

Services Sectors' Concentration: the European Union, Greece, and the New Economic Geography

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Abstract

The aim of this article is to investigate services sectors' concentration in the European Union based on employment data and to disentangle the sector-specific developments and influential factors over time. We find that only the financial intermediation, retail trade and water transport sectors are subject to an increasing level of concentration over time. Moreover, we can detect a strong specialization tendency in the sectors of tourism and public administration for the Greek economy. Implementing a two-way fixed effects model, we find that knowledge spillovers as well as externalities arising from technological similarities appear to be highly significant in explaining services' concentration patterns for the European Union. Technological differences as a reason for services' concentration only appear to have been important in the period prior to the Single European Market Enactment. Further evidence is found for the relevance of factor intensity in explaining concentration of non-market services.

Keywords: Concentration, Services, European Union, Knowledge Spillovers, Technological Similarities

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1. Introduction

Services have become by far the most important branch for generating GDP in the European countries. Data from Eurostat shows that services constitute about 70 percent of total gross value added in the EU-27 for the period from 1995 to 2010 (see figure 1).

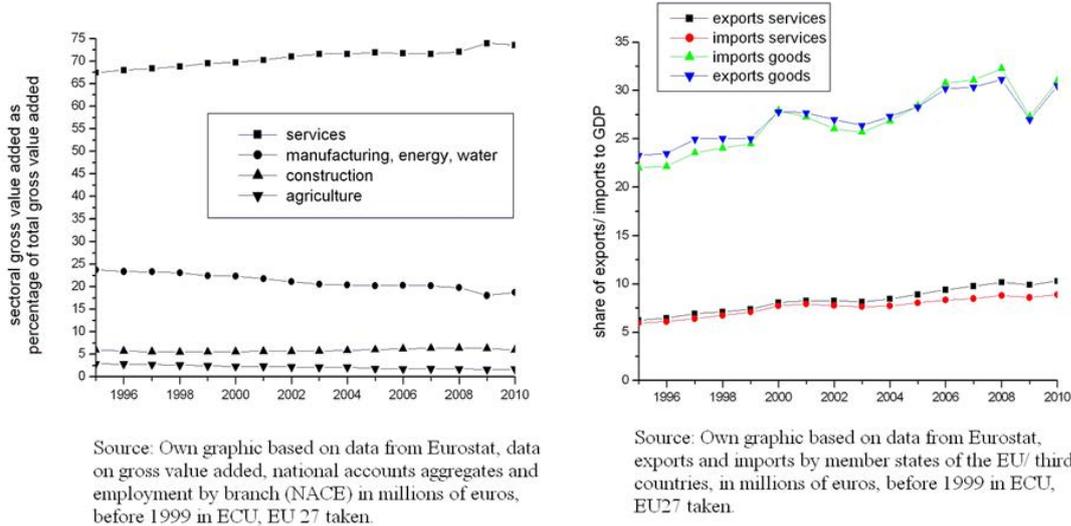


Figure 1: Gross value added and share of exports/ imports by sectors

However, services' trade remains at quite a low level compared to manufacturing goods. Data reveals that services exports/ imports to extra-EU make up just a small share of about 6-10 percent of GDP from 1995 to 2010, whereas industrial goods' exports/ imports range between 22-32 percent.

So far, the analysis of services sectors' concentration patterns has not been very extensive in the literature. Given the high relevance of services' contribution to GDP in various countries over the world, this is quite surprising and therefore demands for a more thorough analysis. The lack of investigation might be attributed to the difficulties related to the measurement of services' values and volumes which manifests in missing services' data within many data sources. Services are different from industrial goods for several reasons: their production and consumption usually occur at the same time and in the same location, and services cannot be stored. Consequently, they are regarded as non-tradables. This fact alone suggests that one can expect services to be more dispersed than manufacturing goods because manufacturing goods could be produced in another place than where being consumed and they can be stored and transported to a place where they are being demanded for, thus easing clustering processes of manufacturing firms.

Some definitions are necessary before proceeding: the term *concentration* refers to the localization of different industries across different countries/ regions. The term *agglomeration* means that the bulk of industrial activity is localized in a country or region. *Specialization*, on the other hand, looks at the spatial side first and addresses countries' or regions' industrial structures. The task of the present contribution is to investigate concentration tendencies in the European Union.

The issue of concentration has been given attention to in a great range of studies on industrial sectors (see for example Krugman 1991 a; Kim 1995; Bruelhart 2001; Bruelhart 1998; Paluzie et al. 2001). The European evidence talks about increasing tendencies of industrial concentration (Bruelhart 1998, 2001; Haaland et al. 1999) .

Given the process of European single market liberalization, services activities have become free to locate anywhere across the member countries of the European Union. The extent of services' localization in the European Union is in that respect especially worthy to be investigated. However, there exist only a few studies in the past that particularly deal with services' concentration in the regional context of the European Union. Oros and Turcu (2008) find that for the three broad sectors of agriculture, industry, and services, inequalities in the European Union from 1995 to 2004 became more pronounced on a regional level of measurement than on a country level. The services sector exhibits the lowest degree of concentration, and it is showing diminishing concentration tendencies over time. However, when decomposing the effects between the country and regional levels, the authors show that concentration fell only in terms of regional measurement, but concentration slightly increased on the country level. Jennequin (2008) found that at a more disaggregated level, services sectors experience only a very slight increase in concentration in the European Union over time. Based on a rather broad level of sectoral disaggregation, finance, insurance, real estate and business services are most concentrated and transport, storage and communication are least. On a more disaggregated level, however, it is remarkable that water transport is most highly concentrated and that concentration increased most over the time from 1991 to 1999 for 7 European countries (Denmark, Finland, France, Germany, Hungary, Italy and Norway). Midelfart-Knarvik et al. (2000) investigated services' concentration in the EU considering only five services sectors. The authors find that financial services, insurance, business, and real estate activities are the sectors that are the most concentrated over time and also those that deconcentrated most between 1982 and 1995. Transport services are the most dispersed services over time; in turn this sector shows the highest increase in concentration over time. In addition, wholesale trade, and retail trade reveal increasing levels of concentration. Hallet (2000) found that especially the banking and insurance sector and other market services were highly concentrated between 1980 and 1995. The development over time appeared to be quite stable. However, the author runs his investigation only on a very broad sectoral classification which comprises 5 types of services sectors.

