	86.5	13.5
Portugal	323.7	277.4	46.2	85.7	14.3
Germany	6 055.9	5 003.4	1 052.5	82.6	17.4
Netherlands	1 146.1	945.8	200.3	82.5	17.5
Estonia	88.8	73.3	15.5	82.5	17.5
Slovenia	127.9	105.1	22.8	82.2	17.8
France	2 541.5	2 078.4	463.0	81.8	18.2
Italy	2 264.3	1 837.4	426.9	81.1	18.9
Czechia	432.4	349.0	83.3	80.7	19.3
Cyprus	43.1	34.5	8.6	79.9	20.1
Finland	399.3	309.8	89.5	77.6	22.4
Sweden	792.9	613.9	179.0	77.4	22.6
Hungary	453.1	338.1	115.0	74.6	25.4
Slovakia	205.1	150.5	54.6	73.4	26.6
Belgium	781.2	554.3	226.9	71.0	29.0
Denmark	461.0	324.0	137.0	70.3	29.7
Malta	28.3	19.2	9.1	67.7	32.3
Austria	510.7	344.7	165.9	67.5	32.5
Ireland	485.8	270.1	215.7	55.6	44.4
Luxembourg	131.3	69.9	61.4	53.3	46.7

Large EU Member States provide the biggest domestic and spillover effects in absolute terms. German exports to non-member countries supported over 1 million jobs outside of Germany, while French and Italian exports to non-member countries each supported more than 400 000 jobs elsewhere in the EU. Moreover, German exports to non-member countries supported 5 million jobs in Germany, while French exports to non-member countries supported 2 million jobs in France and Italian exports to non-member countries supported 1.8 million jobs in Italy.

A full table of the employment in each EU Member State supported by exports to non-member countries is provided in Annex C. For example, in the column for Spain (ES), Spanish exports to non-member countries supported a total of 1.3 million jobs across the whole of the EU-28: 1.12 million jobs in Spain itself; 32 800 jobs in Germany; 30 100 jobs in France; 21 700 jobs in Italy; 19 500 jobs in the United Kingdom; 13 200 jobs in Portugal and 10 800 jobs in Poland, and so on.

Reading the table in Annex C by rows, there were 1.4 million persons employed in Spain whose jobs were supported by exports from EU Member States to non-member countries, of which 1.12 million jobs were supported by Spain's own exports, 65 700 jobs by Germany's exports, 59 300 jobs by France's exports, and so on.

B. Industry level

At their most detailed level, the results cover 64 industries, from agricultural products to services through manufactured products; they are available on the FIGARO webpage. For readability, the results presented in Table 4 are aggregated to show information for 10 main industries.

Table 4: Employment supported by exports of each industry to non-member countries, EU-28, 2010
(thousand persons)

