



PBL Netherlands Environmental
Assessment Agency

MULTI-REGIONAL TRADE DATA FOR EUROPE IN 2010

Project for the EC Institute for Prospective Technological
Studies (JRC-IPTS)

Mark Thissen, Maureen Lankhuizen and Olaf Jonkeren

May 2015

PBL
PBL
2015

Multi-regional trade data for Europe in 2010
Project for the EC Institute for Prospective Technological Studies (JRC-IPTS)

© PBL Netherlands Environmental Assessment Agency

The Hague/Bilthoven, 2015

PBL publication number: 1753

Corresponding author

mark.thissen@pbl.nl

Authors

Mark Thissen (PBL), Maureen Lankhuizen (VU University Amsterdam) and Olaf Jonkeren (PBL)

Graphics

PBL Beeldredactie

**Production coordination
and English-language editing**

PBL Publishers

This publication can be downloaded from: www.pbl.nl/en.

Parts of this publication may be reproduced, providing the source is stated, in the form: Thissen et al. (2015), *Multi-regional trade data for Europe in 2010, Project for the EC Institute for Prospective Technological Studies (JRC-IPTS)*. The Hague: PBL Netherlands Environmental Assessment Agency.

PBL Netherlands Environmental Assessment Agency is the national institute for strategic policy analyses in the fields of the environment, nature and spatial planning. We contribute to improving the quality of political and administrative decision-making, by conducting outlook studies, analyses and evaluations in which an integrated approach is considered paramount. Policy relevance is the prime concern in all our studies. We conduct solicited and unsolicited research that is both independent and always scientifically sound.

Contents

1	INTRODUCTION, AIMS AND OBJECTIVES	4
2	RESULTS	5
3	METHODOLOGY	5
3.1	Re-export correction and trade consistency	6
3.2	Regionalisation of Supply and Use Tables	9
3.2.1	Production and consumption	11
3.3	Extrapolation of the 2000 regional trade matrix to 2010	13
3.3.1	Regionalising IO or supply and use Tables	14
3.3.2	Interregional social accounting matrix (SAM)	14
3.3.3	First step: domestic trade and international trade between regions and countries	17
3.3.4	Second step: international trade between regions	19
3.4	Additional regions	20
4	CONCLUSIONS	21
5	REFERENCES	22

1 Introduction, aims and objectives

Policy research analysing Europe's recent focus on place-based development and the regional smart specialisation perspective has been hampered by data deficiencies. This applies to empirical evidence on interregional relations in particular. Interregional relations are central in these new policy initiatives, as these are based on a systems way of thinking about innovation and growth. Interregional trade relations are also essential for empirically sound regional economic modelling. However, these crucial economic data on trade between regions are noticeably missing from European regional databases.

Regional Economic Modelling (REMO) is the approach taken by the Joint Research Centre (JRC) to incorporate empirical evidence on the economic performances of regions and the interactions between them. An update of the available regional trade data at IPTS (to be used in the regional economic Rhomolo model of IPTS) is needed in order to ensure that scenario analysis is based on more complete and recent data. PBL was asked to develop such a database. This paper sets out how these regional trade data were developed by PBL at the NUTS2 regional level for the year 2010.¹

The data on bilateral trade between the EU NUTS2 regions were developed for the double purpose of regional economic modelling and the analysis of how regions perform in comparison with other regions in the EU. Considering the limited scope of the project, we applied an updating method based on the PBL original freight-based trade data set to develop an up-to-date data set. The resulting bi-regional data set describes the most likely trade flows between European regions, given all the available information, and is consistent with national accounts.

¹ The project was financed by the IPTS Institute of Prospective Technology Studies), part of the JRC of the European Commission.

2 Results

The results of this project are:

1. A complete data set with bilateral trade between all NUTS2 regions in the EU27 (Croatia is not included). The data are fully consistent with international trade between the Member States and trade with the rest of the world for the year 2010 for the 6 product categories used in the Rhomolo model.
2. A clear and thorough description and presentation of the method and assumptions used in constructing the data.

3 Methodology

The only fully consistent database on trade in goods and services at the NUTS2 regional level was constructed by PBL Netherlands Environmental Assessment Agency (Thissen et al., 2013a, 2013b and 2013c). This database, based on a parameter-free estimation of trade data (Simini et al., 2012), was the basis for the tailor-made bilateral trade data set for IPTS. The methodology involves an adaptation of the PBL data set to conform to the Rhomolo specifications. Besides, the PBL data set is extended in order to make it consistent with the national accounts as presented in the WIOD database (Timmer et al., 2012; Dietzenbacher et al., 2013). The WIOD database was constructed around the Feenstra et al. (2005) trade data and the Eurostat supply and use tables. Moreover, the WIOD database makes a detailed distinction between final and intermediate goods trade.

The estimation approach is based on a quadratic minimisation, given constraints that make the estimates consistent with the bilateral trade data at the national level (the WIOD data set). The PBL trade data set for the year 2010 is taken as a prior estimate. A quadratic minimisation function is to be preferred over a logarithmic function (often used in entropy minimisation) because of its mathematical properties that reduce computation time significantly.

IPTS supplied additional data about trade of regions in several new Member States that are not in the PBL trade data set (such as Romania and Bulgaria) with other European regions and with the rest of the world. These data were based on a gravity estimation and used as a prior in the estimation of the final data set.

The resulting bi-regional trade data are for the year 2010 only. An extension of the data set to more recent years is not foreseen in the near future. Direct co-operation with the REMO team ensured a successful execution of the tasks.

The overall approach consists of a number of successive steps. These are outlined below and will be explained in more detail in the remaining sections in this chapter.

1. The WIOD national supply and use tables for the year 2000 are the starting point for the analysis. These tables are first adjusted so as to (1) account for the distribution of the re-exports over de true origin and destination countries, and (2) to ensure consistency in bilateral trade flows (i.e., that import trade flows are consistent with export trade flows) and (3) that exports and imports of each country add up to their national accounts totals as presented in the WIOD database.
2. Regionalisation: using the result of step 1, regional supply and use tables are assembled for each of the 256 NUTS2 regions. This operation, which is known as the regionalisation of national tables in Input-Output literature, was carried out by using regional data on sector production, investment and income development from Eurostat. The outcome of the regionalisation is regional supply and use tables for each EU country, for 14 sectors and 59 product groups in 2010.
3. Next, taking the regionalised supply and use tables and the PBL regional trade data as a prior, the interregional supply and use tables are estimated for the year 2010 using the constrained quadratic minimisation procedure. These estimated regional tables are fully consistent with the WIOD tables obtained in step 1) of the approach. This consistency implies that adding up the regionalised supply and use tables will result in the national WIOD supply and use tables. The interregional supply and use tables have consistent bilateral trade flows (import trade flows among the regions are consistent with the export trade flows). Please note that this procedure results in region-specific coefficients and is, therefore, also from the regionalisation perspective, very different from the commonly used Isard's (1953) Commodity Balance method.
4. In the final step the additional NUTS2 regions that are used in the Rhomolo model, but are not present in the original PBL trade data set, are added to the 2010 interregional trade matrix. This is done by a proportional distribution of the trade data according to the estimated regional gravity trade data supplied by IPTS.

