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# **Integration and Convergence in Regional Europe: European Regional Trade Flows from 2000 to 2010**

## **Integration and Convergence in Regional Europe: European Regional Trade Flows from 2000 to 2010**

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## Abstract

Policy research analysing Europe's recent focus on place-based development (Barca, 2009) and the regional smart specialisation perspective (McCann and Ortega-Argilés, 2011) has been hampered by data deficiencies. This is particularly the case for empirical evidence on interregional relations that are central in these new policy initiatives, which are based on a systems way of thinking about innovation and growth. As a solution to this problem, we propose the development of an up-to-date data set that meets certain requirements. The resulting bi-regional panel data set describes the most likely trade flows between European regions, given all the available information, and is consistent with national accounts over the 2000–2010 period.

From this data set, we derived that European regions are subject to increases in internationalisation and integration. In contrast to earlier findings (Combes and Overmand, 2004), we found that not only the main economic eastern European centres but all eastern European regions are catching up with the rest of Europe. Although these main economic centres were found to be catching up faster. The banking crisis in 2008 resulted in a significant decline in trade between European regions and countries outside Europe, with a strong recovery immediately afterwards. Trade between European regions, however, permanently remained at a lower level, indicating the persistence of the crisis.

# 1. Introduction

Place-based development policies will take centre stage in future cohesion policy (Barca, 2009). The place-based policies evolved directly from the Lisbon Agenda in 2000, and accumulated into the current (smart, sustainable and inclusive) growth objectives of the Europe 2020 policy programme that are central in the envisaged cohesion policy reform after 2013. The policies have a smart specialisation development perspective, based on a systems way of thinking about innovation and growth. They emphasise the economic potential of a region, given its place within a complex regional system (McCann and Ortega-Argilés, 2011). Smart policymaking explicitly builds on network data available on the specific regional context.

Similar to the analysis of regional economic development, a smart specialisation strategy also is severely hampered by data deficiencies. This is particularly the case for reliable up-to-date data on interregional economic transactions. These interregional trade data are central in the new systems way of thinking about innovation and growth. In this paper, we propose a solution to this problem by developing a data set that meets certain requirements.

The presented data set can be used to measure interregional trade relations, the economic position of regions in both a trade network and a dynamic framework. Building on the unique data set on bilateral trade between 256 European NUTS2 regions divided into 59 product categories for the year 2000 (Thissen and Diodato 2012), regional and national information was gathered from Eurostat to extrapolate the data over the period from 2000 to 2010. The resulting bi-regional panel data set describes the most likely trade flows between European regions, given all the available information, and is consistent with national accounts over the 2000–2010 period.

The content of the data is illustrated according to descriptive statistics on the developments in regional trade over the last 10 years. We found that mainly the trade in industrial goods and, to a lesser extent, some groups of business services experienced an increase in the quantity and spread of trade. For agricultural trade, there are a few internationally oriented regions, but in general agricultural products were mainly traded domestically or within the production region. The largest growth in trade was realised in the agricultural regions in central and eastern Europe, confirming they have been catching up over this period of 10 years. The most striking change in trade over the analysed period is the integration of central and eastern European countries into the European economy. The amount and value of trade with central and eastern European regions have increased dramatically, indicating the greater importance of these regions and their economic integration.

The following section presents the methodology used to construct the updated data set. For this update, no model was used to estimate trade patterns, because of the limited use of such a data set in any empirical analyses. The presented data set was constructed only to fit the information available, and no structure was imposed on the data. Section 3 presents some descriptive statistics to illustrate the content of the constructed data. In conclusion, Section 4 presents a discussion, followed by appendices about the region and product classification used.

## 2. Methodology

The update of the data on 2000 to 2010 was based on an extrapolation of the data set on the year 2000 (Thissen et al., 2013), using constrained non-linear optimisation. The objective function in the non-linear optimisation minimised the quadratic distances between the coefficients of the new matrix in relation to the coefficients of the matrix of the previous year. This implies that the procedure needed to be iterative and follow a logical-temporal order; starting with data on year 2000, we updated, year by year, the matrix of trade until the last considered period (2010). The quadratic distances between predicted and new national trade data, final demand, investment demand, and Supply and Use Tables are additional elements that were minimised in the objective function. The optimisation was constrained in such a way that total national value added would be conform the regional and national accounts. The national accounts form the central component of our analysis as we considered them the most reliable statistics available, because they were constructed from many sources of information and are the most used and reported. We therefore constrained all other sources to be consistent with the national accounts. New information was not always available on all years (see Table 2 for an overview of the availability of source data). A constraint or element in the objective function was skipped when no information was available on a specific year. The resulting panel of trade data for the period from 2000 to 2010 stays as close as possible to international trade statistics in a consistent national account framework. The results are as close as possible to the Eurostat Supply and Use Tables and national account statistics on final and investment demand over this period.

The size of the constrained non-linear minimisation problem forced us to divide the procedure into two steps. In a first step, intranational trade and international trade between regions and countries were determined. The second step involved subdividing the international trade between European regions and countries into trade between regions. Throughout this process, all normal consistency rules were applied, so that the amount of product 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. This consistency does not hold in most international trade statistics. The following section presents an interregional social accounting matrix for the year 2000, which was used as a basis for the update over the 2000–2010 period. Subsequently, this section describes the first updating step, according to which the intranational trade (between regions) and international trade (between countries) was extrapolated. Section 2.2 presents step 2 and the methodology that was used to determine the complete multiregional trade table. Finally, Section 2.3 discusses the data sources used.

### 2.1. Interregional social accounting matrix (SAM)

An interregional social accounting matrix (SAM) (SNA, 1993; 2008) was used to update the trade matrix. Using such a SAM, as it is 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, per definition, is exactly the same as the exported amount of this product from region A to region B, as this amount is accounted 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 new information on national and regional accounts to impose requirements that had to be met while minimising any structural change to the elements of the matrix on which no new information was available. Here we see that where 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 change 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 1. 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
		Sectors		Sectors		Products		Products		Final demand	Final demand	
		A	B	A	B	I	II	I	II			
Region 1	sector 1					3	7					10
	sector 2					2	6					8
Region 2	sector 1							5	2			7
	sector 2							3	6			9
Region 1	product 1	2	1					2		1		6
	product 2	2	4						3	6		15
Region 2	product 1			3	1	1					5	10
	product 2			0	2		2				7	11
Region 1	value added	6	3							X		19
	Region 2			4	6							
total		10	8	7	9	6	15	10	11	19		

A stylised version of the SAM is presented in Figure 1, which distinguishes two regions. The SAM consists of a framework in which the transposed Supply and Use Tables of the two regions have been combined (see Figure 1). The two regions have two sectors, A and B, producing two types of products, I and II. The production in the two sectors in the first region is indicated in the first two rows. Similarly, the third and the fourth rows indicate production of region 2, by sector. Total production in these sectors is provided in the last column on the right. The first four columns show the use of the sectors in both regions. The use is divided over different types of goods used in production and total value added which is an aggregation of both labour and capital income.

International trade takes place at product level and was therefore directly entered into the product rows and columns. Thus, Region 1 exports 2 units of good 1 to Region 2, but it is not known whether this is coming from producing Sector 1 or 2. The same is true for the imports. Thus, Region 1 imports 1 unit of good 1 from Region 2 without it being specified whether this is coming from Sector 1 or 2. Information on sectoral exports were not available and therefore not included in the SAM framework. Information on the use of goods in production and consumption was also taken from the product rows, which implies that a product in this part of the table is not qualified according to its origin: products used in a certain region could either be of local origin or be imported, or even could be a mixture of the two. The final demand for goods per region did not equal the total value added that was earned in that same region. The final demand was complemented with interregional savings and investments, in such a way that total income would equal total demand. However, we did not have direct information on these net and often negative interregional savings. Therefore, and to avoid unnecessary complication, interregional transfers were not taken into account in the updating procedure. In our stylised presentation of the SAM, therefore, all value added rows and all final demand columns were added together to have equality between value added and final demand. In general, all row totals equal the column totals of the SAM representing the equality between total expenditure and total income of all the actors involved.