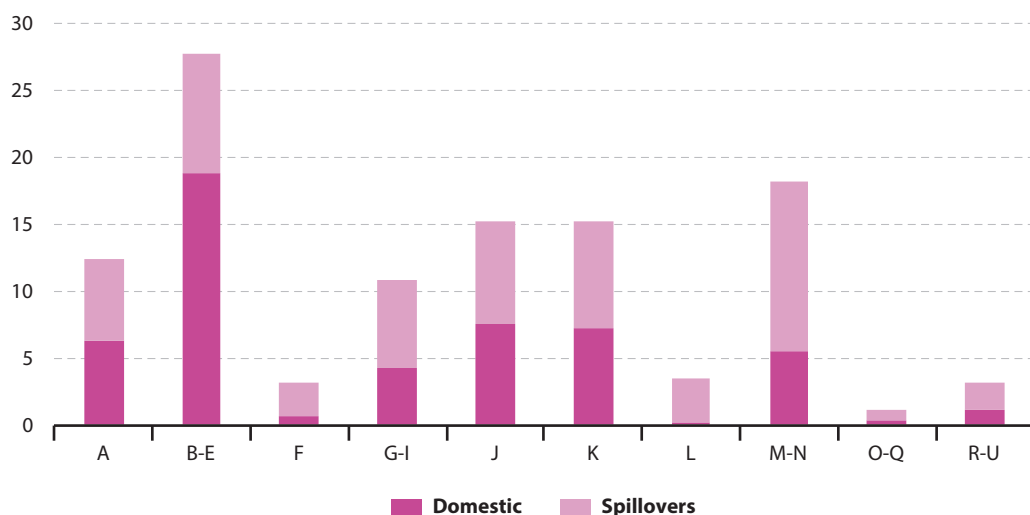
		Exports by product										All products
		A	B-E	F	G-I	J	K	L	M-N	O-Q	R-U	
Employment in industries	A	776.9	660.4	1.8	51.3	4.8	2.2	0.2	8.8	0.9	1.0	1 508.3
	B-E	44.8	9 387.7	26.9	242.4	62.8	29.8	2.2	78.4	7.0	7.0	9 888.9
	F	5.6	271.7	106.4	71.7	12.2	16.1	2.5	23.2	3.0	2.0	514.4
	G-I	47.6	2 691.2	21.1	2 923.3	85.1	74.9	1.4	134.9	9.7	8.6	5 997.7
	J	3.2	264.2	1.8	73.0	483.0	42.5	0.3	50.8	2.5	4.2	925.4
	K	7.0	290.6	2.6	78.9	16.6	500.0	1.3	31.2	1.7	1.9	931.8
	L	0.8	47.1	0.5	17.1	3.2	3.4	5.2	6.8	0.4	0.3	84.8
	M-N	32.9	2 123.0	16.3	488.3	153.8	176.3	2.5	1 647.9	16.4	20.1	4 677.6
	O-Q	4.2	271.1	2.0	62.0	21.2	19.8	0.4	45.1	205.9	2.2	633.9
	R-U	2.4	161.1	1.1	39.8	22.5	13.8	0.2	28.3	2.0	162.7	433.9
All industries		925.4	16 168.0	180.5	4 047.6	865.3	878.7	16.2	2 055.5	249.5	210.0	25 596.7

In 2010, EU-28 exports to non-member countries supported nearly 10 million jobs in industry (Sections B-E), which represented 28 % of the total number of persons employed in industry (see Figure 3). Out of these 9.9 million jobs, 9.4 million were supported by the exports of industry, while 242 000 jobs were supported by the exports of trade, transport, accommodation and food services (Sections G-I), as shown when reading Table 4 by rows.

Trade, transport, accommodation and food services had the second highest number of jobs supported by EU-28 exports to non-member countries (nearly 6 million), followed by professional, scientific and technical activities; administrative and support service activities (Sections M and N), where 4.7 million jobs were supported by exports to non-member countries.

Table 4 also shows (reading by columns) that EU-28 exports of industrial products to non-member countries supported more than 16 million jobs across the EU, with 9.4 million of these in industry, with considerable spillover effects for trade, transport, accommodation and food services (2.7 million jobs) and professional, scientific and technical activities; administrative and support service activities (2.1 million jobs).

Figure 3: Employment supported by exports of each product to non-member countries, EU-28, 2010
(% of total employment)



5. Conclusions

This article describes how the FIGARO dataset may be used for economic analysis, providing a picture of the economic relationships between EU Member States and the rest of the world. In particular, this article provides an example of specific analysis of the relationship between trade and jobs in the EU. It provides interesting results at a detailed level of products/industries that not only enables an understanding of the links that exist between specific industries and/or specific EU Member States with respect to their trade with non-member countries and its impact on jobs, but also helps policymakers monitor the economic (including labour market) gains of international trade and global value chains. The authors envisage a range of alternative applications using the FIGARO dataset, including an analysis of environmental footprints, factor contents of trade, input-output modelling, and other issues.

The FIGARO dataset will also constitute the main reference dataset for the European Commission's economic model, FIDELIO (Rocchi et al. (2018)).

Further comparisons of the results using other international databases such as the world input-output database (WIOD) or the recently published OECD inter-country input-output tables (December 2018) would help to understand the different methodological assumptions used and therefore would also help users to make the best choice about which database to use (depending on their own research objectives).