3.1 Re-export correction and trade consistency

Re-exports are products imported in and exported from a 'transit country'. These re-exports are exports of the 'transit country' in the system of national accounts because the ownership

of these goods changed to a trading company originating from this 'transit country'. This makes re-exports very different from transit goods (or throughput). The latter are goods transported via a 'transit country' independent of ownership. Please note that re-exported goods may never have been in the 'transit country', since the trade is only determined by ownership changes. Also note that transit goods are not part of the system of national accounts and are therefore not part of the reported exports and imports. Re-exports are important foremost in goods trade and less important in services trade. Since re-exports are registered to a different country than the true origin or final destination of the trade flows, they affect both the pattern of trade and the average distance in trade.

We use the WIOD supply and use tables for the year 2010 as a basis for the construction of the regional bilateral trade matrix. These supply and use tables provide detailed information on bilateral trade for 40 countries and the rest of the world. The data include 59 product categories, including services, according to the European Statistical Classification of Products by Activity (CPA) 2002. The data are consistent with countries' national accounts. In this research step we focus on total trade by product category (Lankhuizen and Thissen, 2014).²

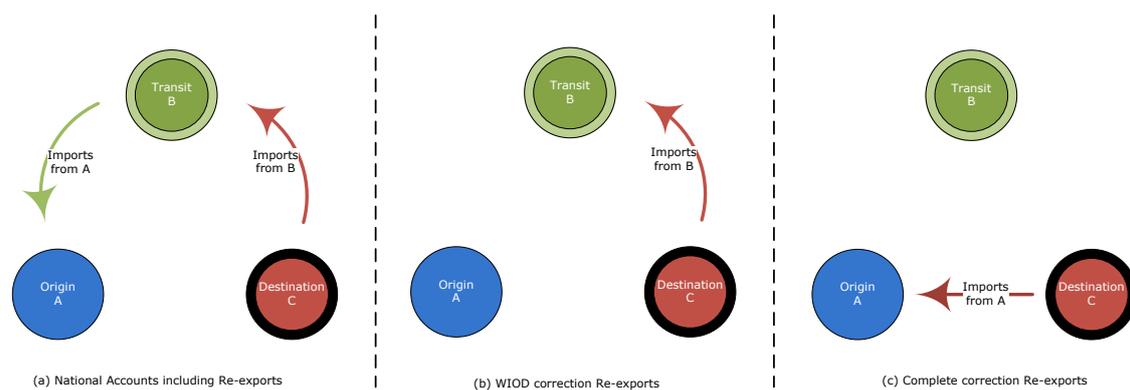
The trade flows between countries in WIOD have not been corrected for re-exports. Hence, an adjustment of the trade pattern in the WIOD trade data is needed before we can regionalise the inter-country trade. The WIOD supply and use tables include estimates of the size of total re-exports per transit country. The re-exports in the WIOD database are minimum estimates derived from the accounting principle that exports cannot be larger than production. Re-exports in WIOD are therefore determined as the exports minus the production if this results in a positive number. In mathematics we can write this as follows.

$$RE_{i,p} = \text{Max}\left[0, \left(Ex_{i,p} - Y_{i,p}\right)\right], \quad (1)$$

where $RE_{i,p}$ denotes re-exports RE per country i and product p , excluding trade margins, $Ex_{i,p}$ denotes exports of p from country i excluding trade margins, and $Y_{i,p}$ is the production of product p in country i .

Figure 1: Re-export corrections to the National Accounts

² We do not distinguish supply or use by industry when estimating the re-exports.



It is then possible to correct trade patterns for the effect of re-exports using the WIOD estimates of the size of re-exports under the assumption that re-exports follow the same trade pattern as the existing trade matrix. We illustrate the necessary corrections that were applied in our methodology graphically in Figure 1.

In Figure 1 we have three countries A, B and C. Country C is the final destination of a certain good that is produced in origin country A and is re-exported by transit country B. The arrows in Figure 1 represent the import flows (in monetary terms) since the WIOD trade database is constructed around the import of goods. Figure 1a) represents a situation in which the re-exported good is imported in both the transit country B and by final destination country C. In the WIOD tables imports of the transit country are corrected for its re-export volumes. In our example in Figure 1b), this is done by taking out the imports coming from country A destined for transit country B. The WIOD trade database thereby takes out the import flow from origin country A to transit country B correctly, but does not address the import flow from transit country B to destination country C. The total trade volume in the WIOD trade database is therefore correct, but the true origins of re-exported goods are wrongly reported. We therefore made a final correction that will result in the situation as shown in Figure 1c). This final correction step consists of moving the import flow from transit country B to destination country C (Figure 1b) to a new flow between origin country A to destination country C (Figure 1c).

Finally, bilateral trade flows were made consistent. This is part of a wider adjustment of the WIOD data to ensure that exports from country A to country C equal imports of country C from country A. In the original WIOD database, exports are not distributed across countries of destination, but at least the total exports in the tables cannot be less than the imports from all other countries after the correction for re-exports. However, before we can evaluate any differences between the values of exports and imports they should both be valued in the same prices. The WIOD tables follow Eurostat in having both exports and imports in fob (free on board). However, not all countries present their exports at the product level in fob, since the Eurostat manual leaves the choice between exports in fob at the product level and total exports in fob open to the bureaus of statistics. Moreover, countries have changed the way

they report the exports over time. In the year 2010 there are 18 out of 40 countries that use a correction term to have only the total value of exports in fob prices. These countries are Austria, Bulgaria, Cyprus, Germany, Spain, Estonia, Finland, France, Greece, Hungary, Italy, Lithuania, the Netherlands, Poland, Portugal, Romania, Slovenia and the United States. This correction factor had to be applied to the different products to obtain fob prices at the product level. Since there is no information available about these margins we have taken the domestic trade and transport margins as a proxy. The correction factor has therefore been applied over the products proportional to the domestic trade and transport margins.

It can be argued that if total exports in the tables are less than the imports from all other countries together this may be due to (at least in part) the wrong destination of re-exports in the WIOD tables. In order to account for this, both the inconsistency in bilateral trade flows as well as the adjustment of the trade patterns due to re-exports are integrally estimated in one procedure. The procedure is explained in a concise way in the appendix A and is more extensively discussed in Lankhuizen and Thissen (2014).

3.2 Regionalisation of Supply and Use Tables

In the second step, the obtained national supply and use tables were regionalised. The main aim of this second step is to obtain, for every region, total exports and total imports, per product for the year 2010. This will be achieved by constructing consistent regional supply and use tables. These tables are organised according to the standard structure of use and supply tables presented in Tables 1 and 2.³

Table 1: Use table

	input industry 1	input industry 2	...	input industry s	household demand	non-profit demand	government demand	fixed capital formation	changes in inventories	changes in valuables	exports	total
product 1												
product 2												
...												
product p												
total												

Table 2: Supply table

	input industry 1	input industry 2	...	input industry s	trade and transport margins	+ taxes -subsidies on production	imports	total
product 1								
product 2								
...								
product p								
total								

These regionalised supply and use tables are conform the national supply and use tables used in WIOD (only the number of sectors is reduced to 14 because of data availability, see Table 3). This means that total use in the region would match total supply, which implies that the totals of the rows in the use table equals the totals of the rows in the supply table.