Apart from investigating descriptive tendencies of services' concentration, the literature has also sought for explanatory factors of concentration, though mainly on manufacturing sectors. Studies for the European Union on industrial sectors find evidence for increasing returns to scale (Amiti 1998, 1999), intermediate goods intensity (Amiti 1998, 1999), forward and backward linkages (Midelfart-Knarvik et al. 2000) and the supply of highly skilled workers and researchers (Midelfart-Knarvik et al. 2000).

Clarifying the causes for agglomeration is still a current concern in research. In a recent rigorous

paper, Ellison et al. (2010) investigated the importance of Marshallian externalities¹ for co-agglomeration of manufacturing industries in the US. Their results reveal that natural resources and all types of the externalities are important explanatory variables. Input-output linkages between firms have a slightly higher level of importance, supporting new economic geography factors for the explanation of agglomeration patterns. Kolko (2010) analyzed the importance of Marshallian externalities in explaining services' agglomeration and co-agglomeration in the US. He found that only knowledge spillovers bear significant explanatory power for services' agglomeration.

The case of services is special since it is well known from the literature that concentration patterns for some services are strong at the more regional or metropolitan level (Kolko (2010)). The reason for that is clear: some services are highly dependent on face-to-face contact with the consumer, so services are dispersed on a very regional level. On the other hand, several services like transportation, media production or investment banking were shown to be highly agglomerated in the US (see also Kolko (2010)). Consequently, investigating services concentration on the national, county, state and more regional level, all have their justification, and the present paper mainly focuses on the national level and will address some issues on the regional level in one of the later sections, also.

This paper aims to address explanatory factors for services' concentration in the European Union for the first time. It remains to be shown whether the ideas of New Economic Geography can explain developments in services sectors' concentration, as well. Therefore, explanatory variables will be derived from the Traditional Trade Theory, New Trade Theory, and the New Economic Geography. Further, we will control for the influences of knowledge spillovers.

Contrary to past studies, we face less essential restrictions on reducing the time or country dimension when considering a more detailed degree of services sectors, which is guaranteed by using the more comprehensive EU KLEMS database. In that way, we can offer a more detailed analysis of region- and sector-specific tendencies and explanatory factors of services sectors' concentration in the European Union. However, especially longer time series on the measure we generate for capturing knowledge spillovers are still not available in the common data sets. This is the basic data constraint we had to deal with in our analysis.

The paper is organized as follows. Part 2 deals with the measurement of services concentration. Part 3 talks about the data set followed up by descriptive analyses in part 4. Part 5 presents the regression analysis and further robustness checks. Part 6 concludes.

2. Measurement of Services Sectors' Concentration

For the following analysis Gini coefficients will be used as in Krugman (1991 a) or Amiti (1998, 1999). They are calculated as follows. First the Balassa index will be computed by using the formula:

$$B_{sc,t} = \frac{\frac{e_{sc,t}}{e_{s,t}}}{\frac{e_{c,t}}{E_t}} \quad (1)$$

where $e_{sc,t}$ denotes services sector s ' employment in country c , $e_{c,t}$ denotes total services sectors' employment in country c , $e_{s,t}$ denotes total services sector s ' employment in the European Union, and E_t denotes total services sectors' employment in the European Union, all at one point in time t . The Gini coefficient is derived by ranking the Balassa index in descending order, then constructing a concentration curve by plotting the cumulative of the numerator on the vertical axis and the cumulative of the denominator on the horizontal axis (cumulating over countries)². The Gini coefficient is equal to twice the area within a 45 degree line and the concentration-curve. The Gini coefficient equals zero if a services sector is totally equally distributed across countries, concentration then will be low. It approaches one, the more the Balassa indices differ from one, concentration then will be high. For reasons of robustness checks, we will also calculate another measure in one of the later sections.

3. Data Issues

Data are taken from the EU KLEMS Database (2008) and can be downloaded online. EU KLEMS is a data collection project funded by the European Commission. The data collection has been done and supported by the OECD, several statistical offices, national economic policy research institutes and academic institutions in the EU. For computation of the Gini coefficients national employment data was used. The variable taken was *number of persons engaged* (in thousands). The application of employment data rather than trade or value added data, for example, is justified by the difficulties arising from deteriorating influences of exchange rate and price dynamics. Data covering 14 European countries and 22 services sectors was employed. The countries included in the analysis are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, UK. Services are given by the OECD ISIC Rev. 3 classification. A further disaggregation of countries or services sectors was prevented by lack of data. Moreover, in some of the following analyses we had to aggregate services sectors due to missing data, such that in a minimum 13 sectors were considered. Data was available for the time period from 1970 to 2005. Values given in local currency for Denmark, Sweden and the UK were converted to euros, using the respective exchange rates at January 4th 1999.³ Furthermore, all countries' values for explanatory variables were deflated using the price index for gross output (1995=100) from the EU KLEMS Database. This has been done in order to cancel out trends just being caused by inflation. Using several price indices for various variables was prevented by the lack of data.

In a further step, more detailed regional data on employment given by the NUTS II classification were extracted from Eurostat. Unfortunately, the more detailed sectoral NUTS II employment data were only available for the years 2000, 2004 and 2008 (Labor costs Survey, NACE Rev.2 classification). Overall, data availability led us to consider 47 regions and 12 services sectors for the year 2004 only (the list of regions can be found in the appendix).

4. Descriptive Analysis of Services Sectors' Concentration

The development of services sectors' concentration in the European Union is shown in the following table.

