

Internationalization, Technology and Business Services Specialization in Europe

Paolo Guerrieri* and Valentina Meliciani**

*University of Rome "La Sapienza"
Email: paolo.guerrieri@uniroma1.it

**University of Teramo
Email: vmeliciani@unite.it

Italy's External Competitiveness
Rome, 24th -25th November 2009

Outline

- I. Background and aims of the work
- II. Literature supporting the conjectures
- III. Empirical evidence
- IV. Results
- V. Conclusions and next steps

Aims of the work

- I. Explaining Business Services (BS: R&D, Computer and related and Other business services) sectoral specialisation in EU NUTS2 regions
- II. Accounting for both (intermediate) demand and supply factors as affecting BS specialisation at the regional level (*within* each region)
- III. Testing the presence of agglomeration effects behind BS specialisation

MOTIVATIONS

- I. Recently a flourishing literature has emphasised the role of business services for economic growth, technology diffusion and internationalisation (see among others Guerrieri et al. 2005; Cox and Rubalcaba, 2007).
- II. BS, ICT and manufacturing-services linkages (growing complexity in the organisation of manufacturing production and distribution).
- III. The role of intermediate demand, forward and backward linkages (new geography models): industries will tend to locate close to supplier and customer industries.
- IV. Forward linkages play a special role in the location of Business services since the growth of these activities is highly dependent on intermediate demand by specific industries.
- V. Role of agglomeration economies.
- VI. Technology and human capital.

The growth of BS across NUTS1 regions - 1995-2005

Table 2: Employment growth in business services and other sectors EU (1995-2005)

Country	Business services/ total empl	Business services	Wholesale and retail trade	Hotels and restaurants	Transport, storage and communication	Manufacturing	Total employment
Austria	7.24%	5.57%	2.21%	2.89%	-0.11%	-0.17%	0.92%
Belgium	10.49%	6.80%	1.35%	1.77%	0.16%	3.97%	0.96%
Bulgaria	3.35%	7.29%	3.17%	4.58%	-2.26%	-2.81%	0.99%
Czech Republic	8.74%	2.17%	-1.96%	0.12%	-1.91%	-0.84%	0.36%
Germany	8.59%	6.12%	0.11%	1.98%	4.67%	-0.93%	0.58%
Spain	8.12%	3.08%	2.37%	3.26%	3.35%	2.15%	3.81%
Finland	5.08%	8.11%	2.09%	2.37%	2.67%	-0.85%	0.95%
France	6.65%	6.80%	2.35%	3.42%	3.88%	0.83%	1.74%
Greece	3.92%	6.33%	4.78%	2.00%	-2.17%	12.01%	0.93%
Hungary	7.09%	4.02%	-0.46%	2.91%	-4.31%	-2.85%	0.42%
Ireland	5.69%	11.56%	5.86%	2.40%	2.73%	-0.30%	3.80%
Italy	8.17%	5.83%	1.54%	15.51%	1.10%	0.24%	1.47%
Netherlands	13.34%	4.70%	1.91%	3.84%	0.60%	-0.93%	1.36%
Norway	7.83%	3.04%	0.88%	-2.83%	-1.47%	1.60%	0.56%
Poland	4.45%	5.36%	1.20%	0.84%	-2.83%	-1.84%	-0.56%
Portugal	6.34%	18.55%	3.96%	5.51%	8.35%	-1.18%	1.13%
Romania	3.14%	14.41%	2.15%	3.77%	-2.31%	-2.05%	-1.90%
Slovakia	4.27%	8.24%	9.36%	8.18%	-0.51%	-1.44%	0.96%
United Kingdom	12.93%	11.24%	2.01%	7.61%	-1.30%	1.21%	0.84%
Average	8.07%	6.74%	2.02%	5.03%	1.06%	0.82%	1.04%

Source: EUROSTAT Regio database

Growth of exports (annual % change)

Region	Merchandise			Other commercial services		
	2000-2007	2006	2007	2000-2007	2006	2007
World	12	16	15	14	16	20
North America	6	15	12	10	12	16
South and Central America	14	21	15	14	20	26
Europe	12	13	16	16	15	22
CIS	20	24	21	28	32	36
Africa	16	19	16	n.a.	10	23
Middle East	16	22	15	15	23	12
Asia	13	18	16	15	20	19

Intermediate demand and intersectoral linkages

- I. The growth of intermediate demand for BS and the changing structure of intersectoral linkages (I-O coefficients) explain the growth of BS (Francois, 1990; Guerrieri and Meliciani, 2005; Savona and Lorentz, 2005; Francois and Woerz, 2007)
- II. Proximity and agglomeration economies might depend also on the nature of intersectoral linkages between BS and the user industries (face-to-face contacts and close spatial interaction Antonietti and Cainelli, 2007; Muller and Zenker, 2001)
- III. Intermediate demand and forward linkages might affect the location of BS (i.e. near their customers' location)

Share of BS in Total Industry Output ...