³ These regional supply and use tables are not a part of the trade data delivered to IPTS.

This equality is the regional version of the more familiar macroeconomic condition that production is equal to consumption plus exports minus imports. The totals of the columns in the regional supply and use tables are also equal because total output of every regional industry equals this industry's total input and value-added. The regional supply and use tables give boundaries to the total regional exports and imports and are therefore crucial to infer regional export and import patterns.

We employed the approach known as the Commodity Balance (CB) method, first suggested by Isard (1953). National supply and use tables were crossed with regional data on value-added, regional investment, government demand and consumer demand (both with regional income as a proxy) from Eurostat (2014). Consistency of regional value-added, investment, government demand and consumer demand with the national account data in WIOD was obtained by multiplying the national value according to WIOD with the share of regions in the national totals. These data provided the necessary information on regional totals, without a distinction between different products. To disaggregate these totals into different products (the rows of the supply and use tables), the national supply and use tables were used. The structure of the national supply and use tables is assumed to give a good approximation for the regional tables. More formally, consumers are assumed to have homogenous preferences throughout the country concerned, homogenous government spending is assumed over the regions, and industries are assumed to use the same production technology, irrespective of their location within the country concerned.

Under these assumptions, regional household demand (*HHD*) per product (CPA, marked with index *g*), for example, is obtained according to Equation (2).

$$HHD_g^r = \frac{HHD^r}{\sum_{R \in N} HHD^r} HHD_g^N, \quad (2)$$

where *N* stands for the country and *R* is the total number of regions within that country. In a comparable way regional production was determined. Since no information is available on regional total exports and imports from Eurostat, we used the regional value-added as a proxy for the regional trade shares in 2010. Exports and imports, therefore, were distributed across regions according to production and consumption shares as explained by Equation (3). For instance, exports would be:

$$X_g^r = \frac{VA_g^r}{\sum_{R \in N} VA_g^r} X_g^N, \quad (3)$$

where *X* is exports and *VA* is value-added per region. It should be emphasised that this is only a first estimate of the international trade of regions, based on fixed shares. The 'true' amount of regional trade is determined in the updating method (step 3).

3.2.1 Production and consumption

In order to regionalise the national supply and use tables, we first distributed production and final demand over the regions. The regional demand in the use tables was divided into intermediate demand (input by industry), household demand, government demand, demand from non-profit organisations, gross fixed capital formation, changes in inventories, and changes in valuables.

With respect to the supply tables, regional output had to be broken down by industries, trade and transport margins and net taxes. First, the data on production were determined per industry as well as the intermediate demand. Although no information is available on output at the European NUTS2 level, we did obtain data on value-added (VA) for 14 economic sectors from Eurostat. Table 3 presents the classification for these 14 economic sectors.

Table 3: Industry classification in 14 sectors

S1	Agriculture
S2	Mining, quarrying and energy supply
S3	Food, beverages and tobacco
S4	Textiles and leather
S5	Coke, refined petroleum, nuclear fuel and chemicals etc.
S6 & S7	Electrical, optical and transport equipment
S8	Other manufacturing
S9	Construction
S10	Distribution
S11	Hotels and restaurants
S12	Transport, storage and communications
S13	Financial intermediation
S14	Real estate, renting and business activities
S15	Non-market services

Maintaining the index g for products and introducing the index s for sectors, regional output and input were constructed using information on value-added in the following way:

$$input_{gs}^r = \frac{VA_s^r}{\sum_{r=1}^{R \in N} VA_s^r} input_{gs}^N \quad (4)$$

$$output_{gs}^r = \frac{VA_s^r}{\sum_{r=1}^{R \in N} VA_s^r} output_{gs}^N \quad (5)$$

This approach is based on two main assumptions. First, the production technology through which a sector transforms inputs into outputs is assumed to be homogeneous throughout the country considered. The regional shares of value-added in the national total of value added

represents a good proxy for the magnitude of the regional industries production shares in national output. In this way consistency per product is maintained, with the sum across regions of output (or input) per product and per industry equalling its national output (or input).

Second, the preferences of final consumers in each region are assumed to reflect preferences nation-wide. The regionalisation was done using Equation (2). Regional household demand was combined with the very small demand from non-profit organisations, since there was no regional information available on non-profit organisations. Regional income statistics were used as a proxy for the household demand. We also used household income as a proxy to regionalise total government demand per region. It is reasonable to assume that the expenditure of the government sector follows the economic size of the region. However, it should be emphasised that the regionalisation of government expenditure over the regions is only done to obtain a first starting point. The size of government expenditure in the region is endogenously determined as part of the optimisation. The demand pattern per product is assumed not to differ between regions, and is thus:

$$GOVD_g^r = \frac{Inc^r}{\sum_{R \in N} Inc^R} GOVD_g^N \quad (6)$$

Where Inc represents the household income in the region.

Gross capital formation is divided into three items: gross fixed capital formation, changes in inventories and changes in valuables. With respect to the gross capital formation we used region information on investment to regionalise the national total capital formation.

Investments were considered per region, therefore:

$$INV_g^r = \frac{INV^r}{\sum_{R \in N} INV^R} INV_g^N \quad (7)$$

Changes in inventories and valuables were made using regional value-added as a proxy. Just as in the case of the government demand and international trade this is only used as a first estimate and the final amount of regional expenditures on inventories and valuables is endogenously determined in the updating methodology. Hence, changes in inventories and valuables (CIV) were defined as:

$$CIV_g^r = \frac{VA^r}{\sum_{R \in N} VA^R} CIV_g^N \quad (8)$$

In a similar fashion, this last consideration could also be applied to the two remaining columns in the supply table: trade and transport margins (TTM) and taxes and subsidies (TAX). Since their regional variation is also assumed to be proportional to production, we defined them as:

$$TTM_g^r = \frac{VA^r}{\sum_{r=1}^{R \in N} VA^r} TTM_g^N \quad (9)$$

and

$$TAX_g^r = \frac{VA^r}{\sum_{r=1}^{R \in N} VA^r} TAX_g^N \quad (10)$$

All data in the regionalised supply and use tables now are defined, except domestic trade, i.e., trade between regions of the same country. We used our PBL data set here as a first estimate. That is, we allocated, for example, the use of a product by an industry to regions in a country according to the intraregional trade of this product that is available in the original PBL trade database. Again, this is only a first proxy for the trade, since this is endogenously determined in the estimation procedure described in the next section.

3.3 Extrapolation of the 2000 regional trade matrix to 2010

Building on the unique database on bilateral trade between 256 European NUTS2 regions in 59 product categories for the year 2000 (Thissen et al., 2013b), as explained in the previous section, regional and national information for the year 2010 from Eurostat was used to extrapolate the data from 2000 to 2010. The resulting bi-regional data set describes the most likely trade flows between European regions, given all the available information, and is consistent with national accounts data as presented in the WIOD database.

The update of the data up until 2010 was based on constrained non-linear optimisation. The objective function in the non-linear optimisation minimised the quadratic distances between the coefficients of the regional SAM matrix in relation to the coefficients of the national SAM matrix given regional data on value-added, fixed capital formation and household demand. The optimisation was constrained in such a way that all cells of the regional supply and use tables add up over the regions to the national cells presented in the WIOD supply and use tables. Moreover, by imposing the constraint that all exports of a region should be equal or smaller than production it is not possible to have regional re-exports.