Table 1: Services sectors' concentration over time

<i>Agglomeration</i>	<i>1970</i>	<i>1980</i>	<i>1990</i>	<i>1995</i>	<i>2000</i>	<i>2005</i>	<i>Per cent change 1970-2005 (1995-2005)</i>	<i>Trend test</i>
All services sectors (18 sectors)	0.186	0.1804	0.1653	0.1575	0.1513	0.1458	-0.2161	-0.0012**
(22 sectors)				0.1702	0.1643	0.159	-0.0658	-0.001**
(13 sectors)	0.1182	0.1159	0.1089	0.1	0.0982	0.0997	-0.1565	-0.001**
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	0.0723	0.0897	0.095	0.0764	0.078	0.0844	0.1674	0.0001
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.1123	0.0922	0.0832	0.0902	0.0862	0.0845	-0.2476	-0.0006**
Retail trade, except of motor vehicles and motorcycles; repair of household goods	0.0445	0.0778	0.0635	0.0783	0.0821	0.0784	0.7618	0.0007**
Hotels and restaurants	0.1347	0.155	0.1441	0.1407	0.1437	0.1495	0.1099	-0.00004
Other Inland transport	0.0838	0.0971	0.0895	0.0749	0.0785	0.0755	-0.099	-0.0003**
Other Water transport	0.3521	0.3351	0.3275	0.3873	0.3817	0.3849	0.0932	0.002**
Other Air transport	0.2042	0.2166	0.1806	0.1984	0.1901	0.1784	-0.1263	-0.0004**
Other Supporting and auxiliary transport activities; activities of travel agencies	0.1663	0.1367	0.1368	0.1084	0.0949	0.0813	-0.5111	-0.0022**
Post and telecommunication	0.0857	0.0789	0.0805	0.0768	0.0806	0.0923	0.077	0.00001
Financial intermediation, except insurance and pension funding				0.0545	0.0635	0.0795	0.4587	0.0022**
Insurance and pension funding, except compulsory social security				0.1852	0.1813	0.1733	-0.0643	-0.0018**
Activities related to financial intermediation				0.1686	0.1527	0.1344	-0.2028	-0.0023**
Real estate activities	0.2371	0.2614	0.2257	0.1879	0.1782	0.1831	-0.2278	-0.0027**
Renting of machinery and equipment	0.4578	0.42	0.333	0.2749	0.2446	0.1891	-0.5869	-0.0082**
Computer and related activities	0.3068	0.2746	0.2709	0.2524	0.2241	0.2008	-0.3455	-0.0025**
Research and development	0.4126	0.4106	0.3746	0.3559	0.3556	0.346	-0.1614	-0.0023**
Other business activities	0.1898	0.1772	0.1434	0.1285	0.108	0.0925	-0.5126	-0.003**
Public admin and defense; compulsory social security	0.1176	0.1003	0.1134	0.1101	0.1224	0.1143	-0.0281	0.0002
Education	0.1047	0.0968	0.0961	0.0901	0.0802	0.0822	-0.2149	-0.0006**
Health and social work	0.1508	0.1472	0.142	0.1294	0.1226	0.1287	-0.1466	-0.0009**
Other community, social and personal services	0.1147	0.0807	0.0761	0.074	0.0719	0.078	-0.32	-0.0007**
Private households with employed persons				0.5017	0.493	0.4875	-0.0283	-0.0014**
Transport and Storage	0.0566	0.0758	0.0775	0.0614	0.0552	0.0502	-0.1131	-0.0005**
Financial intermediation	0.1135	0.0645	0.08	0.0676	0.076	0.0869	-0.2344	-0.0008**
Renting of machinery and equipment, research and development and other business activities	0.1922	0.1865	0.1385	0.1171	0.0995	0.0835	-0.5656	-0.0036**

Source: Own calculations based on EU KLEMS data (2008).

Note: This table displays the Gini coefficients for the years 1970, 1980, 1990, 1995, 2000, and 2005, as well as the changes in Gini coefficients from 1970-2005 or 1995-2005, respectively. In the last column results of a linear trend test over time are shown.

Only data points for 1970, 1980, 1990, 1995, 2000 and 2005, respectively, are displayed for reasons of lucidity. Further, changes in concentration over time were calculated and a linear trend test was applied in order to check for the significance of changes.

As can be seen from table 1, total services sectors' concentration in the European Union decreased by about 22 percent from 1970 to 2005 (resulting for 18 services sectors, since data are available for some sectors only from 1995 to 2005). Most of the services sectors display a significant decrease in concentration (as is the case for wholesale trade, other inland transport, other air transport, other supporting and auxiliary transport activities, insurance and pension funding, activities related to financial intermediation, real estate activities, renting of machinery and equipment, computer and related activities, research and development, other business activities, education, health and social work, other community and social services and private households with employed persons). This is in line with Midelfart-Knarvik et al. (2000) who find financial services, insurance, business and real estate activities to deconcentrate between 1982 and 1995 — although only slightly — as well.

As it can be further seen, only retail trade, other water transport and financial intermediation except of insurance and pension funding showed a significant increase in concentration. Concentration of financial intermediation except insurance and pension funding and retail trade, however, still remains at a low level, only its change over time is huge compared to all other sectors. This contrasts Jennequin (2008), as he finds financial services to be highly concentrated.

In the present study, concentration in financial intermediation except insurance and pension funding records a 46 percent change, concentration in retail trade a 76 percent change, respectively. So, in contrast to Midelfart-Knarvik et al. (2000) and in accordance with Jennequin (2008) this study can reveal an increasing level of concentration in financial services.⁴ Financial services' and retail trade concentration points to a change of economic structures in the national landscape of the European Union. Although financial services and retail trade employees would need to be close in proximity to customers, apparently over time due to the improved information and communication technologies (internet, online banking, online sale etc.), clustering of these activities occurred. Concentration in water transport was quite high in 1970 exhibiting a Gini coefficient of 0.35 which increased to 0.38 in 2005. A high level of concentration for water transport has also been found by Jennequin (2008). The concentration of water transport is not surprising due to its dependence on waterways. Dispersal of services which remain in each nation's responsibility, like education or other community and social services, is not surprising, either. The most dispersed sectors like post, land transport or education are sectors that are most influenced by being close to demand, so these sectors necessarily need to be dispersed and present wherever people live (Jennequin (2008)). These are also sectoral activities that cannot easily be replaced by internet technologies, but will further depend on face-to-face contact between providers and customers.

Overall, the studies of Jennequin (2008) and Midelfart-Knarvik et al. (2000) find that knowledge-intensive business services (KIBS) or finance, insurance, real estate and business services (FIRE),

respectively, are the most concentrated sectors in the EU. The present study, however, employing a more detailed analysis on a wider range of services sectors, time period and sample of countries, can detect that financial services are less concentrated across the member states of the European Union, only their concentration level increased over time. Moreover, this study finds evidence for research and development and computer services being highly localized across member states of the EU. However, the sectors deconcentrate heavily over time. The development of computer services' concentration is in favor of getting closer to customers again. Similarly, in the context of fewer co-localization of services that rely heavily on information technology in the US, Kolko (2010) talks about the internet being a substitute for phone, mail, and travel, however not for in-person interactions.