The main limitation of the current FIGARO dataset concerns data availability, insofar as information is given for reference year 2010 only. This situation will soon change, as the continuation of the FIGARO project foresees the dissemination of time series results by the end of 2020, both in current and previous year's prices.

Acknowledgements

The authors would like to acknowledge helpful comments and input from colleagues in Eurostat and the JRC that contributed towards this paper. The authors would also like to thank the reviewers for their feedback and suggestions.

References

Arto, I., J.M. Rueda-Cantuche, A.F. Amores, E. Dietzenbacher, N. Sousa, L. Montinari and A. Markandya (2015), *EU exports to the World: Effects on Employment and Income*, Publications Office of the European Union, Luxembourg.

Eurostat (2008), *Eurostat Manual of Supply, Use and Input-Output Tables*, Publications Office of the European Union, Luxembourg.

Johnson, R.C. and N. Guillermo (2012), 'Accounting for intermediates: Production sharing and trade in value added', *Journal of International Economics*, Volume 86, Issue 2, pp. 224-236.

Johnson, R.C. and N. Guillermo (2017), 'A Portrait of Trade in Value Added over Four Decades', *The Review of Economics and Statistics*, Volume 99, Issue 5, pp. 896-911.

Koopman, R., Z. Wang and S. Wei (2014), 'Tracing Value-Added and Double Counting in Gross Exports', *American Economic Review*, Volume 104, No 2, pp. 459-494.

Los, B. and M.P. Timmer (2018), 'Measuring Bilateral Exports of Value Added: A Unified Framework', NBER working paper, No 24896.

Los, B., M.P. Timmer and G.J. de Vries (2015), 'How Global are Global Value Chains? A New Approach to Measure International Fragmentation', *Journal of Regional Science*, Volume 55, Issue 1, pp. 66-92.

Miller, R.E. and P.E. Blair (2009), 'Input-Output Analysis: Foundations and Extensions', 2nd edition, Cambridge University Press, New York.

Rémond-Tiedrez, I. and J.M. Rueda-Cantuche (eds.) (2019), *EU inter-country supply, use and input-output tables — Full international and global accounts for research in input-output analysis (FIGARO)*, Eurostat — Statistical working papers, Publications Office of the European Union, Luxembourg.

Rocchi, P., S. Salotti, F. Reynès, J. Hu, T. Bulavskaya, J.M. Rueda Cantuche, J.M. Valderas Jaramillo, A. Velázquez Afonso, A.F. Amores and T. Corsatea (2019), *FIDELIO 3 manual: Equations and data sources*, JRC technical reports, Publications Office of the European Union, Luxembourg.

Timmer, M.P., E. Dietzenbacher, B. Los, R. Stehrer and G.J. de Vries (2015), 'An Illustrated User Guide to the World Input-Output Database: the Case of Global Automotive Production', *Review of International Economics*, Volume 23, Issue 3, pp. 575-605.

Timmer, M.P., A.A. Erumban, B. Los, R. Stehrer and G.J. de Vries (2014), 'Slicing Up Global Value Chains', *Journal of Economic Perspectives*, Volume 28, No 2, pp. 99-118.

Annex A: Comparison of FIGARO results with WIOD 2016 release

With the release of EU inter-country input-output tables compiled for the year 2010, users have a new dataset alongside other international inter-country input-output tables, such as the world input-output database (WIOD) ⁽¹⁴⁾ or the OECD's inter-country input-output tables ⁽¹⁵⁾.

A brief comparison between the FIGARO dataset and the WIOD dataset is described below.

EU-28 employment supported by EU exports to non-member countries amounted to 25.5 million jobs in 2010 according to the FIGARO database, while it concerned 27.4 million jobs in 2010 using the WIOD database (2016 release). As such, the estimation of embodied employment was lower when using the FIGARO database than using the WIOD database.