The size of the constrained non-linear minimisation problem is such that the procedure was divided into two steps. In a first step, domestic trade and international trade from regions to countries was determined. In this step also the regional supply and use tables were determined. The second step involved subdividing the international trade from European regions to countries into trade between regions. Throughout this process, all normal consistency rules were applied, so that the amount of products exported from one region to another (destination) region or country would equal the amount imported into that

destination region or country from that particular region of origin. Re-exports were not allowed on the regional level.

The methodology for constructing the updated data set is outlined in more detail in the next sections.

3.3.1 Regionalising IO or supply and use Tables

Central in our analysis is regionalisation of the WIOD supply and use framework. We use a supply and use framework rather than an Input-Output framework, because the focus is on the regionalisation both trade and regional technological coefficients (the use and supply of products by different economic actors). An input-output framework is built around the assumption that every sector produces only one good. There are two basic approaches to construct a supply and use framework and therefore there are two types of input-output matrices: product-by-product matrices and sector-by-sector matrices. Product-by-product input-output matrices have been constructed around the product classification and sectors are therefore adjusted or mixed in such a way that only one sector makes only one product. Sector-by-sector input-output matrices have been constructed around the sector classification and products are therefore adjusted or mixed in such a way that only one sector makes only one product. This implies that, depending on the type of IO table, either the sectors are not comparable over the nations *and not comparable with regional sector statistics*, or products are not comparable over nations *and not comparable with trade statistics*. Hence, a regionalisation of IO tables can either *only* be based on regional sector statistics or *only* on regional trade statistics. We intended to use both a regional trade database and production and consumption data of different actors in different regions. As a consequence is the regionalisation of a complete supply and use framework the only option available to us.

3.3.2 Interregional social accounting matrix (SAM)

For the sake of convenience, the supply and use data were first entered into a social accounting matrix (SAM) framework (SNA, 1993; 2008). Using such a complete national accounts framework in matrix format, has the advantage that all consistency checks can be performed immediately. Thus, the imported amount of product into region B from region A is, per definition, exactly the same as the exported amount of this product from region A to region B, as this amount is recorded in only one position in the matrix. In general, valuations in a SAM are in nominal terms. Its rows and columns list institutional agents or actors. The matrix shows the flow of goods between actors, from row to column, balanced by an opposite flow of money from column to row. The SAM framework also illustrates the methodology used. We used more recent information from national and regional accounts to impose requirements that had to be met while minimising any structural distance to the elements of the matrix on which no new information was available. Here we see that changes in regional demand or production have a direct impact on regional trade, because

what is exported must be produced and what is imported should represent demand. This minimisation of the structural distance is applied by keeping the changes in the relative numbers of the matrix to a minimum. The consistency of the system of national and regional accounts in a SAM framework, therefore, provides a large amount of information on regional trade developments.

Figure 2: A stylised interregional Social Accounting Matrix

SAM	Region 1: Use		Region 2: Use		Region 1: Supply		Region 2: Supply		Region 1: Use	Region 2: Use	total
	sector 1	sector 2	sector 1	sector 2	product 1	product 2	product 1	product 2	hhd - Investment	hhd - investment	
Region 1 sector 1					3	7					10
Region 1 sector 2					2	6					8
Region 2 sector 1							5	2			7
Region 2 sector 2							3	6			9
Region 1 product 1	1	1	1						1	1	5
Region 1 product 2	2	3		2					5	1	13
Region 2 product 1	1		2	1						4	8
Region 2 product 2		1							1	6	8
Region 1 value added	6	3							transfer	transfer	
Region 2 value added			4	6					transfer	transfer	19
total	10	8	7	9	5	13	8	8		19	x

A stylised version of the SAM is presented in Figure 2, which distinguishes two regions. The SAM consists of a framework in which the use table is combined with the transposed supply table. The two regions distinguished in the SAM have two sectors, 1 and 2, producing two types of products. A product in the SAM, thus, has three characteristics: type of good, the region and the sector of production. The use of this product by different sectors in different regions is presented in the first four columns of the SAM. The production of these products is presented on the top 4 rows of the SAM. Total production in these sectors is provided in the last column on the right. In the bottom two rows we find the total value-added which is an aggregation of both labour and capital income.

Table 4: Non-Industrial actors and other accounts distinguished in the SAM

S16	Final consumption expenditure by households and non-profit organisations
S17	Final consumption expenditure by government
S18	Net capital formation
S19	Inventory adjustment
S20	Trade and transport margins
S21	Taxes less subsidies on products
S22	Exports (outside Europe)
S23	Imports (outside Europe)

International trade takes place at the product level and is divided over different types of use. The use of the final demand categories is presented in the last two columns of the SAM. The use by the different producing sectors is presented in the first two columns. Thus, Region 1 exports a total of 3 units of product 2 to Region 2, 2 of which are used by Sector 2 and 1 unit is used by the final demand categories. The final demand for goods per region does not equal the total value-added earned in that same region. Only when interregional savings would be

specified in the transfer part of the SAM these would be equal. In our SAMs we do not specify the transfer part, because we have no information on these flows and we do not need them in our updating procedure. In our stylised presentation of the SAM, therefore, all value-added rows and all final demand columns were added to obtain equality between total value-added and total final demand. All other rows add up to the same respective columns representing the bookkeeping rules that for every actor total expenditure should equal total income.

Table 5: The 2-digit Classification of Products by Activity (CPA, 1996)

AA01	Products of agriculture, hunting and related services
AA02	Products of forestry, logging and related services
BA05	Fish and other fishing products; services incidental of fishing
CA10	Coal and lignite; peat
CA11	Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying
CA12	Uranium and thorium ores
CB13	Metal ores
CB14	Other mining and quarrying products
DA15	Food products and beverages
DA16	Tobacco products
DB17	Textiles
DB18	Wearing apparel; furs
DC19	Leather and leather products
DD20	Wood and products of wood and cork (except furniture); articles of straw and plaiting materials
DE21	Pulp, paper and paper products
DE22	Printed matter and recorded media
DF23	Coke, refined petroleum products and nuclear fuels
DG24	Chemicals, chemical products and man-made fibres
DH25	Rubber and plastic products
DI26	Other non-metallic mineral products
DJ27	Basic metals
DJ28	Fabricated metal products, except machinery and equipment
DK29	Machinery and equipment n.e.c.
DK30	Office machinery and computers
DL31	Electrical machinery and apparatus n.e.c.
DL32	Radio, television and communication equipment and apparatus
DL33	Medical, precision and optical instruments, watches and clocks
DM34	Motor vehicles, trailers and semi-trailers
DM35	Other transport equipment
DN36	Furniture; other manufactured goods n.e.c.
DN37	Secondary raw materials
EA40	Electrical energy, gas, steam and hot water
EA41	Collected and purified water, distribution services of water