## 2.2. First step: intranational trade and international trade between regions and countries

In this first step, we used constraint non-linear optimisation to determine the intranational regional trade between regions of the same country and the international trade of these regions with countries in the rest of the world. To extrapolate the data for the year 2000 to the year 2010, we specified a non-linear objective function that had to be minimised to obtain the most likely trade

matrix, given the information available. This is followed by a discussion on this non-linear optimisation function and, subsequently, on the constraints that describe additional information and consistency rules.

### 2.2.1. The objective function in the first step of the extrapolation

The quadratic objective function (1) that was minimised in our non-linear optimisation problem was central in our updating procedure. 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 production and international trade. The complete minimisation problem can be described as follows.

$$\begin{aligned}
 \text{Min } Z = & s_m \sum_c \left[ (\hat{a}_{t-1}^c - a_{t-1}^c)^2 + (\hat{a}_{t-1}^c - a_{t-1}^r)^2 \right] \\
 & + s_c \sum_c \left[ (\hat{f} - f)^2 + (\hat{u} - u)^2 + (\hat{m} - m)^2 + (\hat{t}_c - t_c)^2 \right] \\
 & + s_r \sum_r \left[ (\hat{q} - q)^2 + (\hat{e}_r - e_r)^2 + (\hat{i}_r - i_r)^2 + (\hat{d}_r - d_r)^2 \right] \\
 & + s_l \sum_r \left[ (\hat{v} - v)^2 \right] \\
 & \text{s.t. } \textit{Constraints}
 \end{aligned} \tag{1}$$

The variables used are described in Table 1. The indices for goods and services were not included in this equation, for the sake of readability. In the objective function, the variable  $Z$  is minimised. This describes the minimisation of the quadratic distance between the structure of the matrix and additional information on the 2000–2010 period.

All variables were rescaled with factors  $s_m$ ,  $s_c$  or  $s_r$ , in such a way that all deviations would have an expected value of 1, and the information on countries and regions would have a comparable weight in the minimisation procedure. Thus,  $s_m$  has a value of 65 because a row or column of the SAM matrix, on average, has 65 non-zero elements and the expected value of  $a^c$  is therefore equal to 0.01538 (1 divided by 65). The country scaling factor  $s_c$  received a value of 30 to correct for the multiple regions in every country and the higher reliability of country information compared to regional information. This scaling of the elements in the objective function is important, as it makes the size of the quadratic errors of the different variables comparable.

We had no new and reliable information on changes in inventories; however, the average inventory changes are equal to zero over time. The inventory changes, therefore, were minimised, giving them a large weight of  $s_l$  in the minimisation function.<sup>1</sup>

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<sup>1</sup> This weight was set to 625. Increasing the weight any further would not have affected the outcome of the extrapolation.

Table 1. Variables in the objective function

Variable	Description
$Z$	Objective function variable to be minimised
$a_{t-1}^c$	The SAM matrix of the previous year divided by the column total
$a_{t-1}^r$	The SAM matrix of the previous year divided by the row total
$f$	The vectors of national final demand (household consumption, government consumption and investment)
$u$	National Use Table
$m$	National Supply Table
$t_c$	Country trade pattern of goods or services $g$ to country $c$
$q$	Regional household income divided by national household income
$e_r$	Share of goods or services $g$ in region $r$ exports
$i_r$	Share of goods or services $g$ in region $r$ imports
$d_r$	Share of goods or services $g$ produced and sold in the same region $r$
$v$	Stock and value changes
$\tau_{i,j}^{ex}$	The prior for exports from region $i$ to region $j$ .
$\tau_{i,j}^{im}$	The prior for imports into region $j$ from region $i$ .
$Ex_{i,c}$	The exports of region $i$ destined for country $c$ . Result of the first step, exogenous in the second step of the updating procedure.
$Im_{j,c}$	The imports in region $j$ from country $c$ . Result of the first step, exogenous in the second step of the updating procedure.
$s_m, s_c, s_r$	Scaling factors for the matrix, country and regional elements, respectively.
$s_l$	A very large scaling factor
$\hat{x}$	The estimated value of variable $x$ , where $x$ is any of the variables in the objective function
$\bar{x}$	The average value of variable $x$
$Z, Z'$	Objective variables
$RE$	Quadratic relative error
$AE$	Quadratic absolute error

The structure of the complete reference matrices described by  $a_{t-1}^c$  and  $a_{t-1}^r$ , for every step, was that of the previous year. Thus, in the update, the structural changes in the previous year were taken into account and the reference matrix changes per year. The minimisation was performed for every consecutive year.

### 2.2.2. The constraints on the objective function

The objective function was constrained to generate outcomes conform the regional and national accounts published by Eurostat. 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 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 used constraints are discussed with respect to the information they contain.

1. All products sold by an economic agent are received and paid for by another economic agent. This bookkeeping rule was adhered to by the imposed equality of all row and column totals of the SAM for all activities (industries) and products.
2. Information was available on regional value added for the NACE main categories<sup>2</sup> and national value added for all NACE categories. The second and third constraints ensured the consistency of the tables between the national and regional accounts. Information on labour and capital income was required to match regional value added in the regional accounts.<sup>3</sup> The sum of capital and labour income over the regions within each country was forced to match their respective national accounts totals.
3. Finally, a 'no re-export' constraint was applied to ensure that production would always exceed exports, for every region and product.

Combining these constraints with the objective function resulted in the update of the regional trade tables over a 10-year period, with intranational trade between regions and international trade between the European countries and groups of countries in the rest of the world.

### 2.3. Second step: international trade between regions

The international trade between regions and 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 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.

Different objective functions could have been used to estimate the full trade matrix, but we did not have any data available for evaluating these different objective functions. The most important difference seemed to be the minimisation of a relative or absolute difference between expected and estimated values. We therefore applied a mixed objective function where a quadratic absolute and a quadratic relative error both were minimised. Two priors were also 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:

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<sup>2</sup> The NACE main categories are A-B Agriculture, fishing; C-E Industry (except construction); F Construction; G-I Wholesale and retail trade, hotels and restaurants, transport; J-K Financial intermediation, real estate; and L-P public administration and community services, and activities of households.

<sup>3</sup> Please note that within every country, one region and sector combination was excluded from the constraints, because it was automatically satisfied by another constraint: that the sum of regional value added equals national totals.

$$\text{Min } Z' = RE + AE$$

s.t.

$$\begin{aligned} RE &= \sum_{i,j} \frac{1}{\tau_{i,j}^{ex}} (\hat{\tau}_{i,j}^{ex} - \tau_{i,j}^{ex})^2 + \sum_{i,j} \frac{1}{\tau_{i,j}^{im}} (\hat{\tau}_{i,j}^{im} - \tau_{i,j}^{im})^2 \\ AE &= \sum_{i,j} \frac{1}{\bar{\tau}_i^{ex}} (\hat{\tau}_{i,j}^{ex} - \tau_{i,j}^{ex})^2 + \sum_{i,j} \frac{1}{\bar{\tau}_j^{im}} (\hat{\tau}_{i,j}^{im} - \tau_{i,j}^{im})^2 \\ Ex_{i,c} &= \sum_{j \in c} \hat{\tau}_{i,j}^{ex} \\ Im_{j,c} &= \sum_{i \in c} \hat{\tau}_{i,j}^{ex} \end{aligned} \quad (2)$$

in which the variables are as described in Table 2. The priors of exports (imports) were determined by the regional trade pattern of exports (imports) from the previous year, proportionally increased to the level determined in the first step of the updating procedure. Please note that we defined the quadratic relative error slightly differently than in percentages.<sup>4</sup> The reason for this 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  $\bar{\tau}_i^{ex}$ .