There are three main factors that may explain such differences:

1. Employment coefficients, **d**;
2. EU exports to the rest of the world, **e**; and
3. the Leontief inverse, **L**.

1. *Employment coefficients* are defined as the number of persons employed per unit of output. The numerator, number of persons employed, is the same in both databases. However, the denominator, the output may be different between the two databases due to vintage issues or source data. In the FIGARO dataset the output measure comes from supply and use tables (SUTs) provided to Eurostat. This measure may not be fully consistent with the output provided in the latest national releases, as many countries do not revise the SUTs for each release of their national gross domestic product (GDP) figures. The WIOD database used for this comparison was released in November 2016. National data included in FIGARO may be more recent. To compare WIOD data with FIGARO data an exchange rate of 1.3257 USD = 1 EUR was used (the same rate as that applied in the FIGARO database). The percentage differences between output values in the two databases were close to zero for most of the EU Member States. The only significant differences were registered for Cyprus and Ireland (see Figure 4).

Employment coefficients are calculated at a detailed level (64 industries for FIGARO and for 56 industries for WIOD ⁽¹⁶⁾). WIOD employment coefficients tend to be smaller than FIGARO employment coefficients. Although the total employment and total output per EU Member State are similar, at the detailed level of industries differences are present.

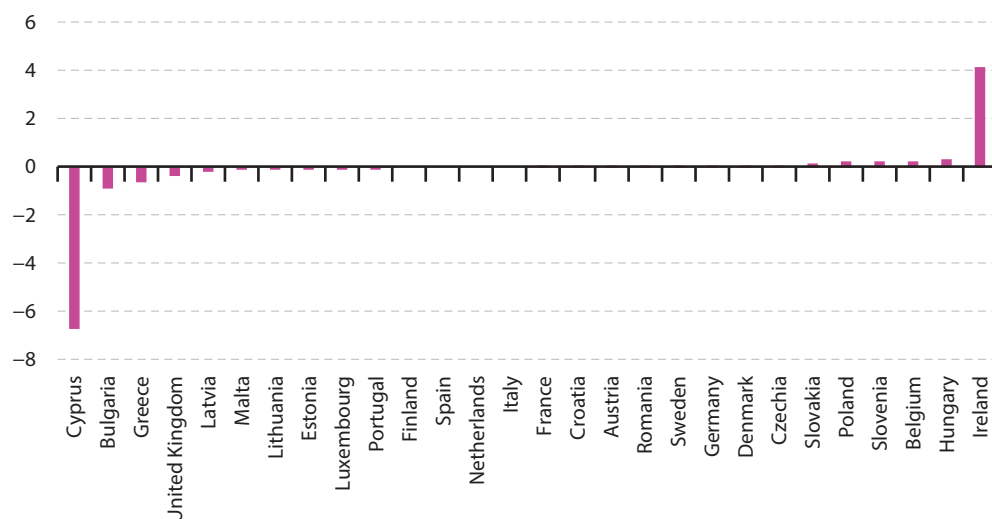
⁽¹⁴⁾ See: <http://www.wiod.org/home>.

⁽¹⁵⁾ See: <http://www.oecd.org/sti/ind/inter-country-input-output-tables.htm>.

⁽¹⁶⁾ In the WIOD database there are only 56 industries, as Sections N, Q and R-S are aggregated.

Figure 4: Gross output, difference between FIGARO and WIOD values, 2010

(%)



2. *EU exports to the rest of the world* were different across the two databases with a higher value in the WIOD database compared with the FIGARO database: total EU-28 exports were valued at EUR 2 014 billion in the WIOD database and at EUR 1 917 billion in the FIGARO database (as such, they were 5.1 % higher in the WIOD database).

The differences varied between EU Member States: the inter-quartile interval was [-0.2 %; 12.7 %] with a median of 5.7 %. The biggest differences were recorded for Croatia, Portugal, Ireland, Cyprus and Malta.

The compilation of the export vector is a core part of the methodology in both databases. A more thorough investigation of this aspect would be worthwhile, examining more closely the compilation of the export vector and the balanced view of trade underlying the two different inter-country input-output tables. However, this task falls beyond the scope of this paper.

3. *The Leontief inverse*: any differences between the two matrices result from different methodologies. The main divergence relates to adjustments for goods sent abroad for processing, merchanting transactions, re-exports, and so on that are included in the FIGARO dataset ⁽¹⁷⁾.