Above average manufacturing Industries		Share	Above average service industries		Share
Printed matter and recorded media		8.2%	Computer and related services		19.5%
Chemicals and chemical products		8.1%	Other business services		17.5%
Office machinery and computers		8.0%	Research and development services		13.9%
Tobacco products		7.6%			
Radio, television and communication equipment and apparatus		7.3%			
Medical, precision and optical instruments, watches and clocks		6.4%			
Average manufacturing Industries		Share	Average service industries		Share
Machinery and equipment n.e.c.		5.0%	Insurance and pension funding services, except compulsory social security services		10.5%
Electrical machinery and apparatus n.e.c.		4.8%	Services auxiliary to financial intermediation		9.0%
Other transport equipment		4.8%	Wholesale trade and commission trade, except of motor vehicles and motorcycles		8.9%
Rubber and plastic products		4.5%	Post and telecommunications services		8.1%
Food products and beverages		4.4%	Renting of machinery and equipment without operator and of personal and household goods		8.0%
Furniture; other manufactured goods n.e.c.		4.2%	Financial intermediation services, except insurance and pension funding services		7.7%
Wearing apparel; furs		4.1%	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel		7.6%
Other non-metallic mineral products		4.0%	Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods		6.7%

...continued

Below average manufacturing industries	Share	Below average service industries	Share
Motor vehicles, trailers and semi-trailers	3.9%	Supporting and auxiliary transport services; travel agency services	5.3%
Pulp, paper and paper products	3.7%	Water transport services	5.2%
Recovered secondary raw materials	3.5%	Air transport services	4.5%
Fabricated metal products, except machinery and equipment	3.4%	Hotels and restaurants services	4.1%
Textiles	3.3%	Real estate services	3.5%
Leather and leather products	3.0%	Land transport; transport via pipelines services	3.3%
Basic metals	2.8%		
Wood and of products of wood and cork (except furniture); articles of straw and plaiting materials	2.3%		
Coke, refined petroleum products and nuclear fuels	2.0%		
<i>Average</i>	<i>4.7</i>		<i>8.4</i>
<i>Standard Deviation</i>	<i>1.9</i>		<i>4.5</i>