## 2.4 The data sources

The data needed for the update were collected from various sources. The main data sources were the regional Supply and Use Tables on the year 2000, as introduced in Thissen et al. (2013). This data set provided the base year data for the year 2000, which was subsequently extrapolated to 2010. The data needed for the update were obtained from Eurostat and several individual bureaus of statistics. Thus, all data were obtained from public sources. In the panel data set on the 2000–2010 period, the data on 2000 differ slightly from the base year 2000 data set, because data sources were different and so was the construction of a completely consistent data set. Thus, contrary to the tables on 2000 presented in Thissen et al. (2013, the panel data on regional trade in the current study do not depend on the Cambridge econometrics (2008) data set and the Feenstra (2004) trade data. Table 2 presents a complete list of the data used.

Table 2 Data used in updating bilateral trade for the 2000–2010 period

Data on	Time-period	Data source	Version date	Extraction date	Source
<b>National GDP</b>	2000-2010	GDP and main components - Current prices	14-7-11	15-7-11	Eurostat
<b>Gross Value Added in 33 branches</b>	2000-2010	National Accounts by 60 branches - aggregates at current prices	14-7-11	15-7-11	Eurostat
<b>Final demand</b>	2000-2010	Final consumption aggregates - Current prices	14-7-11	21-7-11	Eurostat
<b>Investment demand</b>	2000-2010	Gross fixed capital formation by 6 asset types - current prices	14-7-11	21-7-11	Eurostat
<b>Total country trade</b>	2000-2010	Exports and imports by Member States of the EU/third countries -	16-7-11	17-7-11	Eurostat

<sup>4</sup> A relative error based on percentage would have been as follows:

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

Current prices					
<b>Services trade A</b>	2000-2003	International trade in services (from 1985 to 2003)	30-6-11	9-7-11	Eurostat
<b>Services trade B</b>	2004-2010	International trade in services (since 2004)	17-5-11	11-7-11	Eurostat
<b>Goods trade</b>	2000-2010	EU27 Trade Since 1988 by HS2-HS4	n/a	17-7-11	Eurostat
<b>Goods trade Norway</b>	2000-2010	Norway trade by HS1988	n/a	20-7-11	Statistics Norway
<b>National accounts, Supply and Use Tables</b>	2000-2007 if available	National accounts, Supply and Use Tables	various	23-9-10	Eurostat
<b>National accounts, Import tables</b>	2000-2007 if available	National accounts, import tables	various	September 2010	Various bureaus of Statistics
<b>Regional GVA, NUTS2, NACE main industries</b>	2000-2008	Gross value added at basic prices at NUTS level 3	30-6-11	8-7-11	Eurostat
<b>Wage sum, NUTS2, NACE main industries</b>	2000-2008	Compensation of employees at NUTS level 2	7-7-11	8-7-11	Eurostat

We corrected national exports and imports for the re-exports using the information from the import tables. The existence and size of the re-exports problem is illustrated by export totals being larger than production totals in several typical product categories. In other words, according to official statistics, countries appear to export more than they produce. Re-exports are the trade flows that reach their final destination while being owned by traders from a third country without receiving any substantial transformation in transit from the country of origin to the country of destination (SNA, 2008). They are meant to go from country A to country B, but for a variety of reasons (e.g. location of a wholesale trader, transport hub, or the country of destination being landlocked) they pass through the customs of country C. In many cases this flow, instead of being recorded correctly as an export from A to B, is registered twice. First, as an export from A to C. Then, as an export from C to B. In our view this is problematic in at least two ways: 1) the total amount of trade is over-reported, and 2) the origin-destination pattern of products is misreported. Import tables were not available on all countries and all years. We therefore estimated the re-exports for countries with more than one table available by using a simple OLS regression, and for those with no import tables available, we used the lowest the re-export figures from the other countries.

### 3. Trade of European regions between 2000 and 2010

#### Trends in internationalisation

International trade has grown rapidly over the first decade of this century. The value of output sold by European firms outside their national borders has increased from 3.1 trillion euros in 2000 to 4.6 trillion in 2010. This represents an annual (composite) growth rate of approximately 3.9%. Thus, after accounting for inflation, this still leaves a significant annual growth rate of 1.5%<sup>5</sup>, and is a clear indication of increased internationalisation and higher integration of the economy. In 2000, however, the majority of economic interactions still took place within national borders and about 82% of the output within Europe had its final destination in the country of production. The overall picture on internationalisation has changed only moderately, because most products continue to be used in the own region and only a small amount is exported. In 2010, as can clearly be seen in Figure 2, the share of European production sold within national borders was still above 80%. The difference in pace between export growth and internal growth resulted in a modest increase in the share of exports in total production of 1.7 percentage points.

Figure 2. Share of European production by destination in 2000 and 2010

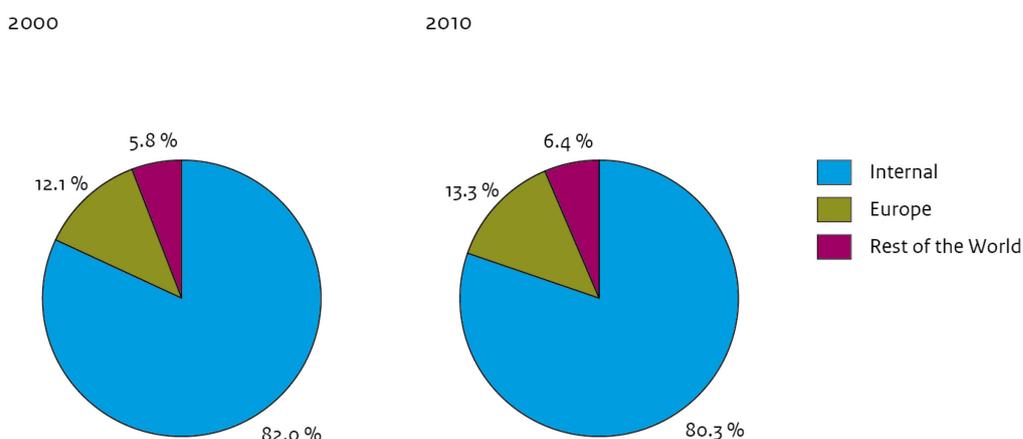
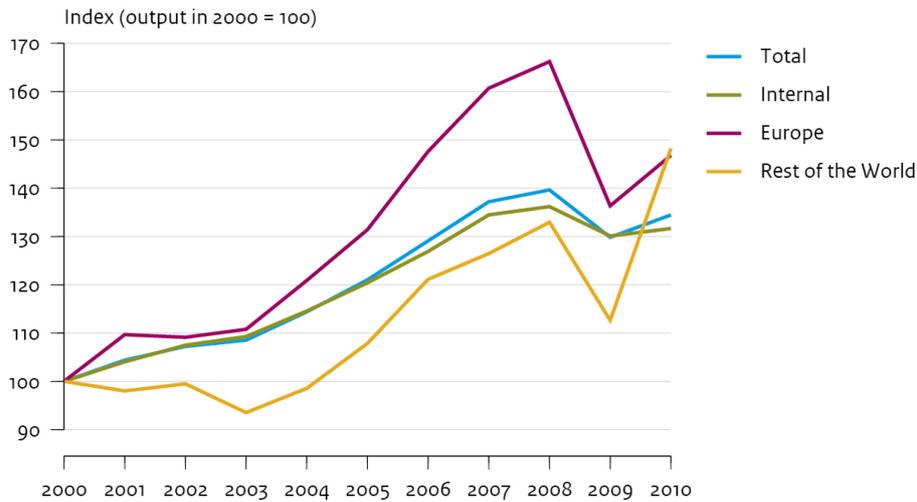