⁽¹⁷⁾ For further details on the adjustments included in the FIGARO dataset, refer to Rémond-Tiedrez and Rueda-Cantuche (2019).

Annex B: List of industries in FIGARO

List of industries in FIGARO

Section	Division(s)	Label
A	01	Products of agriculture, hunting and related services
A	02	Products of forestry, logging and related services
A	03	Fish and other fishing products; aquaculture products; support services to fishing
B	05 to 09	Mining and quarrying
C	10 to 12	Food, beverages and tobacco products
C	13 to 15	Textiles, wearing apparel, leather and related products
C	16	Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials
C	17	Paper and paper products
C	18	Printing and recording services
C	19	Coke and refined petroleum products
C	20	Chemicals and chemical products
C	21	Basic pharmaceutical products and pharmaceutical preparations
C	22	Rubber and plastic products
C	23	Other non-metallic mineral products
C	24	Basic metals
C	25	Fabricated metal products, except machinery and equipment
C	26	Computer, electronic and optical products
C	27	Electrical equipment
C	28	Machinery and equipment n.e.c.
C	29	Motor vehicles, trailers and semi-trailers
C	30	Other transport equipment
C	31 and 32	Furniture and other manufactured goods
C	33	Repair and installation services of machinery and equipment
D	35	Electricity, gas, steam and air conditioning
E	36	Natural water; water treatment and supply services
E	37 to 39	Sewerage services; sewage sludge; waste collection, treatment and disposal services; materials recovery services; remediation services and other waste management services
F	41 to 43	Constructions and construction works
G	45	Wholesale and retail trade and repair services of motor vehicles and motorcycles
G	46	Wholesale trade services, except of motor vehicles and motorcycles
G	47	Retail trade services, except of motor vehicles and motorcycles
H	49	Land transport services and transport services via pipelines
H	50	Water transport services
H	51	Air transport services
H	52	Warehousing and support services for transportation
H	53	Postal and courier services
I	55 and 56	Accommodation and food services

List of industries in FIGARO (continued)

Section	Division(s)	Label
J	58	Publishing services
J	59 and 60	Motion picture, video and television programme production services, sound recording and music publishing; programming and broadcasting services
J	61	Telecommunications services
J	62 and 63	Computer programming, consultancy and related services; Information services
K	64	Financial services, except insurance and pension funding
K	65	Insurance, reinsurance and pension funding services, except compulsory social security
K	66	Services auxiliary to financial services and insurance services
L	68	Real estate services
M	69 and 70	Legal and accounting services; services of head offices; management consultancy services
M	71	Architectural and engineering services; technical testing and analysis services
M	72	Scientific research and development services
M	73	Advertising and market research services
M	74 and 75	Other professional, scientific and technical services and veterinary services
N	77	Rental and leasing services
N	78	Employment services
N	79	Travel agency, tour operator and other reservation services and related services
N	80 to 82	Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services
O	84	Public administration and defence services; compulsory social security services
P	85	Education services
Q	86	Human health services
Q	87 and 88	Residential care services; social work services without accommodation
R	90 to 92	Creative, arts, entertainment, library, archive, museum, other cultural services; gambling and betting services
R	93	Sporting services and amusement and recreation services
S	94	Services furnished by membership organisations
S	95	Repair services of computers and personal and household goods
S	96	Other personal services
T	97 and 98	Services of households as employers; undifferentiated goods and services produced by households for own use
U	99	Services provided by extraterritorial organisations and bodies

Annex C: Employment supported by exports to non-member countries

Employment supported by exports to non-member countries, 2010
(thousand persons)