Source: EUROSTAT Input-Output database

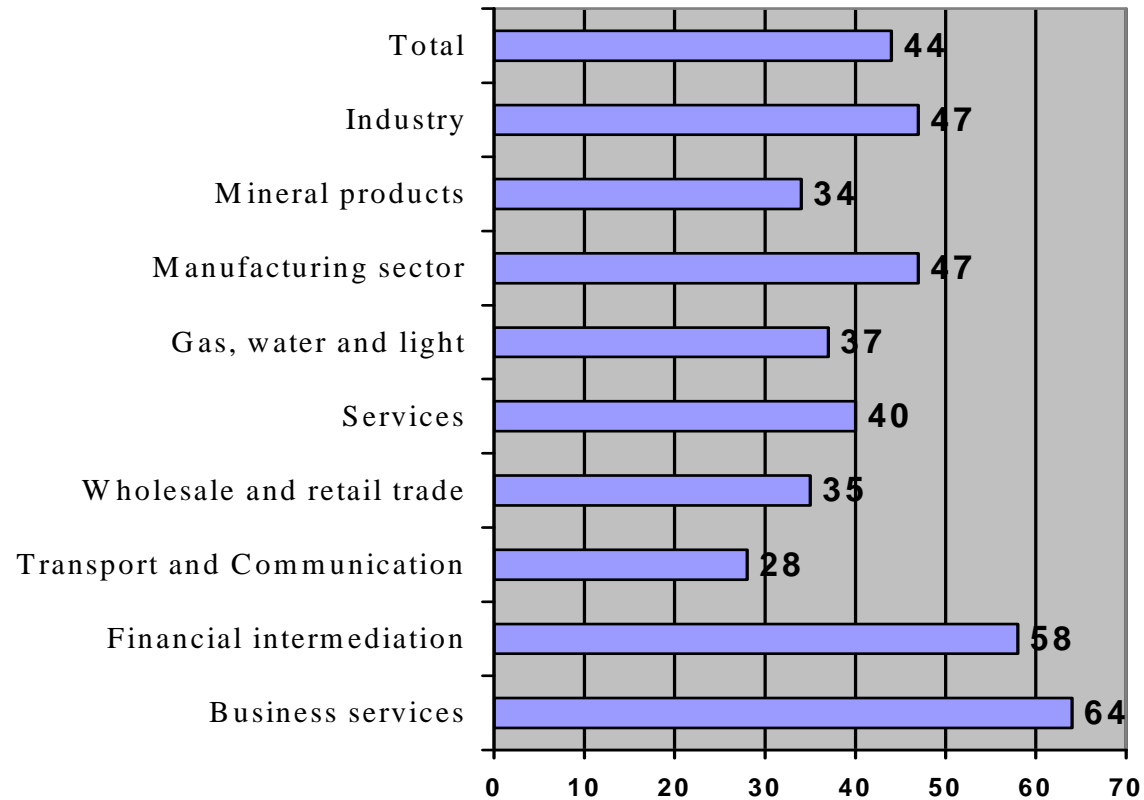
Notes: Industries are defined as above (below) average when the share is higher (lower) than the average plus (minus) (1/2)*standard deviation.

Technology and human capital

- I. BS have turned into KIBS: the vision of services as technological laggard is outdated (Miles, 2001 and 2005)
- II. High innovation intensity of BS empirically supported by the flourishing CIS-based literature (Evangelista, 2000; Cainelli et al., 2006)
- III. BS intensive users of highly skilled human capital (Kox and Rubalcaba, 2007), educated in both science and engineering and 'soft' disciplines (Abreu et al., 2008)

Innovation intensity in BS (EU CIS3)