FA45	Construction work
FA50	Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of automotive fuel
GA51	Wholesale trade and commission trade services, except of motor vehicles and motorcycles
GA52	Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods
HA55	Hotel and restaurant services
IA60	Land transport; transport via pipeline services
IA61	Water transport services
IA62	Air transport services
IA63	Supporting and auxiliary transport services; travel agency services
IA64	Post and telecommunication services
JA65	Financial intermediation services, except insurance and pension funding services
JA66	Insurance and pension funding services, except compulsory social security services
JA67	Services auxiliary to financial intermediation
KA70	Real estate services
KA71	Renting services of machinery and equipment without operator and of personal and household goods
KA72	Computer and related services
KA73	Research and development services
KA74	Other business services
LA75	Public administration and defence services; compulsory social security services
MA80	Education services
NA85	Health and social work services
OA90	Sewage and refuse disposal services, sanitation and similar services
OA91	Membership organisation services n.e.c.
OA92	Recreational, cultural and sporting services
OA93	Other services
PA95	Private households with employed persons

Our regional SAMs distinguish the 14 industry categories presented in Table 3, and the non-Industrial actors and other accounts presented in Table 4. Products are classified according to the 2-digit Classification of Products by Activity (CPA, 1996) presented in Table 5. There is a total of 62 goods and services in CPA 2002. Yet, products with numbers 96, 97 and 99 (goods produced by households for own use, services produced by households for own use and services provided by extra-territorial organisations and bodies) are not included in the supply and use system of accounts, reducing the total number of products analysed in this study to 59.

3.3.3 First step: domestic trade and international trade between regions and countries

In this first step, we used constrained non-linear optimisation to determine the trade of regions with regions within the same country, and the international trade between these regions and other countries.

The objective function in the first step of the extrapolation

Equation (11) shows the non-linear quadratic objective function to be minimised in our non-linear optimisation problem. The function describes how new information is used to find updated matrices, given the growth in production and demand indicated in the national and regional accounts. In general, the change in the structure of the demand, supply and regional trade pattern was minimised, given new information on for instance regional value-added and international trade. The complete minimisation problem can be described as follows.

$$\begin{aligned} Min Z = \sum_{i \in c} \left[\left(\hat{a}_i^c - a_i^c \right)^2 + \left(\hat{a}_i^r - a_i^r \right)^2 + \left(\hat{t}_i - t_i \right)^2 \right] \\ + \text{constraints} \end{aligned} \quad (11)$$

Where the index i stands for the region, a_i^c represents the elements of the regional SAM matrix divided by its column total, a_i^r represents the elements of the regional SAM matrix divided by its row total, and t_i stands for the international trade margins divided by the total exports per product. For matters of convenience we left out the summation over the elements of the SAM matrix. The SAM matrix is aggregated for all the imports from regions and countries except the regions from the own country. Thus in this first step of the procedure only the domestic trade and non-trade coefficients of the regional SAM matrices are determined. The international trade is determined in the second step of the procedure. As a consequence the first step in the procedure can be done for all countries separately.

The constraints on the objective function

The objective function was constrained to generate outcomes conform the regional and national accounts in WIOD. Moreover, economic theory was used to derive information which was implemented in the procedure by adding additional constraints. The most common additional information derived from theory was the non-negativity condition of trade flows. The limitation to only have positive trade values guaranteed that all goods had a positive price and were therefore valued with a positive number in the SAM. Below, all constraints used are discussed along with the information they contain.

1. All elements summed over all regions in a country add up to the same elements in the national WIOD-based SAM. This constraint guarantees that the regional SAMs are completely compatible with the WIOD database.
2. All products sold by an economic agent are received and paid for by another economic agent. This bookkeeping rule was adhered to by imposing the equality of

all row and column totals of the SAM for all activities (classified according to industry) and products.

3. Information was available on regional value-added for the distinguished industries. Value-added of the sectors in the regions was therefore fixed.
4. Information was available on regional total household demand and regional total gross fixed capital formation. These items have therefore been fixed also in the procedure.
5. Finally, a 'no re-export' constraint was applied to ensure that production would always exceed exports, for every region and product. Please note that this constraint should be imposed on the product level and not on the industry level.

Solving the minimisation problem under these constraints resulted in the update of the regional SAM, including domestic trade from the year 2000 to the year 2010.

3.3.4 Second step: international trade between regions

The international trade between regions of European countries was determined in the first step of the procedure, described above. In the second step, these international trade flows were subdivided into regions of destination and regions of origin, resulting in a full regional origin–destination matrix. No additional information was available on these trade patterns, except on international trade between countries. We used constrained non-linear quadratic optimisation to combine this information with existing trade patterns to determine the final panel data on trade between NUTS2 regions for the 2000–2010 period.

The most important part of the supply and use framework are the technical coefficients. These coefficients are crucial in, for instance, Input-output analysis. Hence, it makes sense to minimise the quadratic error of these coefficients. However, with respect to trade this is different. Absolute values are just as important as relative values. We therefore applied a mixed objective function where a quadratic absolute \widehat{ae} and a quadratic relative error \widehat{re} were both minimised simultaneously. Two priors were taken into account: one being the estimated trade from an export perspective, and the other from an import perspective.

This gives the following objective function:

$$\begin{aligned}
 \text{Min } Z' &= \sum_s \widehat{re}_s + \widehat{ae}_s \\
 \text{s.t.} & \\
 \widehat{re}_s &= \sum_{i,j} \frac{1}{\tau_{i,j}^{ex}} \left(\widehat{\tau}_{s,i,j}^{ex} - \tau_{s,i,j}^{ex} \right)^2 + \sum_{i,j} \frac{1}{\tau_{i,j}^{im}} \left(\widehat{\tau}_{s,i,j}^{im} - \tau_{s,i,j}^{im} \right)^2 \\
 \widehat{ae}_s &= \sum_{i,j} \frac{1}{\tau_i^{ex}} \left(\widehat{\tau}_{s,i,j}^{ex} - \tau_{s,i,j}^{ex} \right)^2 + \sum_{i,j} \frac{1}{\tau_j^{im}} \left(\widehat{\tau}_{s,i,j}^{im} - \tau_{s,i,j}^{im} \right)^2 \\
 Ex_{c,d,s} &= \sum_{i \in c, j \in d} \widehat{\tau}_{s,i,j}^{ex} \\
 Im_{s,d,c} &= \sum_{i \in c, j \in d} \widehat{\tau}_{s,i,j}^{ex}
 \end{aligned} \tag{12}$$

in which $Ex_{c,d}$ denotes exports of country c destined for country d (directly taken from the WIOD tables) and $Im_{j,c}$ denotes imports in country d from country c (directly taken from the WIOD tables). The regional trade estimation is performed on the importing sector level (s) and thereby completely consistent with the WIOD tables. The priors of exports (imports) were determined by the regional trade pattern of exports (imports) from the year 2000. Please note that we defined the quadratic relative error slightly different than in percentages.⁴ The reason is related to the weight of both errors in the objective function. In the above specification, both weights are exactly the same because the sum of trade between all regions $\tau_{i,j}^{ex}$ is equal to the sum over all regions of the average value of the trade $\bar{\tau}_i^{ex}$.

3.4 Additional regions

Lastly, 30 NUTS2 regions that were not in the PBL data set were added to the 256 NUTS2 regions to obtain the complete trade data set for the EU27. The missing regions were all regions in Romania, Bulgaria and Slovenia. Slovenia was recently split into two regions and therefore still presented as one region in the PBL database. Additionally, the Islands of Portugal were included in the database constructed for IPTS and Denmark was changed in a different regional classification.