Figure 2 also shows that exports between European nations as well as to the rest of the world have grown. However, this image does not do justice to the dynamics of international trade between 2000 and 2010. Within this time period, growth patterns varied substantially. Figure 3 shows that, between 2000 and 2010, exports within Europe and to the rest of the world grew by the same percentage. However, trade within Europe rose sharply between 2000 and 2007 and, following the global financial crisis, it fell abruptly to the level of several years earlier. The year 2010 showed signs of recovery, but given the subsequent euro crisis, it is not likely that this positive trend continued in the years to follow.

<sup>5</sup> We used an annual inflation rate of 2.4%. Which is the average growth rate of the consumer price index in the EU27 (Eurostat).

**Figure 3. Value of output per destination between 2000 and 2010**

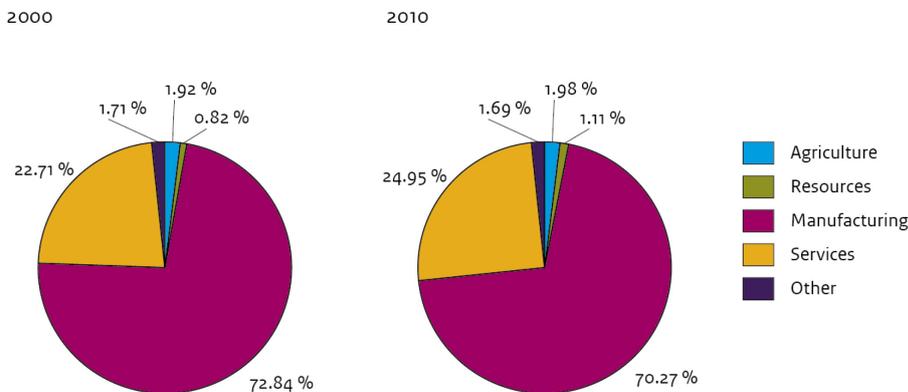


The trade from Europe to the rest of the world has very different dynamics than the trade within Europe. Until 2004 the balance was negative, even in nominal terms. Then, in 2005, the trend reversed and international trade started to grow quickly. Not as quickly as the trade within Europe, but enough to almost catch up with the average growth in production. The subsequent crisis represented a big drop, but directly following 2009, sales to the rest of the world showed a remarkably strong recovery, which made it the fastest growing market over the whole decade.

**Sector shares**

There are also substantial differences in exports and export growth between the various sectors. The manufacturing industry dominated exports, despite services being the largest output in Europe. This was most likely caused by the higher transportation costs related to services, which in many cases required movement of either supplier or consumer (Sampson and Snape, 1985). Figure 4, however, shows that the share of services in total exports has increased over time, reaching almost one fourth of the total export value in 2010. This growth was at the expense of the manufacturing industry that lost over 2 percentage points of its share. In nominal terms, manufacturing exports grew by 3.6%, annually, from 2000 to 2010, but the even faster growth in internationally supplied services changed the sectoral composition of trade. The resource sectors grew to only slightly more than a 1% share of the value of exports in 2010. Shares of agricultural trade and that in the rest of the economy remained stable.

**Figure 4. Share of exports in different sectors in 2000 and 2010**



### *Regional concentration of exports*

Trade between European regions was dominated by a few large agglomerations, along with a number of specialised regions that dominated the production of certain goods or services. The concentration of exports at a limited number of locations may have depended on the concentration of population. In fact, when considering the 256 NUTS2 regions in our data set, 45% of the population live in the 50 largest regions<sup>6</sup>. Given that labour certainly remained a very important production factor, it may come as no surprise that the concentration of exports was largely determined by the distribution of the population: 50% of exports came from these 50 largest regions<sup>7</sup>.

However, some exceptions were found in the relation between population and the value of exports. The region of Inner London, in 2010, was ranked 6th largest export region despite it only being ranked the 39th largest region with respect to population. Other examples are the Dutch region of North Brabant which was ranked 28th in export value and 57th in population size, and the Polish region of Malopolska Province which ranked 156th in export value and 34th in population size. Thus, population agglomerations seem to explain only partially the regional concentration of exports. The reasons for these differences are related to regional differences in capital intensity, human capital and the sectoral composition of the region. However, providing a full explanation of the territorial distribution of exports was beyond the aim of this study.

Table 4 presents the regions with the largest regional exports in 2010. We focused on a typical aggregation of products into agricultural goods, technological goods and financial and business services. We chose these product categories to cover the complete spectrum of the economy. The largest agglomerations were included in the list of the largest exporters. At the top of this list is Ile de France, followed by the main European economic centres. London is listed in 6th position, which is partly due to the division of London into outer and inner London. The list of top exporting economies does not include any central or eastern European regions. This emphasises the continuing large gap in economic size between western European and central and eastern European regions. This gap appears to be narrowing for some regions, but differences continue to exist to this day.

In 2010, China was the second largest exporter of goods to Europe, following the United States. However, it should be noted that the total value of exports from the United States was only half the amount exported from the French region of Ile de France, while China would rank seventh if its total exports to Europe would be compared to that of European NUTS2 regions.

The most important European exporting regions were the large agglomerations at the top of the list in Table 4. The export value of the largest agglomeration, Ile de France, is even more than 3 times larger than the number 15 on the list. However, there are various smaller, more specialised regions that are important; with respect to agriculture these are the Dutch region of South Holland and the Danish Great Belt,, in high-technology for example the German regions of Cologne and Arnsberg, and in financial and business services this is Luxembourg.

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<sup>6</sup> Year 2010.

<sup>7</sup> Please note that regional exports include intranational trade between regions within the same country. Regional exports therefore equal production minus the amount of goods that are both produced and used within the same region.

Table 4. Top 15 exporting regions in 2010

Ranking	Total	(billion*)	Agriculture	(billion*)	High tech	(billion*)	Financial and Business services	(billion*)
1	Ile de France	(554)	Andalusia	(8)	Lombardy	(59)	Ile de France	(155)
2	Lombardy	(357)	South Holland	(6)	Ile de France	(59)	Inner London	(63)
3	Catalonia	(235)	Lombardy	(5)	Stuttgart	(42)	Luxembourg Grand D	(46)
4	Community of Madrid	(225)	Great Belt	(5)	Southern and eastern Ireland	(37)	Southern and eastern Ireland	(43)
5	Rhone-Alpes	(221)	Aquitaine	(5)	Catalonia	(36)	Lombardy	(40)
6	Inner London	(200)	Emilia-Romagna	(4)	Dusseldorf	(35)	Rhone-Alpes	(36)
7	Dusseldorf	(191)	Castilla and León	(4)	Rhone-Alpes	(35)	Outer London	(35)
8	Upper Bavaria	(188)	Cataluna	(4)	Upper Bavaria	(35)	Community of Madrid	(31)
9	Veneto	(175)	Castile-La Mancha	(4)	Veneto	(27)	Darmstadt	(30)
10	Stuttgart	(172)	Champagne-Ardenne	(4)	Arnsberg	(27)	Dusseldorf	(30)
11	Lazio	(169)	Veneto	(4)	Darmstadt	(27)	Upper Bavaria	(29)
12	Darmstadt	(165)	Sicily	(4)	Cologne	(26)	North Holland	(27)
13	Andalusia	(162)	Pays de la Loire	(4)	Piedmont	(26)	Stockholm	(27)
14	Emilia Romagna	(160)	Apulia	(4)	Karlsruhe	(25)	Lazio	(26)
15	Piedmont	(155)	Brittany	(4)	Prov. Antwerp	(23)	Provence-Alpes-Cote d'Azur	(26)