	Exports by																											Sum for all Member States	
	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE		UK
BE	554.3	0.2	1.2	4.2	37.0	0.2	7.0	0.6	4.5	27.3	0.1	10.0	0.2	0.1	0.3	5.5	1.4	0.6	14.1	2.2	2.1	0.7	0.5	0.3	0.5	1.8	4.9	15.5	697.4
BG	57	504.8	1.3	1.5	20.4	0.2	1.2	4.1	3.4	7.0	0.1	17.0	0.4	0.1	0.2	0.2	1.8	0.3	2.3	4.1	1.8	0.6	5.2	0.5	1.2	0.9	1.4	4.9	592.3
CZ	6.8	0.7	349.0	3.7	104.8	0.5	3.2	0.6	5.4	14.6	0.3	17.3	0.5	0.2	0.6	0.8	8.7	0.1	7.1	13.9	10.0	0.6	1.3	1.6	14.5	2.5	6.2	11.8	587.5
DK	1.6	0.1	0.4	324.0	9.6	0.2	2.2	0.3	1.2	2.8	0.0	2.3	0.0	0.1	0.2	0.3	0.7	0.2	1.8	0.5	1.0	0.1	0.1	0.1	0.2	2.4	12.0	5.6	370.4
DE	48.5	2.5	19.0	30.7	5003.4	1.7	25.3	4.2	32.8	94.3	1.1	85.3	0.8	0.7	1.6	17.0	26.5	1.4	48.4	56.0	26.2	4.5	5.0	3.8	9.2	17.6	39.8	91.2	5698.6
EE	0.5	0.0	0.1	2.1	3.1	73.3	0.5	0.1	0.2	0.7	0.0	0.5	0.1	1.0	0.6	0.1	0.1	0.0	0.7	0.3	0.3	0.0	0.0	0.0	0.0	6.9	4.0	0.8	96.1
IE	2.6	0.1	0.5	0.9	8.8	0.1	270.1	0.1	2.1	4.9	0.0	5.0	0.0	0.0	0.0	1.8	0.6	0.1	2.5	0.6	0.5	0.2	0.1	0.1	0.1	0.9	1.8	16.3	321.0
EL	1.6	2.1	0.4	1.4	12.8	0.1	0.7	274.4	1.5	3.5	0.1	6.5	1.6	0.1	0.2	0.3	0.5	0.2	1.5	0.8	0.6	0.2	1.2	0.2	0.2	1.1	1.1	5.6	320.4
ES	11.8	0.6	2.7	8.1	65.7	0.3	8.2	1.7	1127.1	59.3	0.2	38.7	0.2	0.2	0.6	2.0	2.8	0.4	10.5	4.1	4.1	15.5	1.1	0.6	1.2	2.8	6.3	32.4	1409.1
FR	37.3	0.8	4.1	6.4	114.8	0.4	13.5	1.9	30.1	2078.4	0.3	50.3	0.2	0.2	0.4	7.4	5.7	0.9	18.8	6.7	6.0	3.4	2.3	1.2	2.8	4.3	12.6	48.8	2459.9
HR	0.9	0.1	0.4	0.5	5.1	0.0	0.4	0.1	0.3	1.5	116.5	4.4	0.1	0.0	0.0	0.1	0.7	0.1	0.6	2.0	0.3	0.1	0.1	1.6	0.2	0.2	0.4	1.2	138.1
IT	13.4	2.0	5.4	7.1	98.7	0.6	10.8	4.8	21.7	66.4	1.2	1837.4	0.4	0.3	0.8	2.7	6.3	1.5	9.3	14.0	8.0	2.7	4.2	3.8	3.1	4.9	8.3	30.2	2170.1
CY	0.1	0.1	0.0	0.2	2.7	0.4	0.4	0.6	0.1	0.2	0.0	0.2	34.5	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.0	0.1	0.0	0.1	0.1	0.3	0.9	41.9
LV	0.5	0.0	0.2	2.4	3.9	2.6	0.5	0.1	0.5	0.9	0.0	1.0	0.3	115.4	1.6	0.1	0.2	0.1	0.7	0.4	0.8	0.0	0.1	0.0	0.1	2.5	3.3	2.0	140.3