For the following regression analysis, explanatory variables were not available for all of the 22 services sectors. Therefore, an aggregated Gini index for 13 services was computed and sectors had to be aggregated for transport and storage⁵, financial intermediation⁶ and renting of machinery and equipment, research and development and other business activities⁷. As can be seen from table 1, information on a high level of agglomeration for water transport and the increase of concentration in pure financial intermediation thus gets lost.

Investigating in which country services got actually localized delivers further interesting results. The three countries a sector got most or least concentrated in for the years 1970 and 2005 — as the ranking of the Balassa index would indicate — are shown in table 2.

Taking a closer look at Greece for reasons of current interest, one can see that in the year 2005 transport and storage activities, hotels and restaurants, retail trade, and sale of motor vehicles were highly concentrated. In other words, a large share of Greek employees in services sectors was working in services related to tourism, for example, compared to the employment share of Greece within the EU. These tendencies are explained by the history and landscape. Tourism has been important for Greece since ages, since people want to go and see the Greek cultural heritage from the ancient times. Furthermore, Greece owns the highest share of the world merchant fleet. It amounts to 15.96 percent of the world fleet's tonnage (UNCTAD 2010). In addition, the high Greek Balassa Index for education has to be interpreted as Greece having a higher services' employment share in that branch than its employment share in total EU employment would suggest. Overall, the public sector is a large employer. Mitsopoulos and Pelagidis (2011) highlight that government spending was related to changing governments over time. Whereas from 1991 to 2004 primary expenses of the central government were held around 13.7 - 15.6 percent of GDP, from 2004 until 2009 the new government increased expenditures to 20.5 percent of GDP. The absolute value thus increased enormously since GDP grew rapidly over time. The authors explain that the significant increase in government spending was due to wages that had to be paid given that the staff increased in the public sector over time and because of the needs of social security funds for the public sector employees' pensions.

Table 2: Services sectors' concentration evaluated by the Balassa index

	<i>Highest Balassa index</i>		<i>Lowest Balassa index</i>	
	<i>1970</i>	<i>2005</i>	<i>1970</i>	<i>2005</i>
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	Denmark Portugal Italy	Portugal Greece Italy	Sweden Spain France	Belgium Netherlands Sweden
Wholesale trade and commission trade, except of motor vehicles and motorcycles	Portugal Netherlands Belgium	Portugal Denmark Austria	Greece Spain UK	Greece UK Ireland
Retail trade, except of motor vehicles and motorcycles; repair of household goods	Ireland Spain UK	Greece Portugal Spain	Sweden Netherlands France	Sweden Belgium Finland
Hotels and restaurants	Portugal Austria Greece	Greece Spain Portugal	Netherlands Sweden Denmark	Sweden Denmark Belgium
Transport and storage	Greece Finland Spain	Greece Finland Austria	Netherlands France Italy	UK Portugal Netherlands
Post and telecommunications	Ireland Austria Belgium	Ireland Finland Belgium	Spain Portugal Netherlands	Portugal Italy Netherlands
Financial intermediation	Germany Belgium Netherlands	Ireland UK Germany	Sweden Italy Ireland	Finland Portugal Sweden
Real estate activities	Finland Portugal Austria	Finland Sweden Austria	Greece Italy Ireland	Greece Italy Portugal
Renting of machinery and equipment, research and development and other business activities	Netherlands France UK	Netherlands Belgium UK	Portugal Finland Spain	Portugal Greece Spain
Public admin and defense; compulsory social security	Germany Belgium France	Belgium Portugal France	Denmark Spain Finland	UK Netherlands Sweden
Education	Sweden Belgium Ireland	Sweden Greece France	Spain Netherlands Germany	Netherlands Spain Austria
Health and social work	Sweden Finland Denmark	Denmark Sweden Finland	Spain Belgium Greece	Greece Spain Portugal
Other community, social and personal services	Italy Sweden Ireland	Ireland Sweden UK	Portugal Belgium France	Belgium Portugal France

Source: Own calculations based on EU KLEMS data (2008).

Note: The three countries with either highest or lowest Balassa index for a services sector for the years 1970 and 2005 are displayed in this table.

In the EU, the financial services are mostly concentrated in Ireland, UK and Germany. Before the beginning of the financial crisis, the financial sector of the UK was functioning very well. In its staff report, the IMF (2007) talks about a steady rise of net exports of financial services of UK from 1995 to 2005 from 10 billions US Dollars to about 35 billions with an especially sharp increase from 2003 to 2005. At that time, the financial services from the UK flourished, the system was said to be open and flexible to capital flows and "in a position of strength" (IMF 2007, p. 26).

Health and social work and other community, social and personal services are mostly localized in the Northern European countries like Denmark, Sweden, Finland, Ireland and the UK. This

demonstrates the fact that the Northern European countries (Denmark, Finland and Sweden) possess big social welfare systems, employing a huge workforce. Andersen et al. (2007) talk about the "Nordic Model" as a special economic and social system being existent for the Northern European countries Denmark, Finland, Iceland, Norway and Sweden. These countries would be comprehensive welfare states with transfers to households and publicly provided social services, high public and private spending for child care, education, and research and development, and good labor market institutions, which comprise strong labor unions, good wage coordination, generous unemployment benefits and active labor market policies. As it can be seen, the highest share of services' employment working in educational services is in fact given in Sweden.

In table 3, a closer look is taken at the level of specialization of the Greek economy in 2005, again evaluated by using the Balassa indices. For this part of the analysis, measuring specialization, a slightly different measurement for the Balassa index is taken which is given by the following formula:

$$B_{sG,t} = \frac{\frac{e_{sG,t}}{e_{G,t}}}{\frac{e_{s,t}}{E_t}} \quad (2)$$

Here, the employment in a given sector *s* in Greece (G) is considered as a share of Greece's total employment and set in relation to the services sector *s*' employment share in the whole EU.