\*in euros

Table 5. Top 5 countries exporting to the EU in 2010

Ranking	Total	(billion*)	Agriculture	(billion*)	High tech	(billion*)	Financial and Business services	(billion*)
1	United States	(319)	Middle and South America	(11)	United States	(42)	United States	(120)
2	China	(198)	Africa	(5)	Switzerland	(31)	Switzerland	(41)
3	Switzerland	(155)	United States	(4)	China	(15)	Rest of Europe	(31)
4	Asia	(153)	Asia	(3)	Asia	(11)	Japan	(11)
5	Middle and South America	(125)	Rest of Europe	(3)	Japan	(9)	China	(7)

\*in euros

The market for agricultural products is very different from other markets. The most important European regions, in 2010, were not automatically also the main production regions in Europe listed in the column of total production. Agricultural exports were dominated by the Spanish region of Andalucía, the Dutch South Holland and agricultural regions in Italy, Denmark and France. Outside Europe, the countries in Middle and South America were important exporters to the European market. These countries are not listed among the main exporters when total value of exports is considered, mainly due to the low value of agricultural products.

The high-tech sector was not only dominated by the Italian region of Lombardy and the French Ile de France, but also by many of the German regions. The dominant regions in the financial and business services were 'the usual suspects'; Ile de France (Paris), Luxembourg, southern and eastern Ireland (Dublin), and Lombardy (Milan). Table 4 shows that, together, inner and outer London would have received a higher ranking, although still lower than that of Ile de France. This emphasises the importance of the French capital city in supplying financial and business services.

### *Convergence*

Tables 6 and 7 present the growth in exports of European regions and (blocks of) countries exporting to Europe, from 2000 to 2010. The rising economic importance of China is also confirmed by the regional trade data. The growth in the value of Chinese exports to European regions was larger than that of any European region. There was also strong growth in European imports from Russia, due to an increasing trade in Russian gas, oil, and financial and business services.

Table 6 gives a completely different picture than the one that would be presented according to the size of the European regions. The growing regions were found to be predominantly in central and eastern Europe. The main exception was Luxembourg, with strong growth in the financial and business services. Table 6 strongly indicates a pattern of convergence between eastern and western Europe (where the east is catching up to the west). Most of the eastern European regions that were shown to be growing the fastest were also the leading agglomeration in their area. This raises the question of whether the whole of eastern Europe grew faster or only a few agglomerated regions.

The pattern and regional distribution of the convergence may be analysed with the help of Figure 5. The figure shows that the export level of eastern European regions in 2000, generally, was lower than in the western regions. The growth in exports, however, clearly was higher for these eastern regions. In the lower half of Figure 5, the western and eastern European regions are presented separately; here can be seen that both cases lack a level-growth relationship. Growth rates appear independent from levels. This situation, in the long term, has led to a skewed distribution (Gibrat's law, Simon 1955) and suggests that, in accordance with Combes and Overman (2004), there is no convergence within the two blocks. However, apart from a limited number of exceptions (e.g. Luxembourg), all eastern European regions were found to have grown faster than the western European regions.

Table 6. Top 15 regions with growing export (2000-2010)

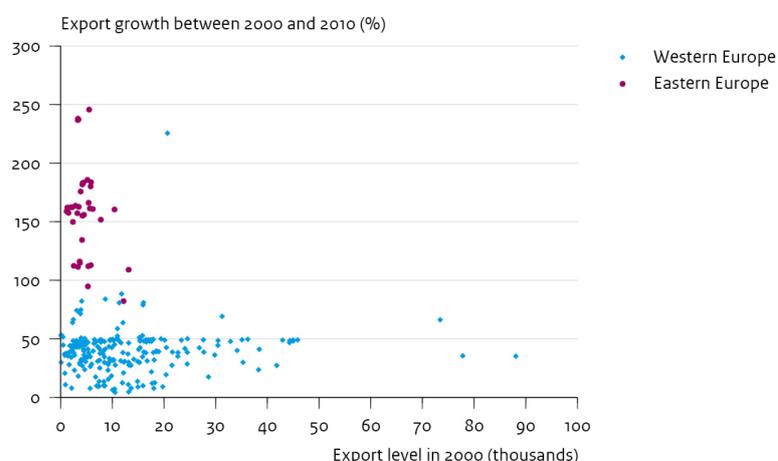
Ranking	Total	Agriculture	High tech	Financial and Business services
1	Luxembourg Grand D (325%)	Latvia (4599%)	Latvia (431%)	Luxembourg Grand D (710%)
2	Western Slovakia (292%)	Slovenia (1400%)	Malta (354%)	Slovenia (646%)
3	Central Slovakia (268%)	Lithuania (1137%)	Bratislava (334%)	Malta (488%)
4	Eastern Slovakia (274%)	Estonia (622%)	Western Slovakia (321%)	Southern and eastern Ireland (405%)
5	Bratislava (275%)	Western Slovakia (301%)	Estonia (315%)	Estonia (328%)
6	Lithuania (252%)	Central Slovakia (294%)	Eastern Slovakia (310%)	Central Slovakia (264%)
7	Prague (233%)	Eastern Slovakia (292%)	Prague (308%)	Bratislava (256%)
8	Latvia (234%)	Central Hungary (257%)	Central Slovakia (306%)	Prague (252%)
9	Moravia-Silesia (235%)	Malta (249%)	Lithuania (305%)	Agder og Rogaland (244%)
10	Jihovýchod (232%)	Attica (235%)	Jihovýchod (270%)	Silesia Province (240%)
11	Severovýchod (235%)	Western Norway (217%)	Severovýchod (269%)	Eastern Slovakia (237%)
12	Central Moravia (233%)	Bratislava (215%)	Central Hungary (266%)	Western Slovakia (236%)
13	Severozápad (229%)	Prague (211%)	Moravia-Silesia (264%)	Sør-Østlandet (232%)
14	Jihozápad (231%)	OsloogAkershus (200%)	Central Moravia (263%)	Jihovýchod (231%)
15	Central Bohemia (231%)	Moravia-Silesia (198%)	Severozápad (263%)	Mazovia Province (229%)

Table 7. Top 5 countries with growing exports to EU countries (2000-2010)

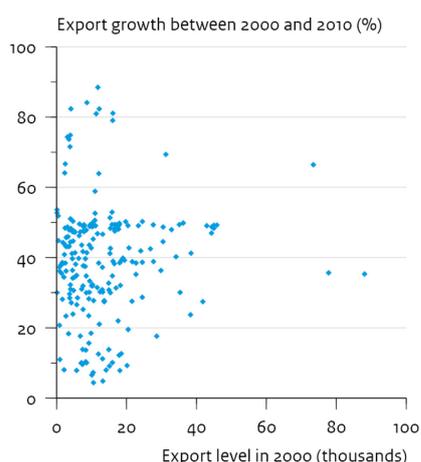
Ranking	Total	Agriculture	High tech	Financial and Business services
1	China (496%)	Rest of Europe (281%)	China (377%)	China (727%)
2	Russia (367%)	China (190%)	Switzerland (214%)	Northern America (589%)
3	Switzerland (233%)	Korea (170%)	Turkey (211%)	Russia (566%)
4	Rest of Europe (238%)	Turkey (167%)	Rest of Europe (176%)	Hong Kong (444%)
5	Turkey (163%)	Middle and South America (164%)	Russia (176%)	Switzerland (409%)