The same methodology has been used to obtain the trade for these regions missing from the PBL data set. In all cases the trade was already available at the country level. Thus, all regions available in the PBL database already traded with the countries. The only thing we had to do is subdivide this trade over the different regions in these countries. We used the share from the external IPTS gravity estimation database to obtain the trade data for the regions in these countries. Thus, for instance, trade from Andalusia to Romania was subdivided over the Romanian regions according to the proportions taken from the gravity-based IPTS database. Exactly the same approach was followed to subdivide the imports. Finally, the internal trade between the missing regions from the same country was subdivided according to the trade patterns in the IPTS gravity-based trade database. For example, the proportions of domestic trade were obtained by dividing the Romanian domestic trade from the gravity-based IPTS trade database by the total Romanian domestic trade. The domestic trade in the new database was subsequently obtained by multiplying these proportions with the domestic trade as given in the WIOD database.

⁴ A relative error based on percentage would have been as follows:

$$\widehat{re}_s = \sum_{i,j} \left(\frac{1}{\tau_{s,i,j}^{ex}} \right)^2 \left(\hat{\tau}_{s,i,j}^{ex} - \tau_{s,i,j}^{ex} \right)^2 + \sum_{s,i,j} \left(\frac{1}{\tau_{s,i,j}^{im}} \right)^2 \left(\hat{\tau}_{s,i,j}^{im} - \tau_{s,i,j}^{im} \right)^2.$$

4 Conclusions

This paper describes the construction of a database on regional trade between all NUTS2 regions in the EU27. The methodology used was based on an extrapolation of the PBL trade database for 2000 to 2010, using new regional information. The resulting regional data set describes the most likely trade flows between European regions, given all the available information, and is consistent with national accounts. The ensuing data are also fully consistent with international trade between the Member States and with the rest of the world, for the 6 product categories used in the Rhomolo model.

5 References

- Dietzenbacher E, Los B, Steher R, Timmer MP and De Vries GJ. (2013). The Construction of World Input-Output Tables in the WIOD Project. *Economic Systems Research*, 25: 71–98.
- Feenstra RC, Lipsey RE, Deng H, Ma AC and Mo H. (2005). *World Trade Flows: 1962–2000*. National Bureau of Economic Research.
- Isard W. (1953). Regional commodity balances and interregional commodity flows. *American Economic Review* 43: 167–80.
- Lankhuizen M and Thissen M. (2014). Identifying true trade patterns: correcting bilateral trade flows for re-exports, 22nd IIOA Conference, Lisbon.
- Simini F, González MC, Maritan A and Barabási A. (2012). A universal model for mobility and migration patterns, *Nature*, 484, pp. 96–100, doi:10.1038/nature10856.
- Stone R. (1963). *Input-output relationships 1954–1966*, The department of applied economics University of Cambridge, Chapman and Hall, Cambridge.
- System of National Accounts (1993 and 2008). *System of National Accounts (SNA)*. United Nation website: <http://unstats.un.org/unsd/nationalaccount/sna.asp>
- Timmer MP. (ed) (2012). 'The World Input-Output Database (WIOD): Contents, Sources and Methods', WIOD Working Paper Number 10, downloadable at <http://www.wiod.org/publications/papers/wiod10.pdf>
- Thissen M and Löfgren H. (1998). A new approach to SAM updating with an application to Egypt, *Environment and Planning A* 30: 1991–2003.
- Thissen M, Van Oort F, Diodato D and Ruijs A. (2013a). *European regional competitiveness and Smart Specialization; Regional place-based development perspectives in international economic networks*, Cheltenham: Edward Elgar.
- Thissen M, Diodato D and Van Oort F. (2013b). *Integrated regional Europe: European regional trade flows in 2000*. PBL Netherlands Environmental Assessment Agency, The Hague.
- Thissen M, Diodato D and Van Oort F. (2013c). *European regional trade flows: An update for 2000–2010*. PBL Netherlands Environmental Assessment Agency, The Hague.

Appendix A: Estimating trade flows not including re-exports

A.1 Determining the re-exports matrices

We derived the following variables from the WIOD supply and use tables:

1. $RE_{i,p}$ Re-exports RE per country i and product p excluding trade margins.
2. $T_{i,j,p}$ Imports of product p by country j coming from country i excluding trade margins.
3. $ITM_{i,j,p}$ The international trade margin in imports of product p by country j coming from country i .
4. $IM_{j,p}$ Imports by country j excluding trade margins.
5. $Ex_{i,p}$ Exports from country i excluding trade margins.

Under the assumption of the same import patterns of imports and re-exports we have the following probabilities of the origin of imports $PI_{i,j,p}$ and destination of exports $PE_{i,j,p}$:

6. $PI_{i,j,p} = \frac{T_{i,j,p}}{\sum_{i'} T_{i',j,p}}$ probabilities of the origin of imports
7. $PE_{i,j,p} = \frac{T_{i,j,p}}{\sum_{j'} T_{i,j',p}}$ probabilities of the destination of exports

We want to determine the re-exports table $REOD_{i,q,j,p}$ describing the re-export of product p coming from country i , re-exported by country q , and with final destination country j . To determine this re-exports table $REOD_{i,q,j,p}$ we minimise Z

$$Z = \sum_{i,q,p} (\hat{e}_{i,q,p})^2 + \sum_{q,j,p} (\hat{e}'_{q,j,p})^2 + \sum_{i,q,j,p} (\hat{e}_{i,q,j,p})^2 \quad (13)$$

under the following constraints. First of all, the errors $\hat{e}_{i,q,p}$, $\hat{e}'_{q,j,p}$ and $\hat{e}_{i,q,j,p}$ are determined by the following equations:⁵

$$REO_{i,q,p} = PI_{i,q,p} RE_{q,p} + \hat{e}_{i,q,p} \quad (14)$$

$$RED_{q,j,p} = PE_{q,j,p} RE_{q,p} + \hat{e}'_{q,j,p} \quad (15)$$

$$REOD_{i,q,j,p} = \frac{REO_{i,q,p}}{RE_{q,p}} RED_{q,j,p} + \hat{e}_{i,q,j,p} \quad (16)$$

Equations (14) and (15) describe the origin $REO_{i,q,p}$ and the destination $RED_{q,j,p}$ of the re-exports. Equation (16) specifies that re-exports are determined endogenously. Moreover, the system will be solved under the conditions that re-exports attributed to some origin i can never exceed total exports from that country, and that re-exports to a destination j cannot exceed the imports of that country. That is,

$$\sum_q REO_{i,q,p} \leq Ex_{i,p} \quad (17)$$

$$\sum_q RED_{q,j,p} \leq IM_{j,p} \quad (18)$$

The quadratic minimisation (13) under the constraints (14), (15), (16), (17) and (18) will give us the re-export matrices $REOD_{i,q,j,p}$.