Table 3: Greece — Balassa index in 2005

	<i>Total EU services' employment in thousands</i>	<i>in percent</i>	<i>Greece's services' employment in thousands</i>	<i>in percent</i>	<i>Balassa index</i>
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	3898.17	3.1	109	4.17	1.34
Wholesale trade and commission trade, except of motor vehicles and motorcycles	7559.61	6.01	108	4.12	0.69
Retail trade, except of motor vehicles and motorcycles, repair of household goods	14811.8	11.78	427	16.34	1.39
Hotels and restaurants	8558.84	6.81	276	10.58	1.55
Transport and storage	7418.67	5.9	229	8.76	1.48
Post and telecommunications	2539.28	2.02	51	1.96	0.97
Financial intermediation	5068.3	4.03	99	3.79	0.94
Real estate activities	1800.98	1.43	3	0.11	0.08
Renting of machinery and equipment, research and development and other business activities	20799.83	16.55	294	11.26	0.68
Public admin and defense; compulsory social security	11671.86	9.29	303	11.61	1.25
Education	11690.25	9.3	287	10.99	1.18
Health and social work	17012.05	13.53	206	7.87	0.58
Other community, social and personal services	8490.68	6.75	151	5.79	0.86

Source: Own calculations based on EU KLEMS data (2008).

Note: In this table the decomposition of Balassa indices for Greece based on different levels of specialization is shown. In columns two and three total EU services' employment is shown both in levels and in percent, in columns four and five Greece's services' employment is shown both in levels and in percent.

With a Balassa index value of 1.55, most of the Greeks employed in services — that is 10.58 percent — work in the branch of hotels and restaurants, whereas only 6.81 percent of total EU services' employment is working in this branch. The Balassa index is also high for (in descending order): transport and storage, retail trade, sale of motor vehicles, public administration and education. These facts correspond to results from table 2. One can learn that Greek employment is also explicitly high in the branch of public administration, indicating the high number of employees in the public sector.

What do the results obtained above mean for the Greek Economy? The data so far showed that the Greek economy mainly specialized in services related to tourism, like hotels and restaurants, transport and storage, retail trade, or services financed by the public sector, like public administration and education. In 2010 salaries of Greek public sector's employees were decided to be reduced, public administration was more and more consolidated and with 2011 public sector's jobs were decided to be axed. These undertakings were done and planned in order to increase public savings. As has been seen from the data, this means a reduction of employment in branches where Greece got particularly specialized in. In fact, the austerity programs will cause Greek employment and thus the economic structure to change immensely, which will cause unemployment to increase, negatively affecting the citizens' welfare. Another problem arises from the specialization in tourism: in times of economic and social distress tourists are less willing to come to the country and so another source of income diminishes.

5. Econometric Analysis

5.1 Explaining Services Sectors' Concentration

In order to explain services sectors' concentration, explanatory variables will be derived from two different branches of trade theories and from the New Economic Geography. These theories point to different reasons for countries' specialization or sectoral concentration. In addition, knowledge spillovers shall be captured in the regression framework. In extracting the possible influential factors we will follow the literature of Amiti (1999), Haaland et al. (1999), Torstensson (1996), Rosenthal and Strange (2001), and Kolko (2010), for example. Our measures for factor intensity and intermediate products intensity are in accordance with those taken by Amiti (1999), our technology measure resembles the one taken by Haaland et al. (1999)/ Torstensson (1996).

Heckscher-Ohlin theory tells us that a country specializes in producing and exporting that good that is produced relative intensively with the factor the country is relatively well endowed with. Factor intensity can be operationalized as:

$$fact_{st} = \left| \frac{w_{st}L_{st}}{VA_{st}} - \frac{\overline{w_t L_t}}{\overline{VA_t}} \right| \quad . \quad (2)$$

$w_{st}L_{st}$ denotes labor compensation in millions of euros in services sector s and VA_{st} denotes gross value added in millions of euros in services sector s at time point t . The measure consists of the deviation of the share of labor compensation to value added to the services sectors' average share of

labor compensation to average value added. Taking the absolute value of this measure captures a basic element of Heckscher-Ohlin's theory: services sectors exhibiting either a high labor or a high capital intensity (represented by either high or low labor compensation compared to the European average) will show up a high level of services sectors' concentration. A positive influence of *fact* on services sectors' concentration can be expected.

New Trade Theories focus on scale economies in production. Using scale effects, firms can either produce more output at a given cost or a given output at lower costs. For countries' economic structures both divergence and equalization is possible. In case of a homogeneous good divergence happens through the process of further integration. Countries will specialize in one good which they will start trading with. In case of a heterogenous good, consumers could get access to a greater variety of products via free trade through economic integration. Intra-sectoral trade will seize, leading to equalized sectoral structures across countries. Scale economies shall be captured by the following measure:

$$scale_{st} = \frac{w_{st}L_{st} + Cap_{st} + Int_{st}}{Q_{st}} \quad (3)$$

$w_{st}L_{st}$ denotes labor compensation in millions of euros in service s at time t , Cap_{st} capital compensation in millions of euros, Int_{st} intermediate inputs in millions of euros and Q_{st} denotes gross output as a volume index (1995=100). A negative relationship between concentration and scale intensity can be expected. This is because the more output can be produced at a per unit cost, the lower will be the measure *scale*. Increasing returns to scale positively influence concentration, since firms will want to locate closer to each other in order to reap off scale economies (Krugman 1979; Krugman 1980).

The basic New Economic Geography model (Krugman 1991 b) deals with forward and backward linkages occurring among firms and workers. If workers move to a region, the rise in their regional expenditures increases the incentive for firms to locate there, too (home market or market size effect which constitutes the so called backward linkage). Consequently, firms locating in one place will lead to goods' prices to fall — products get cheaper because of competing firms — which increases the incentive for workers to move to this place (price index effect which constitutes the so called forward linkage) . A similar way of reasoning holds in the models of Krugman and Venables (1995) and Krugman and Venables (1996). There, mutual dependencies exist between upstream and downstream firms. Industries making use of economies of scale will locate at sites where demand is high, usually this will be in the larger market (backward linkage). They can minimize transport costs this way. Demand in turn will be high in places where firms are already located in, because their products will be less expensive (forward linkage). New Economic Geography's reasoning is going to be modeled in the following way:

$$intermediate_{st} = \frac{P_{st}Q_{st} - VA_{st}}{P_{st}Q_{st}} \quad (4)$$

$P_{st}Q_{st}$ denotes gross output in millions of euros and VA_{st} is gross value added in millions of euros.

Services sectors that use a lot of intermediate products are expected to show a higher level of concentration than other services sectors, based on elements of New Economic Geography models (Krugman 1991 b; Krugman and Venables 1995; Krugman and Venables 1996). Therefore a positive relationship between concentration and intermediate products intensity is assumed. As has been mentioned by Amiti (1999), the measure of intermediate products intensity, however, might only consider vertical linkages of downstream firms and does not use inputs from firms within sectors. The last aspect cannot be taken care of here, either, because data are lacking on detailed input-output structures for services. However, the measure for intermediate products intensity is said to be fair enough to capture important features of new economic geography theory.