**Figure 5. Export level in 2000 versus growth between 2000 and 2010**

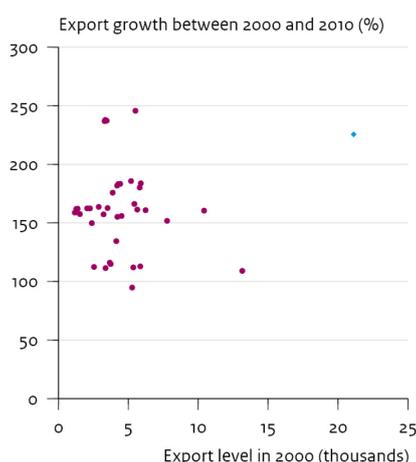
Whole sample of European regions



Western European regions



Eastern European regions

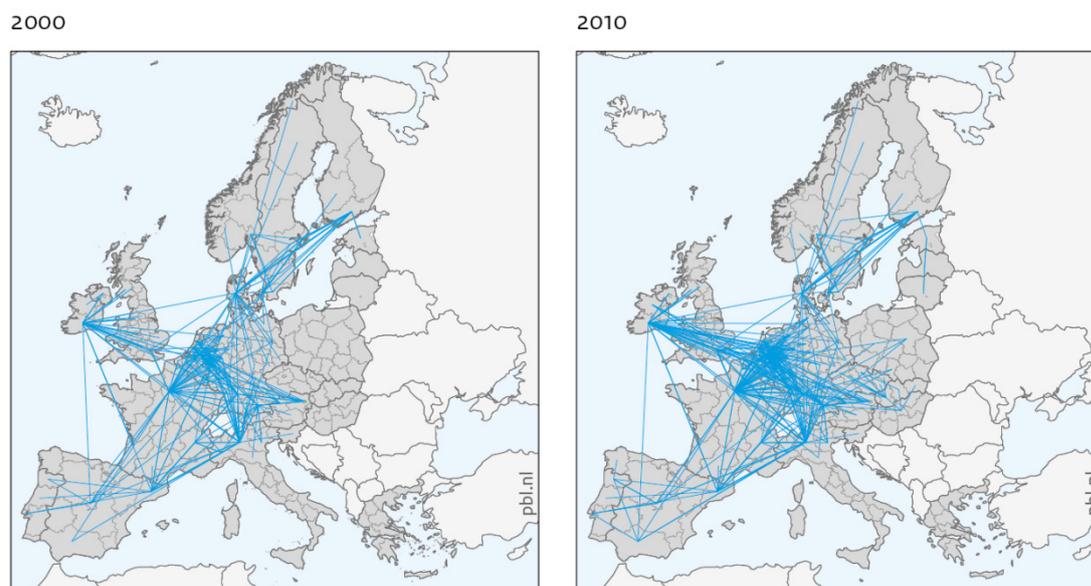


Combes and Overman (2004) claim that Europe, since the fall of Berlin Wall, has been experiencing both convergence between countries and divergence between regions. However, our study has indicated that, although the smaller eastern European regions are not catching up with the main eastern European economic regions, they have shown higher growth rates. Eastern European countries are catching up and every eastern European region has a higher growth rate than nearly every western one. Nevertheless, since leading eastern regions are catching up faster, the initial overall gap between eastern European regions has not been narrowing.

*An illustration of the data set*

Figure 6 illustrates the complete data set of trade flows between European regions in 2000 and 2010. The figures show only trade flows above 500 million euros (2000 price level). The figures clearly show the concentrations of exports in several main economic regions from where the majority of trade flows originated, or for where they were destined. The number of trade flows from and to the eastern parts of Europe increased substantially between 2000 and 2010. This illustrates the earlier mentioned pattern of convergence of eastern European regions.

**Figure 6. Trade flows in 2000 and 2010, with a threshold of 500 million euros (2000 price level<sup>8</sup>)**



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<sup>8</sup> For 2010, the threshold was corrected for inflation using EU27 HCPI, which according to Eurostat has a 2010–2000 ratio equal to 1.2628. It implies a threshold of approximately 631 million euros and an average inflation rate of 2.37%.

## 4. Discussion

The regional trade data in this paper present the most likely trade between European NUTS2 regions, given the information available for the 2000–2010 period and based on the regional trade data presented in Thissen et al. (2013) and additional data from Eurostat. Data were not only derived from combining these different data sources, but were also imputed from simple economic consistency and bookkeeping rules. Data were not measured as a flow from one region to another, but were typically based on non-survey techniques. These data preferably should be used as network data.

We found the most important European export regions to consist of a few large agglomerations and several specialised regions with respect to specific product markets. In particular, the market for agricultural products was found to be very different from other product markets, as different regions dominate this export market. The most important European regions are Andalusia, South Holland and the agricultural regions of Italy, Denmark and France.

International trade was found to have grown, although 80% of products would stay within the same production nation. Up to the economic crisis of 2008, trade between European regions grew the most, whereas after the crisis, the main growth was in trade with the rest of the world. The central and eastern European regions showed the largest growth in exports. This would point to strong convergence of *all* central and eastern European regions (catching up with the west). However, large differences were found in growth between these central and eastern European regions, indicating divergence. The strong growth in the export of financial and business services from countries outside Europe to European regions is most notable. This increase in international service trade is evidence of the growing possibilities of digital trade (via the internet), possibly in combination with a decrease in international barriers with respect to this type of trade. The wider group of services grew by 2.2 percentage points and the share of services in total trade amounted to 25% in 2010.

Examples of how regional trade data may be used for regional economic development strategies are presented in a book on the competitiveness of regions and smart specialisation strategies (Thissen et al. in prep.).

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## Appendix A: The data set on interregional bilateral trade

The data set documented in this paper describes bilateral trade flows between 256 European regions, for the period from 2000 to 2010. Export and import flows were measured in values (million euros) and divided into 59 product and service categories. All of these 256 regions are part of the EU25, except for Cyprus and Norway. The choice of regions was determined by data availability. The regional classification follows the second level of Eurostat's *Nomenclature of Statistical Territorial Units* (NUTS2), which in many cases in Europe is equivalent to a pre-existing countries' administrative division. Section 1.2 details the regional units in which the data were divided. We used the *Classification of Products by Activity* (NACE1.1-CPA 2002), which is also used by Eurostat for the Supply and Use Tables in the national accounts. Consistent with Eurostat's publications, we used the second level of this classification (2-digits), which distinguishes between 59 goods and services. This disaggregation of products is reported in Section 1.3. It must be noted that the data set provides information not only on international trade between regions, but also reports the trade between regions within the same country. Moreover, since for the whole research, a large emphasis was put on consistency between all accounts, the data set also includes information on regional products used within the same region (the diagonal of the trade matrix). More information on the structure of the data set, the definition of the regions and the industry and product classification can be found in Appendix A and in Thissen and Diodato (2012).

### A1. Region and product classification

The data set includes 256 NUTS2 regions from 25 European countries; all of which are in the European Union, except Norway (see Table 1).