We can subsequently use these matrices $REOD_{i,q,j,p}$ to determine trade matrices $TRE_{i,j,p}$ that are cleaned from re-exports. The starting point are the trade matrices given in the WIOD where re-exports have already been taken out of imports. The only thing we have to do is adjust the WIOD trade tables by changing the origin of the re-exported imports. Thus, first we subtract the re-exported imports from the original trade tables at their final destination and we subsequently add all the 'true' origins of these re-exports. This is explained by the following equation:

$$TRE_{i,j,p} = T_{i,j,p} - RED_{i,j,p} + \sum_q REOD_{i,q,j,p} \quad (19)$$

A.2. Closing the system: exports equal imports

We know that total imports coming from a certain origin cannot exceed the exports of that origin. Therefore, the following condition should be satisfied (please note that in this

⁵ We minimise both absolute and relative errors. The latter serves to ensure small trade flows are not increased or decreased disproportionately by (absolute) changes in trade due to re-exports.

formulation any difference between exports and imports from other countries is going to the rest of the world):

$$Ex_{i,p} \geq \sum_j TRE_{i,j,p} \quad (20)$$

This gives the following condition that has to be added to the estimation of the re-exports that can be obtained by substituting (16) and (19) into (20).

$$Ex_{i,p} \geq \sum_j \left(T_{i,j,p} - RED_{i,j,p} + \sum_q \frac{REO_{i,q,p}}{RE_{q,p}} RED_{q,j,p} \right) \quad (21)$$

Please note that this constraint is non-linear and including this constraint will change the problem from a quadratic (or conic) minimisation problem into a non-linear minimisation problem.

The degree that exports of a country are larger than the sum of the imports coming from that country to all the other distinguished countries is due to missing exports to the rest of the world. These can therefore be booked as such.

A.3. International trade margins

WIOD lists international trade margins $ITM_{i,j,p}$ separately. These trade margins also have to be corrected for re-exports. The international trade margins cleaned from re-exports are estimated simultaneously with the estimation of re-exports by using the fact that total imports *cif* of product p by a country (in the supply table) are equal to imports in basic prices plus re-exports plus international trade margins. Hence,

$$IMcif_{j,p} = \sum_j \left(\left(1 + \frac{ITM_{i,j,p}}{T_{i,j,p}} \right) * \left(T_{i,j,p} - RED_{i,j,p} + \sum_q REOD_{i,q,j,p} \right) \right) \quad (22)$$

It is assumed that the share of trade margin in the total trade, $\frac{ITM_{i,j,p}}{T_{i,j,p}}$, is constant.

A.4. The complete minimisation problem

The minimisation problem needed to determine the re-export tables consists therefore of the minimisation of Z in Equation (13) under the constraints (14), (15), (16), (17), (18), (21) and (22). The minimisation resulted in the complete re-export matrices and the new trade tables between countries for 59 product categories.

A.5. Disaggregating trade over demand categories

Unfortunately there is no information that distinguishes the different demand categories. We therefore can only apply the above mentioned methodology for total trade of different product categories. Thus in a last step we have to divide this trade and the associated ITMs over the different demand categories. This is a typical RAS (Stone, 1963) problem where given prior knowledge about the content of a matrix (the old WIOD database) a new matrix has to be constructed given new information on the totals. This methodology is also known as a bi-proportional updating method and can be shown to be exactly the same as an Entropy minimisation (Thissen and Lofgren, 1998). We used the methodology described by Thissen and Lofgren (1998) to update the matrices and obtained new estimates for both the trade and the international trade margins divided over the different demand categories.

Appendix B: The region and product classification of the trade data set

The constructed trade data set follows the standard CPA product classification in main categories and the NUTS2 regional classification for the EU27. Both classifications are presented in Tables B.1 and B.2.

Table B.1: The Rhomolo Classification and the Classification of Products by Activity (CPA, 2002)

<i>Rhomolo Classification</i>	<i>CPA</i>	<i>Name</i>
<i>AB</i>	A	PRODUCTS OF AGRICULTURE, HUNTING AND FORESTRY
	B	FISH AND OTHER FISHING PRODUCTS; SERVICES INCIDENTAL TO FISHING
<i>CDE</i>	C	PRODUCTS FROM MINING AND QUARRYING
	D	MANUFACTURED PRODUCTS
	E	ELECTRICAL ENERGY, GAS, STEAM AND WATER
<i>F</i>	F	CONSTRUCTION WORK
<i>GHI</i>	G	WHOLESALE AND RETAIL TRADE SERVICES; REPAIR SERVICES OF MOTOR VEHICLES, MOTORCYCLES AND PERSONAL AND HOUSEHOLD GOODS
	H	HOTEL AND RESTAURANT SERVICES
	I	TRANSPORT, STORAGE AND COMMUNICATION SERVICES
<i>JK</i>	J	FINANCIAL INTERMEDIATION SERVICES
	K	REAL ESTATE, RENTING AND BUSINESS SERVICES
<i>LMNOPQ</i>	L	PUBLIC ADMINISTRATION AND DEFENCE SERVICES; COMPULSORY SOCIAL SECURITY SERVICES
	M	EDUCATION SERVICES
	N	HEALTH AND SOCIAL WORK SERVICES
	O	OTHER COMMUNITY, SOCIAL AND PERSONAL SERVICES
	P	SERVICES OF HOUSEHOLDS
	Q	SERVICES PROVIDED BY EXTRA-TERRITORIAL ORGANIZATIONS AND BODIES

Table B.2 The Rhomolo regional classification derived from the Nuts2 classification