Ricardian trade theory states that differences in production technologies will lead to countries getting relative production advantages in certain goods, which will induce specialization. Differences in production technologies shall be measured via different labor productivities:

$$techdiff_{st} = \sqrt{\frac{1}{c} \sum_j \left(\frac{\frac{VA_{sj}}{E_{sj}}}{\frac{1}{c} \sum_j \frac{VA_{sj}}{E_{sj}}} - \frac{\frac{VA_{sj}}{E_{sj}}}{\sum_s \frac{VA_{sj}}{E_{sj}}} \right)^2} . \quad (5)$$

VA_{sj} denotes value added in services sector s in country j and E_{sj} denotes employment in services sector s in country j , where $j = 1, \dots, c$. This measure describes the deviation between the share of labor productivity in sector s in country j relative to this sector's labor productivity in the EU and the share of a country's labor productivity in relation to all countries' and sectors' labor productivity in the EU. A higher deviation results in a higher value for *techdiff* and should thus influence services' concentration positively.

Knowledge spillovers are not easy to be operationalized. Kolko (2010) , for example, employs the share of workers with graduate degrees. The author mentions that through this measure, though, not only knowledge spillovers but also effects of labor market pooling might be captured. Due to limited data availability, we also used a proxy which is the share of hours worked by highly skilled workers. The idea behind is that a larger employment of the highly skilled will invoke positive spillovers among peers, resulting in mutual benefits. We expect that knowledge spillovers (*knowspill*) influence services' concentration positively.

A regression function has been estimated via a two-way fixed effects estimation procedure:

$$lngini_{st} = \alpha + \beta_1 lnfact_{st} + \beta_2 lnscale_{st} + \beta_3 lnintermediate_{st} + \beta_4 lntechdiff_{st} + \beta_5 lnknowspill_{st} + \gamma_s + \delta_t + u_{st} \quad (6)$$

13 services sectors and 35 time points are considered for the analysis.⁸ The Gini coefficient is regressed on the logarithm of factor intensity, scale economies, intermediate products' intensity, technology differences, knowledge spillovers, sectoral dummies γ_s and time dummies δ_t . Time dummies are taken relative to 1971, services dummies are taken relative to the sector *sale, maintenance and repair of motor vehicles*. By the logs of variables the coefficients can be interpreted as percentage changes in variables. The results are given in table 4.⁹

Table 4: Regression results services' concentration

	<i>ln(gini)</i>	<i>ln(gini)</i>	<i>ln(gini)</i>	<i>ln(Krugman index)</i>	<i>ln(Krugman index)</i>
	(1)	(2)	(3)	(4)	(5)
constant	-0.8608** (0.1841)	0.1611 (0.5089)	0.075 (0.5086)	-0.5662** (0.2062)	-0.1426 (0.7079)
ln(factor intensity)	-0.0087 (0.0107)	-0.0216** (0.0102)	-0.0197** (0.009)	0.0197* (0.0118)	-0.027** (0.0118)
ln(scale intensity)	0.3829** (0.0608)	0.1478* (0.0875)	0.1822** (0.0839)	0.3127** (0.0658)	-0.07 (0.1188)
ln(intermediate products intensity)	0.6236** (0.0975)	-0.1047 (0.1134)	-0.1055 (0.0999)	0.4984** (0.1345)	-0.2148 (0.1339)
ln(technological differences)	-1.0573** (0.1344)		-0.9489** (0.2436)	-0.9486** (0.1477)	-0.6141** (-0.6141)
ln(knowledge spillovers) (1992-2005)		0.8366** (0.1415)	0.6567** (0.1399)		0.6738** (0.1714)
N observations	455	182	182	455	182
R ²	0.919	0.965	0.97	0.891	0.948
F-Stat	137.69	383.87	462.98	105.11	236.84

Source: Own calculations based on EU KLEMS data (2008).

Note: Two-way fixed effects estimation. Services sectors and time dummies included. ** denotes significance at the 5 percent level, * denotes significance at the 10 percent level. White standard errors are taken.

The results in columns 1-3 show that the coefficient for knowledge spillovers is significant and positive in all specifications. Knowledge spillovers as measured here by the share of hours worked by high-skilled workers, play an important role in explaining services' concentration. The coefficient for intermediate products intensity is significant and positive only in one specification. The influence of factor intensity on services' concentration seems to be negligible due to the low negative value of the coefficient. The coefficient for technology differences does not show the expected sign. Obviously, services do not concentrate more in case of big technological differences across regions, but in fact they do if technologies are more similar. So, it is not the Ricardian argument that is supported by this variable, but some further influence of knowledge spillovers and positive externalities comes through. The coefficient for scale economies does not bear the expected sign. The positive sign for scale economies might indicate a situation that has been explained before for the case of a heterogenous good. Through increasing liberalization consumers get access to a greater variety of products, intra-sectoral trade increases, economic structures across countries equalize. Another reason prominent in the industry concentration literature is that benefits through scale economies were already used in former periods of time (Haaland et al. 1999). The following section, producing robustness checks, will shed light on these issues.

5.2 Sensitivity Analysis

Robustness of the results shall be tested in the following by using a different measure for the dependent variable and by dividing the sample into different time periods and differentiating between effects for market and non-market services, respectively.

The Krugman index as having been taken in Krugman (1991 a) will be calculated as an alternative

dependent variable. Midelfart-Knarvik et al. (2000) took a slightly different modeling of this measure which is:

$$K_{s,t} = \sum_{c=1}^C \left| \frac{e_{sc,t}}{e_{s,t}} - \frac{1}{S-1} \sum_{s=1}^{S-1} \left(\frac{e_{sc,t}}{e_{s,t}} \right) \right| \quad (7)$$

$K_{s,t}$ measures the deviation of the share of services' employment for sector s in country c relative to this sector's total EU employment from the other ($S-1$) services sectors' mean of these sectoral shares.

The index is calculated for the 13 sectors described in the text above.