LT	1.1	0.1	0.2	2.8	6.6	1.1	0.4	0.1	0.6	2.3	0.0	1.9	0.1	2.5	178.3	0.1	0.3	0.0	1.1	0.7	1.4	0.1	0.1	0.1	0.1	1.1	2.2	1.5	206.8
LU	2.2	0.1	0.1	0.3	4.8	0.0	3.8	0.1	0.5	2.5	0.0	1.8	0.0	0.0	0.0	69.9	0.1	0.1	0.6	0.3	0.2	0.1	0.1	0.0	0.0	0.1	0.4	2.2	90.4
HU	3.4	0.8	4.0	2.3	53.5	0.2	2.3	0.6	3.7	9.6	0.5	13.9	0.2	0.1	0.3	0.5	338.1	0.1	4.9	12.8	3.7	0.4	4.8	1.5	4.7	1.6	3.4	8.5	480.4
MT	0.3	0.0	0.0	0.1	1.4	0.0	1.3	0.1	0.1	0.5	0.0	0.3	0.0	0.0	0.0	0.1	19.2	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.9	24.9
NL	27.7	0.3	1.3	6.7	46.3	0.3	27.4	1.0	6.5	18.6	0.1	13.3	0.2	0.2	0.4	1.6	2.8	0.2	94.5	3.4	3.1	0.9	0.6	0.4	0.6	3.9	7.4	22.7	1143.7
AT	2.5	0.6	2.8	1.4	55.6	0.1	1.3	0.5	2.2	6.9	0.4	14.4	0.1	0.1	0.1	0.6	5.2	0.3	2.7	344.7	2.3	0.3	1.4	1.9	1.3	1.3	2.4	5.3	458.6
PL	13.1	1.8	20.8	16.1	174.1	2.7	8.1	1.4	10.8	35.9	0.5	34.7	0.8	1.6	4.8	1.4	19.1	0.3	16.2	13.2	1063.4	1.1	4.7	1.9	9.6	8.6	20.1	31.5	1518.4
PT	2.9	0.1	0.5	1.6	12.6	0.1	2.0	0.2	13.2	11.6	0.0	5.9	0.1	0.0	0.1	0.5	0.5	0.1	2.3	0.9	0.6	284.9	0.2	0.1	0.2	1.0	1.3	7.7	351.1
RO	5.6	9.2	2.8	1.7	49.5	0.2	2.6	3.3	6.6	21.6	0.5	46.8	0.7	0.1	0.2	0.3	14.0	0.2	7.6	8.3	4.0	1.2	780.3	1.1	2.3	1.6	3.0	5.9	981.4
SI	0.7	0.2	0.8	0.6	12.0	0.1	0.3	0.2	0.7	2.6	0.8	8.4	0.0	0.0	0.1	0.1	1.8	0.0	0.9	4.3	0.8	0.1	0.3	105.1	0.6	0.3	0.7	1.5	144.2
SK	2.1	0.4	10.1	1.3	33.2	0.1	0.6	0.3	2.2	7.9	0.2	9.4	0.0	0.1	0.3	0.2	9.0	0.0	2.8	7.6	5.2	0.2	1.2	1.0	150.5	0.9	3.1	4.4	254.7
FI	2.1	0.1	0.4	2.9	11.1	2.0	1.1	0.3	1.2	3.1	0.0	2.9	0.1	0.3	0.3	0.5	0.5	0.1	2.9	1.0	1.1	0.1	0.2	0.1	0.1	309.8	10.8	4.2	359.4
SE	4.9	0.2	1.2	17.2	23.2	1.1	2.3	0.4	2.4	8.2	0.1	5.9	0.1	0.2	0.4	1.1	1.1	0.1	4.5	2.0	2.1	0.3	0.2	0.4	11.3	613.9	11.3	716.6	
UK	26.9	0.6	2.5	12.9	81.1	0.5	88.2	3.4	19.5	48.3	0.2	28.8	1.2	0.2	0.3	15.9	4.4	1.6	34.9	5.5	5.0	2.3	1.4	0.6	1.1	8.9	22.0	3404.8	3822.9
EU-28	781.2	528.8	432.4	461.0	6055.9	88.8	485.8	305.4	1 301.2	2 541.5	123.5	2 264.3	43.1	124.1	192.7	131.3	453.1	28.3	1 146.1	510.7	1 155.1	320.5	817.3	127.9	205.1	399.3	792.9	3 779.4	25 596.7