Table 1. The European countries in the data set

L1	Austria	L11	Hungary	L21	Portugal
L2	Belgium	L12	Ireland	L22	Sweden
L3	Czech Republic	L13	Italy	L23	Slovenia
L4	Germany	L14	Lithuania	L24	Slovakia
L5	Denmark	L15	Luxembourg	L25	United Kingdom
L6	Estonia	L16	Latvia		
L7	Spain	L17	Malta		
L8	Finland	L18	Netherlands		
L9	France	L19	Norway		
L10	Greece	L20	Poland		

The data set also covers the trade between the European regions and the rest of the world. This 'rest of the world' group was subdivided into main economic countries and groups of economically less important countries. These additional trading partners are presented in Table 2.

Table 3. Additional trading partners of Europe

L26	Rest of Europe	L35	Cyprus
L27	Africa	L36	Canada
L28	Asia	L37	China
L29	Japan	L38	Hong Kong
L30	Middle and South America	L39	Korea
L31	Australia and Oceania	L40	Singapore
L32	Northern America	L41	Switzerland
L33	Russia	L42	Turkey
L34	Rest of the World	L43	United States

Table 3 presents a list of all the NUTS2 regions in the data set. The first column refers to NUTS2 code while the second reports the names of the regions.

Table 3. NUTS2 regions in the data set

<b>R1</b>	AT11	Burgenland	<b>R129</b>	GR30	Attiki
<b>R2</b>	AT12	Niederösterreich	<b>R130</b>	GR41	Voreio Aigaio
<b>R3</b>	AT13	Wien	<b>R131</b>	GR42	Notio Aigaio
<b>R4</b>	AT21	Kärnten	<b>R132</b>	GR43	Kriti
<b>R5</b>	AT22	Steiermark	<b>R133</b>	HU10	Közép-Magyarország
<b>R6</b>	AT31	Oberösterreich	<b>R134</b>	HU21	Közép-Dunántúl
<b>R7</b>	AT32	Salzburg	<b>R135</b>	HU22	Nyugat-Dunántúl
<b>R8</b>	AT33	Tirol	<b>R136</b>	HU23	Dél-Dunántúl
<b>R9</b>	AT34	Vorarlberg	<b>R137</b>	HU31	Észak-Magyarország
<b>R10</b>	BE10	Région de Bruxelles	<b>R138</b>	HU32	Észak-Alföld
<b>R11</b>	BE21	Prov. Antwerpen	<b>R139</b>	HU33	Dél-Alföld
<b>R12</b>	BE22	Prov. Limburg (B)	<b>R140</b>	IE01	Border, Midlands and Western
<b>R13</b>	BE23	Prov. Oost-Vlaanderen	<b>R141</b>	IE02	Southern and Eastern
<b>R14</b>	BE24	Prov. Vlaams Brabant	<b>R142</b>	ITC1	Piemonte
<b>R15</b>	BE25	Prov. West-Vlaanderen	<b>R143</b>	ITC2	Valle d'Aosta
<b>R16</b>	BE31	Prov. Brabant Wallon	<b>R144</b>	ITC3	Liguria
<b>R17</b>	BE32	Prov. Hainaut	<b>R145</b>	ITC4	Lombardia
<b>R18</b>	BE33	Prov. Liège	<b>R146</b>	ITD1	Provincia Bolzano
<b>R19</b>	BE34	Prov. Luxembourg (B)	<b>R147</b>	ITD2	Provincia Trento
<b>R20</b>	BE35	Prov. Namur	<b>R148</b>	ITD3	Veneto
<b>R21</b>	CZ01	Praha	<b>R149</b>	ITD4	Friuli-Venezia Giulia
<b>R22</b>	CZ02	Střední Čechy	<b>R150</b>	ITD5	Emilia-Romagna
<b>R23</b>	CZ03	Jihozápad	<b>R151</b>	ITE1	Toscana
<b>R24</b>	CZ04	Severozápad	<b>R152</b>	ITE2	Umbria
<b>R25</b>	CZ05	Severovýchod	<b>R153</b>	ITE3	Marche
<b>R26</b>	CZ06	Jihovýchod	<b>R154</b>	ITE4	Lazio
<b>R27</b>	CZ07	Střední Morava	<b>R155</b>	ITF1	Abruzzo
<b>R28</b>	CZ08	Moravskoslezsko	<b>R156</b>	ITF2	Molise
<b>R29</b>	DE11	Stuttgart	<b>R157</b>	ITF3	Campania
<b>R30</b>	DE12	Karlsruhe	<b>R158</b>	ITF4	Puglia
<b>R31</b>	DE13	Freiburg	<b>R159</b>	ITF5	Basilicata
<b>R32</b>	DE14	Tübingen	<b>R160</b>	ITF6	Calabria
<b>R33</b>	DE21	Oberbayern	<b>R161</b>	ITG1	Sicilia

<b>R34</b>	DE22	Niederbayern	<b>R162</b>	ITG2	Sardegna
<b>R35</b>	DE23	Oberpfalz	<b>R163</b>	LT00	Lietuva
<b>R36</b>	DE24	Oberfranken	<b>R164</b>	LU00	Luxembourg
<b>R37</b>	DE25	Mittelfranken	<b>R165</b>	LV00	Latvija
<b>R38</b>	DE26	Unterfranken	<b>R166</b>	MT00	Malta
<b>R39</b>	DE27	Schwaben	<b>R167</b>	NL11	Groningen
<b>R40</b>	DE30	Berlin	<b>R168</b>	NL12	Friesland
<b>R41</b>	DE41	Brandenburg - NO	<b>R169</b>	NL13	Drenthe
<b>R42</b>	DE42	Brandenburg - SW	<b>R170</b>	NL21	Overijssel
<b>R43</b>	DE50	Bremen	<b>R171</b>	NL22	Gelderland
<b>R44</b>	DE60	Hamburg	<b>R172</b>	NL23	Flevoland
<b>R45</b>	DE71	Darmstadt	<b>R173</b>	NL31	Utrecht
<b>R46</b>	DE72	Gießen	<b>R174</b>	NL32	Noord-Holland
<b>R47</b>	DE73	Kassel	<b>R175</b>	NL33	Zuid-Holland
<b>R48</b>	DE80	Mecklen.-Vorpom.	<b>R176</b>	NL34	Zeeland
<b>R49</b>	DE91	Braunschweig	<b>R177</b>	NL41	Noord-Brabant
<b>R50</b>	DE92	Hannover	<b>R178</b>	NL42	Limburg (NL)
<b>R51</b>	DE93	Lüneburg	<b>R179</b>	NO01	Oslo og Akershus
<b>R52</b>	DE94	Weser-Ems	<b>R180</b>	NO02	Hedmark og Oppland
<b>R53</b>	DEA1	Düsseldorf	<b>R181</b>	NO03	Sor-Ostlandet
<b>R54</b>	DEA2	Köln	<b>R182</b>	NO04	Agder og Rogaland
<b>R55</b>	DEA3	Münster	<b>R183</b>	NO05	Vestlandet
<b>R56</b>	DEA4	Detmold	<b>R184</b>	NO06	Trondelag
<b>R57</b>	DEA5	Arnsberg	<b>R185</b>	NO07	Nord-Norge
<b>R58</b>	DEB1	Koblenz	<b>R186</b>	PL11	Lódzkie
<b>R59</b>	DEB2	Trier	<b>R187</b>	PL12	Mazowieckie
<b>R60</b>	DEB3	Rhein Hessen-Pfalz	<b>R188</b>	PL21	Malopolskie
<b>R61</b>	DEC0	Saarland	<b>R189</b>	PL22	Slaskie
<b>R62</b>	DED1	Chemnitz	<b>R190</b>	PL31	Lubelskie
<b>R63</b>	DED2	Dresden	<b>R191</b>	PL32	Podkarpackie
<b>R64</b>	DED3	Leipzig	<b>R192</b>	PL33	Swietokrzyskie
<b>R65</b>	DEE1	Dessau	<b>R193</b>	PL34	Podlaskie
<b>R66</b>	DEE2	Halle	<b>R194</b>	PL41	Wielkopolskie
<b>R67</b>	DEE3	Magdeburg	<b>R195</b>	PL42	Zachodniopomorskie