As can be seen from table 5, the same concentration tendencies for services sectors emerge as in case of taking the Gini coefficient for the 13 sectors.¹⁰

Table 5: Services sectors' concentration by Krugman index of concentration

Services sector	Krugman index 2005	Services sector	Krugman index 1970
Most agglomerated			
Real estate activities	0.2622	Real activities	0.3357
Hotels and restaurants	0.2343	Renting of machinery and equipment and other business activities	0.3052
Health and social work	0.189	Hotels and restaurants	0.2282
Public admin and defense, compulsory social security	0.1794	Public admin and defense, compulsory social security	0.2074
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.1727	Health and social work	0.1972
Most dispersed			
Transport and storage	0.0928	Retail trade, except of motor vehicles and motorcycles; repair of household goods	0.096
Other community, social and personal services	0.1063	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	0.0993
Retail trade, except of motor vehicles and motorcycles; repair of household goods	0.11	Transport and storage	0.108
Financial intermediation	0.1151	Post and telecommunications	0.1139
Post and telecommunications	0.132	Education	0.1498

Source: Own calculations based on EU KLEMS data (2008).

Note: The table displays values of the Krugman concentration index. Since for 1970 data are not available for financial intermediation, insurance and pension funding, activities related to financial intermediation and private households, Krugman indices were calculated for 13 services sectors, only, aggregating the three sectors of financial intermediation, transport/storage and renting of machinery/equipment/research/development/other business activities. Only the five most and least agglomerated services sectors in 1970 and 2005 are shown in this table.

In the next step, regressions are run with the Krugman index as the dependent variable and the explanatory variables from the former regression framework. Results given in table 4 columns 4 and 5 show that knowledge spillovers appear to be relevant, both measured as direct influence due to higher shares of hours worked by high-skilled workers and as indirect influence via technology similarity. The influence of factor intensity appears to be negligible again and the effect of scale economies and intermediate products intensity is not that clear since the coefficients are not significant in either specification.

Table 6: Robustness checks services' concentration

	<i>ln(Krugman index) 1971-1985</i>	<i>ln(Krugman index) 1986-2005</i>	<i>ln(Krugman index) market services</i>	<i>ln(Krugman index) non-market services</i>	<i>ln(Krugman index) market services</i>	<i>ln(Krugman index) non-market services</i>
	(6)	(7)	(8)	(9)	(10)	(11)
constant	-1.2419** (0.3014)	-1.2097** (0.3633)	0.3113 (0.2261)	-0.0478 (0.3944)	0.7427 (0.7839)	-3.1984** (0.8242)
ln(factor intensity)	0.0211 (0.0155)	-0.0169 (0.0128)	0.0084 (0.0108)	0.3331** (0.1176)	-0.0281** (0.0117)	-0.8524** (0.4042)
ln(scale intensity)	0.6468** (0.1064)	0.0389 (0.1095)	0.5411** (0.0699)	-0.2928 (0.2655)	-0.1051 (0.1589)	-0.9213* (0.4716)
ln(intermediate goods intensity)	-0.1969 (0.2092)	0.3363** (0.1655)	1.2662** (0.1494)	-0.1469 (0.0971)	-0.4142* (0.2307)	0.2348 (0.6395)
ln(technological differences)	0.87** (0.2941)	-1.0266** (0.1641)	-0.4921** (0.1446)	-2.6376** (0.8465)	-0.4348 (0.2642)	
ln(knowledge spillovers) (1992-2005)					1.077** (0.2531)	0.4069* (0.226)
N observations	195	260	350	105	140	42
R ²	0.934	0.923	0.913	0.871	0.952	0.899
F-Stat	184.56	171.88	113.98	21.36	190.64	19.94

Source: Own calculations based on EU KLEMS data (2008).

Note: Two-way fixed effects estimation. Services sectors and time dummies included. ** denotes significance at the 5 percent level, * denotes significance at the 10 percent level. White standard errors are taken.

Further robustness checks are given in table 6. Dividing the sample into the time of the pre-Single European Market Enactment (SEME) era (the years until the end of 1985) and the post-SEME era yields meaningful results. In 1986 the Single European Act was signed which involved the member countries' joint effort to collaborate in terms of economic and monetary policy in order to achieve the goal of economic convergence. These efforts can be expected to have formed the economic structure in the European Union accordingly. The coefficients for scale intensity and technological differences bear positive signs and are significant for the pre-SEME period. For the post-SEME period, intermediate products intensity bears a positive and significant coefficient, technology differences bear a negative significant coefficient. These results lend support to the interpretation that services concentration followed Ricardian arguments of specialization in case of technological differences across countries in the pre-SEME era, but the primary driver for concentration after the launch of the Single European Act is knowledge spillovers due to the clustering. The bulk of increasing product variety's influence on services concentration seems to have been valid in the pre-SEME period, whereas intermediate products intensity matters only in the post-SEME period. We therefore observe that over different time periods different influences are at work.

Another check is done based on the division between market and non-market services (see the classification in the appendix). While the results in columns 8 and 9 imply the pure effect across the sectoral division of services sectors, results from columns 10 and 11 mix the sectoral dependencies with time period differences.¹¹ As such, results in columns 10 and 11 are only difficult to interpret. Increasing product variety appears to be important for market services' concentration only, as well as intermediate products intensity. Factor intensity, however, is relevant for concentration of non-market

services. This can be nicely interpreted, since the services of education, health and social service are especially labor-intensive, so clearly services' concentration depends on labor intensity. Both market and non-market services' concentration are influenced by technology similarity and with some cautious interpretation also by knowledge spillovers. Note, however, that the sample got severely reduced for the regression shown in column 11, so meaningful inference is hard to be drawn. Furthermore, for the last specification an investigation showed that multi-collinearity problems arise from taking up both technology differences and knowledge spillovers variables in the regression. As such, only the variable capturing knowledge spillovers was finally included.

Table 7: Correlation matrix for further robustness checks of services' concentration for the year 2004

	<i>ln(NUTS Krugmanindex)</i>	<i>II-sample ln(gini)</i>	<i>ln(Krugman index)</i>
<i>ln(factor intensity)</i>	0.3267	0.6581	0.5496
<i>ln(scale intensity)</i>	-0.0023	0.1452	0.1914
<i>ln(intermediate goods intensity)</i>	-0.4518	-0.4676	-0.4329
<i>ln(technological differences)</i>	-0.6753	-0.6840	-0.6181
<i>ln(knowledge spillovers)</i>	0.4113	0.1819	0.0414

Source: Own calculations based on EU KLEMS data (2008) and Eurostat.