<i>Code</i>	Name	<i>Code</i>	Name	<i>Code</i>	Name
AT11	Burgenland	FI1A	Pohjois-Suomi	PL51	Dolnoslaskie
AT12	Niederosterreich	FI20	Aland	PL52	Opolskie
AT13	Wien	FR10	Ile de France	PL61	Kujawsko-Pomorskie
AT21	Karnten	FR21	Champagne-Ardenne	PL62	Warminsko-Mazurskie
AT22	Steiermark	FR22	Picardie	PL63	Pomorskie
AT31	Oberosterreich	FR23	Haute-Normandie	PT11	Norte
AT32	Salzburg	FR24	Centre	PT15	Algarve
AT33	Tirol	FR25	Basse-Normandie	PT16	Centro (PT)
AT34	Vorarlberg	FR26	Bourgogne	PT17	Lisboa
BE10	Region de Bruxelles	FR30	Nord - Pas-de-Calais	PT18	Alentejo
BE21	Prov. Antwerpen	FR41	Lorraine	PT20	Região Autónoma dos Açores
BE22	Prov. Limburg (B)	FR42	Alsace	PT30	Região Autónoma da Madeira
BE23	Prov. Oost-Vlaanderen	FR43	Franche-Comte	SE11	Stockholm
BE24	Prov. Vlaams Brabant	FR51	Pays de la Loire	SE12	ostra Mellansverige
BE25	Prov. West-Vlaanderen	FR52	Bretagne	SE21	Sydsverige
BE31	Prov. Brabant Wallon	FR53	Poitou-Charentes	SE22	Norra Mellansverige
BE32	Prov. Hainaut	FR61	Aquitaine	SE23	Mellersta Norrland
BE33	Prov. Liege	FR62	Midi-Pyrenees	SE31	ovre Norrland
BE34	Prov. Luxembourg (B)	FR63	Limousin	SE32	Småland med oarna
BE35	Prov. Namur	FR71	Rhone-Alpes	SE33	Västsverige
CZ01	Praha	FR72	Auvergne	SK01	Bratislavský kraj
CZ02	Stredni Cechy	FR81	Languedoc-Roussillon	SK02	Zapadne Slovensko
CZ03	Jihozapad	FR82	Provence-Alpes-Cote d Azur	SK03	Stredne Slovensko
CZ04	Severozapad	FR83	Corse	SK04	Východne Slovensko
CZ05	Severovýchod	GR11	Anatoliki Makedonia Thraki	UKC1	Tees Valley and Durham
CZ06	Jihovýchod	GR12	Kentriki Makedonia	UKC2	Northumberland Tyne and Wear
CZ07	Stredni Morava	GR13	Dytiki Makedonia	UKD1	Cumbria
CZ08	Moravskoslezsko	GR14	Thessalia	UKD2	Cheshire
DE11	Stuttgart	GR21	Ipeiros	UKD3	Greater Manchester
DE12	Karlsruhe	GR22	Ionia Nisia	UKD4	Lancashire
DE13	Freiburg	GR23	Dytiki Ellada	UKD5	Merseyside
DE14	Tubingen	GR24	Stereia Ellada	UKE1	East Riding, North Lincolnshire
DE21	Oberbayern	GR25	Peloponnisos	UKE2	North Yorkshire
DE22	Niederbayern	GR30	Attiki	UKE3	South Yorkshire
DE23	Oberpfalz	GR41	Voreio Aigaio	UKE4	West Yorkshire
DE24	Oberfranken	GR42	Notio Aigaio	UKF1	Derbyshire and Nottinghamshire
DE25	Mittelfranken	GR43	Kriti	UKF2	Leicestershire Rutland
DE26	Unterfranken	HU10	Kozep-Magyarország	UKF3	Lincolnshire
DE27	Schwaben	HU21	Kozep-Dunantul	UKG1	Herefordshire Worcestershire
DE30	Berlin	HU22	Nyugat-Dunantul	UKG2	Shropshire and Staffordshire

DE41	Brandenburg - Nordost	HU23	Del-Dunantul	UKG3	West Midlands
DE42	Brandenburg - Südwest	HU31	eszak-Magyarország	UKH1	East Anglia
DE50	Bremen	HU32	eszak-Alfold	UKH2	Bedfordshire Hertfordshire
DE60	Hamburg	HU33	Del-Alfold	UKH3	Essex
DE71	Darmstadt	IE01	Border Midlands	UKI1	Inner London
DE72	Giessen	IE02	Southern and Eastern	UKI2	Outer London
DE73	Kassel	ITC1	Piemonte	UKJ1	Berkshire Bucks Oxfordshire
DE80	Mecklenburg-Vorpommern	ITC2	Valle dAosta Vallee dAoste	UKJ2	Surrey East and West Sussex
DE91	Braunschweig	ITC3	Liguria	UKJ3	Hampshire and Isle of Wight
DE92	Hannover	ITC4	Lombardia	UKJ4	Kent
DE93	Lüneburg	ITD1	Bolzano-Bozen	UKK1	Gloucestershire Wiltshire
DE94	Weser-Ems	ITD2	Provincia Autonoma Trento	UKK2	Dorset and Somerset
DEA1	Düsseldorf	ITD3	Veneto	UKK3	Cornwall and Isles of Scilly
DEA2	Köln	ITD4	Friuli-Venezia Giulia	UKK4	Devon
DEA3	Münster	ITD5	Emilia-Romagna	UKL1	West Wales and The Valleys
DEA4	Detmold	ITE1	Toscana	UKL2	East Wales
DEA5	Arnsberg	ITE2	Umbria	UKM2	North Eastern Scotland
DEB1	Koblenz	ITE3	Marche	UKM3	Eastern Scotland
DEB2	Trier	ITE4	Lazio	UKM5	South Western Scotland
DEB3	Rheinessen-Pfalz	ITF1	Abruzzo	UKM6	Highlands and Islands
DEE0	Saarland	ITF2	Molise	UKN0	Northern Ireland
DED1	Chemnitz	ITF3	Campania	BG31	Severozapaden
DED2	Dresden	ITF4	Puglia	BG32	Severen tsentralen
DED3	Leipzig	ITF5	Basilicata	BG33	Severoiztochen
DEF0	Schleswig-Holstein	ITF6	Calabria	BG34	Yugoiztochen
DEG0	Thüringen	ITG1	Sicilia	BG41	Yugozapaden
DK01	Hovedstadsreg	ITG2	Sardegna	BG42	Yuzhen tsentralen
DK02	Ost for Storebælt	LT00	Lietuva	CY00	Kypros/Kibris
DK03	Syddanmark	LU00	Luxembourg (Grand-D)	SI01	Vzhodna Slovenija
DK04	Midtjylland	LV00	Latvija	SI02	Zahodna Slovenija
DK05	Nordjylland	MT00	Malta	RO11	Nord-Vest
EE00	Eesti	NL11	Groningen	RO12	Centru
ES11	Galicia	NL12	Friesland	RO21	Nord-Est
ES12	Principado de Asturias	NL13	Drenthe	RO22	Sud-Est
ES13	Cantabria	NL21	Overijssel	RO31	Sud – Muntenia
ES21	Pais Vasco	NL22	Gelderland	RO32	București – Ilfov
ES22	Foral de Navarra	NL23	Flevoland	RO41	Sud-Vest Oltenia
ES23	La Rioja	NL31	Utrecht	RO42	Vest
ES24	Aragon	NL32	Noord-Holland	JPN	Japan
ES30	Comunidad de Madrid	NL33	Zuid-Holland	BRA	Middle and South America
ES41	Castilla y Leon	NL34	Zeeland	AUS	Australia and Oceania
ES42	Castilla-la Mancha	NL41	Noord-Brabant	MEX	Northern America
ES43	Extremadura	NL42	Limburg (NL)	RUS	Russia
ES51	Cataluna	PL11	Lódzkie	BGR	Bulgaria
ES52	Comunidad Valenciana	PL12	Mazowieckie	ROU	Roumania
ES53	Illes Balears	PL21	Malopolskie	IND	India

<i>ES61</i>	Andalucia	<i>PL22</i>	Slaskie	<i>IDN</i>	Indonesia
<i>ES62</i>	Region de Murcia	<i>PL31</i>	Lubelskie	<i>CAN</i>	Canada
<i>ES63</i>	Ceuta (ES)	<i>PL32</i>	Podkarpackie	<i>CHN</i>	China
<i>ES64</i>	Melilla (ES)	<i>PL33</i>	Swietokrzyskie	<i>KOR</i>	Korea
<i>ES70</i>	Canarias (ES)	<i>PL34</i>	Podlaskie	<i>TUR</i>	Turkey
<i>FI13</i>	Ita-Suomi	<i>PL41</i>	Wielkopolskie	<i>USA</i>	United States
<i>FI18</i>	Etela-Suomi	<i>PL42</i>	Zachodniopomorskie	<i>TWN</i>	Taiwan
<i>FI19</i>	Lansi-Suomi	<i>PL43</i>	Lubuskie	<i>ZROW</i>	Rest of the World