<b>R68</b>	DEF0	Schleswig-Holstein	<b>R196</b>	PL43	Lubuskie
<b>R69</b>	DEG0	Thüringen	<b>R197</b>	PL51	Dolnoslaskie
<b>R70</b>	DK01	Hovedstadsreg	<b>R198</b>	PL52	Opolskie
<b>R71</b>	DK02	Øst for Storebælt	<b>R199</b>	PL61	Kujawsko-Pomorskie
<b>R72</b>	DK03	Vest for Storebælt	<b>R200</b>	PL62	Warminsko-Mazurskie
<b>R73</b>	EE00	Eesti	<b>R201</b>	PL63	Pomorskie
<b>R74</b>	ES11	Galicia	<b>R202</b>	PT11	Norte
<b>R75</b>	ES12	Principado de Asturias	<b>R203</b>	PT15	Algarve
<b>R76</b>	ES13	Cantabria	<b>R204</b>	PT16	Centro (PT)
<b>R77</b>	ES21	Pais Vasco	<b>R205</b>	PT17	Lisboa
<b>R78</b>	ES22	Com. Foral de Navarra	<b>R206</b>	PT18	Alentejo
<b>R79</b>	ES23	La Rioja	<b>R207</b>	SE01	Stockholm
<b>R80</b>	ES24	Aragón	<b>R208</b>	SE02	Östra Mellansverige
<b>R81</b>	ES30	Comunidad de Madrid	<b>R209</b>	SE04	Sydsverige
<b>R82</b>	ES41	Castilla y León	<b>R210</b>	SE06	Norra Mellansverige
<b>R83</b>	ES42	Castilla-la Mancha	<b>R211</b>	SE07	Mellersta Norrland
<b>R84</b>	ES43	Extremadura	<b>R212</b>	SE08	Övre Norrland
<b>R85</b>	ES51	Cataluña	<b>R213</b>	SE09	Småland med öarna
<b>R86</b>	ES52	Comunidad Valenciana	<b>R214</b>	SE0A	Västsverige
<b>R87</b>	ES53	Illes Balears	<b>R215</b>	SI00	Slovenija
<b>R88</b>	ES61	Andalucia	<b>R216</b>	SK01	Bratislavský kraj
<b>R89</b>	ES62	Región de Murcia	<b>R217</b>	SK02	Západné Slovensko
<b>R90</b>	ES63	Ciudad Autónoma de Ceuta	<b>R218</b>	SK03	Stredné Slovensko
<b>R91</b>	ES64	Ciudad Autónoma de Melilla	<b>R219</b>	SK04	Východné Slovensko
<b>R92</b>	ES70	Canarias	<b>R220</b>	UKC1	Tees Valley and Durham
<b>R93</b>	FI13	Itä-Suomi	<b>R221</b>	UKC2	Northumberland, Tyne and Wear
<b>R94</b>	FI18	Etelä-Suomi	<b>R222</b>	UKD1	Cumbria
<b>R95</b>	FI19	Länsi-Suomi	<b>R223</b>	UKD2	Cheshire
<b>R96</b>	FI1A	Pohjois-Suomi	<b>R224</b>	UKD3	Greater Manchester
<b>R97</b>	FI20	Åland	<b>R225</b>	UKD4	Lancashire
<b>R98</b>	FR10	Île de France	<b>R226</b>	UKD5	Merseyside
<b>R99</b>	FR21	Champagne-Ardenne	<b>R227</b>	UKE1	East Riding and North Lincoln
<b>R100</b>	FR22	Picardie	<b>R228</b>	UKE2	North Yorkshire
<b>R101</b>	FR23	Haute-Normandie	<b>R229</b>	UKE3	South Yorkshire

<b>R102</b>	FR24	Centre	<b>R230</b>	UKE4	West Yorkshire
<b>R103</b>	FR25	Basse-Normandie	<b>R231</b>	UKF1	Derby and Nottingham
<b>R104</b>	FR26	Bourgogne	<b>R232</b>	UKF2	Leicester, Rutland and Northants
<b>R105</b>	FR30	Nord - Pas-de-Calais	<b>R233</b>	UKF3	Lincolnshire
<b>R106</b>	FR41	Lorraine	<b>R234</b>	UKG1	Hereford, Worcester and Warks
<b>R107</b>	FR42	Alsace	<b>R235</b>	UKG2	Shrop and Stafford
<b>R108</b>	FR43	Franche-Comté	<b>R236</b>	UKG3	West Midlands
<b>R109</b>	FR51	Pays de la Loire	<b>R237</b>	UKH1	East Anglia
<b>R110</b>	FR52	Bretagne	<b>R238</b>	UKH2	Bedford, Hertford
<b>R111</b>	FR53	Poitou-Charentes	<b>R239</b>	UKH3	Essex
<b>R112</b>	FR61	Aquitaine	<b>R240</b>	UKI1	Inner London
<b>R113</b>	FR62	Midi-Pyrénées	<b>R241</b>	UKI2	Outer London
<b>R114</b>	FR63	Limousin	<b>R242</b>	UKJ1	Berks, Bucks and Oxford
<b>R115</b>	FR71	Rhône-Alpes	<b>R243</b>	UKJ2	Surrey, East and West Sussex
<b>R116</b>	FR72	Auvergne	<b>R244</b>	UKJ3	Hampshire and Isle of Wight
<b>R117</b>	FR81	Languedoc-Roussillon	<b>R245</b>	UKJ4	Kent
<b>R118</b>	FR82	Provence-Alpes-Côte d'Azur	<b>R246</b>	UKK1	Gloucester, Wilt and North Somerset
<b>R119</b>	FR83	Corse	<b>R247</b>	UKK2	Dorset and Somerset
<b>R120</b>	GR11	Anatoliki Makedonia, Thraki	<b>R248</b>	UKK3	Cornwall and Isles of Scilly
<b>R121</b>	GR12	Kentriki Makedonia	<b>R249</b>	UKK4	Devon
<b>R122</b>	GR13	Dytiki Makedonia	<b>R250</b>	UKL1	West Wales and The Valleys
<b>R123</b>	GR14	Thessalia	<b>R251</b>	UKL2	East Wales
<b>R124</b>	GR21	Ipeiros	<b>R252</b>	UKM1	North Eastern Scotland
<b>R125</b>	GR22	Ionia Nisia	<b>R253</b>	UKM2	Eastern Scotland
<b>R126</b>	GR23	Dytiki Ellada	<b>R254</b>	UKM3	South Western Scotland
<b>R127</b>	GR24	Stereia Ellada	<b>R255</b>	UKM4	Highlands and Islands
<b>R128</b>	GR25	Peloponnisos	<b>R256</b>	UKN0	Northern Ireland

## Product categories

In our study, trade between European regions is detailed at the product level. Export and imports flows are divided according to the 2-digit *Classification of Products by Activity* (CPA 1996). The classification has received a revisions from the version of 2002 (CPA 2008). Nonetheless, to date, Eurostat publishes national accounts which are in line with the classification of 1996. There is a total of 62 goods and services in CPA 2002, but products with number 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 amount of products to the 59 number of products analysed in our study.

Table 3. 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

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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

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