Note: This table displays Pearson correlation coefficients. The Krugman index in the first data column has been calculated for NUTS II-level data stemming from Eurostat. Only 12 services sectors were taken (because public administration data were missing for a lot of regions) and 47 regions

An investigation for more regionally detailed sectoral data was planned as the next step. However, the NUTS II data available in Eurostat on a more detailed sectoral level meant a reduction to the time points of 2000, 2004 and 2008. For the year 2000, observations were only very fragmented. Furthermore, several lacking data points on services sectors also meant a drop-out of several regions in the sample. Due to these problems, a regression analysis could not be performed. In table 7, however, simple correlations between the constructed Krugman index on NUTS II employment data for 2004 and the explanatory country-level variables are displayed. In comparison with the Gini coefficient and the Krugman index for country-level data, a far higher correlation between knowledge spillovers and concentration is indicated for the NUTS II-level measure of concentration. A simple correlation, however, does not tell us much about the factor's influence in a multi-factorial interdependence system. Thus, with a hopefully better data coverage at hand in the future, further relationships should be investigated.

6. Conclusion

Clarifying the development of services' concentration and disentangling its driving forces in the specific context of the European Union has been the aim of the present contribution. The past literature has barely investigated trends and explanatory factors of services' concentration. In fact, so far, there was no such study investigating the explanatory factors of services' concentration on a detailed sectoral level for the European Union over a longer time period. The analysis of this paper is meant to

fill this gap.

Several interesting results have been derived from the analysis. On average, services sectors in the European Union underwent a tendency of steady dispersion over time. Only the sectors of retail trade, water transport and financial intermediation except of insurance and pension funding recorded a significant increase in concentration.

Taking a closer look at country-specific concentration patterns of services, it could be shown that the Greek workforce is especially large compared to the European average in the branches of retail trade, hotels and restaurants, transport and storage, public administration and education. We explained that the current austerity programs will alter the economic/ employment structure in Greece, causing unemployment in the branches that Greece got mostly specialized in.

As concerns the explanatory factors for services' concentration, the regression analysis reveals that knowledge spillovers play an important role on the country level and apparently also on a more regional level. Further, services do concentrate more in case of high technological similarity across countries, not supporting the Ricardian argument, but instead indicating benefits arising from spillovers and positive externalities. Technological differences as a reason for services' concentration only appear to have been important in the pre-Single European Market Enactment period, whereas intermediate products intensity — representing New Economic Geography factors — seems to matter only in the period after the enactment of the European Single Market. Moreover, increasing product variety and intermediate products intensity appear to be important for market services' concentration only. For non-market services' concentration, factor intensity is important, since these services are highly labor-intensive.

The results point to the relevance of policies enhancing education and R&D, since a proper training of the workforce will evoke positive knowledge spillovers, fostering the clustering of economic activity. Clustering, in turn, might give rise to a process of mutual benefits, as is commonly known from the New Economic Geography literature (see Marshall 1938, Krugman 1991, etc.). The results further reveal that intermediate products intensity, and as such the linkages between suppliers, have become stronger after the Single European Market Enactment. Consequently, politics could take care of a provision of an adequate infrastructure in order to guarantee the flow of intermediates.

In our analysis we faced data constraints as regards the more detailed sectoral regional level. For future research, one might set up a study investigating various services sectors' concentration in the EU once better data become available. Also, the issue of co-agglomeration of services sectors would deserve a clarification in the context of the European Union. Further, due to the changing landscape of Europe through increasing efforts of liberalization and enlargement, it would be interesting to consider particularly the East-European countries.

Appendix

Included NUTS II regions:

Vlaams Gewest, Baden-Württemberg, Bayern, Berlin, Brandenburg, Hamburg, Hessen, Mecklenburg-Vorpommern, Niedersachsen, Nordrhein-Westfalen, Rheinland-Pfalz, Sachsen, Sachsen-Anhalt, Schleswig-Holstein, Thüringen, Voreia Ellada, Attiki, Noroeste, Noreste, Comunidad de Madrid, Centro (Spain), Este(Spain), Sur (Spain), Canarias, Nord-Ovest (Italy), Nord-Est (Italy), Centro (Italy), Sud (Italy), Isole (Italy), West-Nederland, Zuid-Nederland, Ostösterreich, Südösterreich, Westösterreich, Centro (Portugal), North East (UK), North West (UK), Yorkshire and the Humber, East Midlands, West Midlands, East of England, London, South East (UK), South West (UK), Wales , Scotland, Northern Ireland.

Division between market and non-market services:

Market services: Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel; Wholesale trade and commission trade, except of motor vehicles and motorcycles; Retail trade, except of motor vehicles and motorcycles; repair of household goods; Hotels and restaurants; Transport and storage; Post and telecommunications; Financial intermediation; Real estate activities; Renting of machinery and equipment, research and development and other business activities

Non-market services: Education; Health and social work; Other community, social and personal services

Notes

¹ Marshall (1938) differentiates three reasons for firms benefitting from clustering: 1. a local labor pool, which offers a large enough number of workers with adequate skills available for a firm, 2. information spillovers, that is information is easily available and eases buying and selling decisions for example, and 3. input-output linkages, where it is assumed that firms will benefit from cheaper inputs when they are clustered together. Firms can realize economies of scale when clustering in an area because of the aforementioned reasons. Economies of scale are external to a single firm and internal for the cluster.

² Note that in contrast to a commonly known Lorenz-curve the concentration-curve lies on the upper side of a 45 degree line.

³ See ECB, exchange rate statistics.

⁴ Note from table 1 (at the bottom) that at a high level of aggregation of financial intermediation the increase in concentration vanishes.

⁵ Comprising the sectors other inland transport, other water transport, other air transport, other supporting and auxiliary transport activities; activities of travel agencies.

⁶ Comprising financial intermediation except insurance and pension funding, insurance and pension

funding except compulsory social security and activities related to financial intermediation.

⁷ Comprising renting of machinery and equipment, computer and related activities, research and development and other business activities.

⁸ Remember that in constructing the dependent and independent variables values were aggregated over 14 countries.

⁹ A White test indicated heteroskedasticity of error terms such that White's heteroskedasticity-consistent standard errors were calculated.

¹⁰ Note that just 13 sectors are taken for analysis here since data are missing for the years until 1995 for several sectors.

¹¹ Note: due to inclusion of the knowledge spillovers variable the data set gets reduced to 1992-2005.

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