Figure 1: Share of innovative firms across sectors, EU
1998-2000

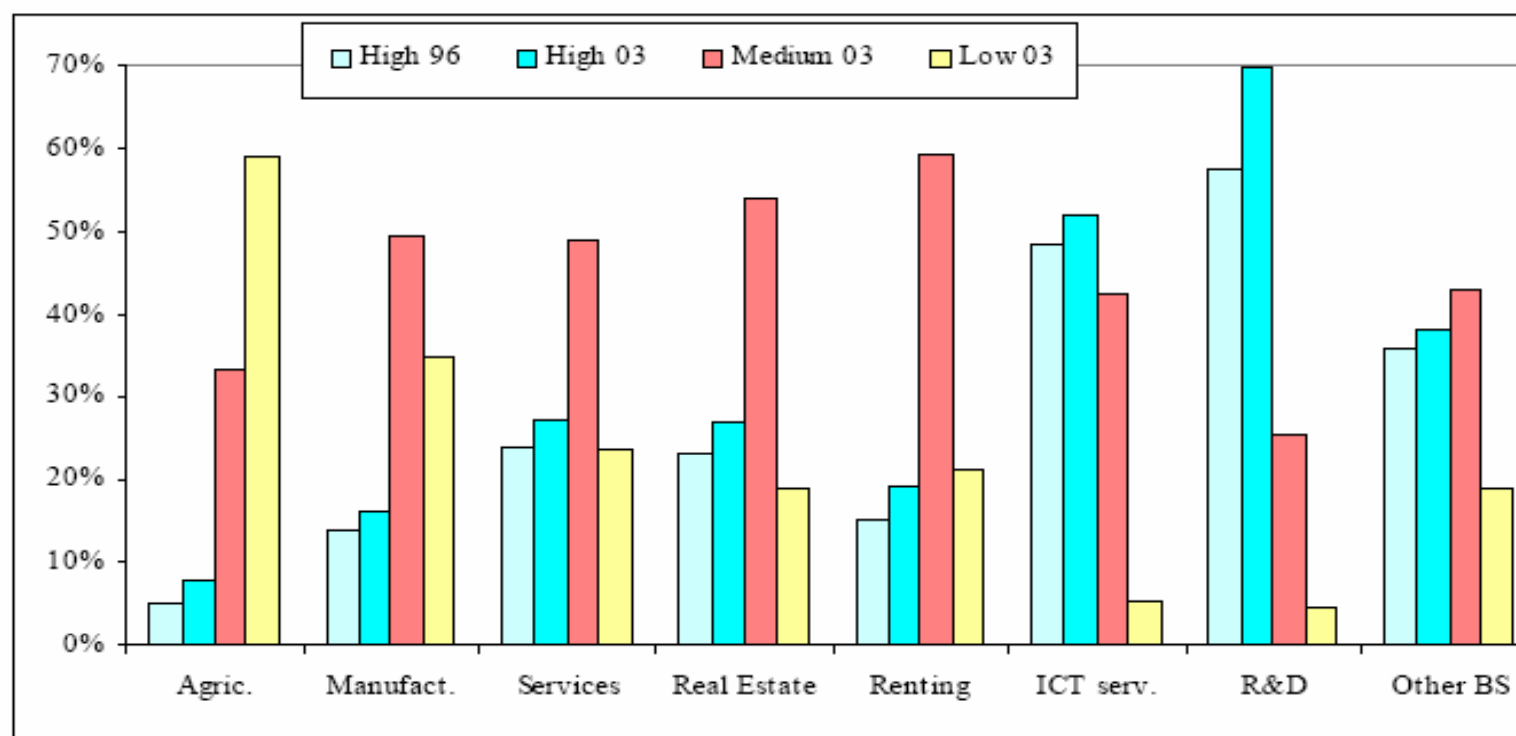


Source: Eurostat Third Community Innovation Survey, 2004

Note: business services are: Information services, R&D services, engineering and consultancy

Human capital in BS (EU Labour Force Survey)

Figure 2: Education attainment levels in business services compared to other economic activities, EU15, 1996 and 2003



Source: Kox and Rubalcaba (2007b), calculated on the basis of data from European Labour Force Surveys

Explaining BS specialisation: determinants

- I. Nature of inter-sectoral linkages and role of intermediate demand
- II. Technological innovation-related determinants, role of R&D and ICT
- III. Role of human capital and high skilled reservoir of employment
- IV. Agglomeration economies (Capital cities, population density)

Formalising the conjectures: The econometric model

Equation for specialisation in Business services:

$$BS_{it} = \alpha_1 INTDEM_{it} + \alpha_2 TEC_{it} + \alpha_3 HC_{it} + \alpha_4 AGGL_{it} + e_{it}$$

List of variables (I)

BS_{it} : share of employment in business services over total employment of region i at time t

$INTDEM_{it}$: weighted sum of employment in above average users manufacturing industries (Table 1) over total regional employment. Weights are given by the average (across countries) share of Business services in total industry output as computed from Eurostat symmetric Input Output tables

TEC_{it} : technology-related variables including:

(i): R&D expenditures over GDP;

(ii): Patents in ICT over population;

List of variables (II)

HC_{it} : share of population with tertiary education

$AGGL_{it}$: proxy of agglomeration economies, including:

- (i) the share of population over the regional area (population density);
- (ii) dummies for regions where capital cities are located.

Country and time dummies are also included

The most BS specialised NUTS2 regions and...

Code	Region	CA
Uki1	Inner London	5.81
be1	Région de Bruxelles-Capitale	3.54
es3	Comunidad de Madrid	3.14
fr1	Ile de France	2.98
Ukj1	Berkshire, Bucks and Oxfordshire	2.68
nl31	Utrecht	2.48
pt17	Lisboa	2.41
nl32	Noord-Holland	2.21
Ukh2	Bedfordshire, Hertfordshire	2.19
de6	Hamburg	2.11
Ukj2	Surrey, East and West Sussex	2.05
de71	Darmstadt	2.03
fr71	Rhone-Alpes	1.98
No01	Oslo og Akershus	1.95
Hu1	Kozép-Magyarország	1.95
Ukj3	Hampshire and Isle of Wight	1.95
at13	Wien	1.94
Ukd2	Cheshire	1.91
nl33	Zuid-Holland	1.89
de5	Bremen	1.88
ro08	Bucuresti (SRE 2002)	1.84
Ukd3	Greater Manchester	1.79
itc4	Lombardia	1.78
Ukk1	Gloucestershire, Wiltshire and Bristol/Bath area	1.71
Uki2	Outer London	1.70

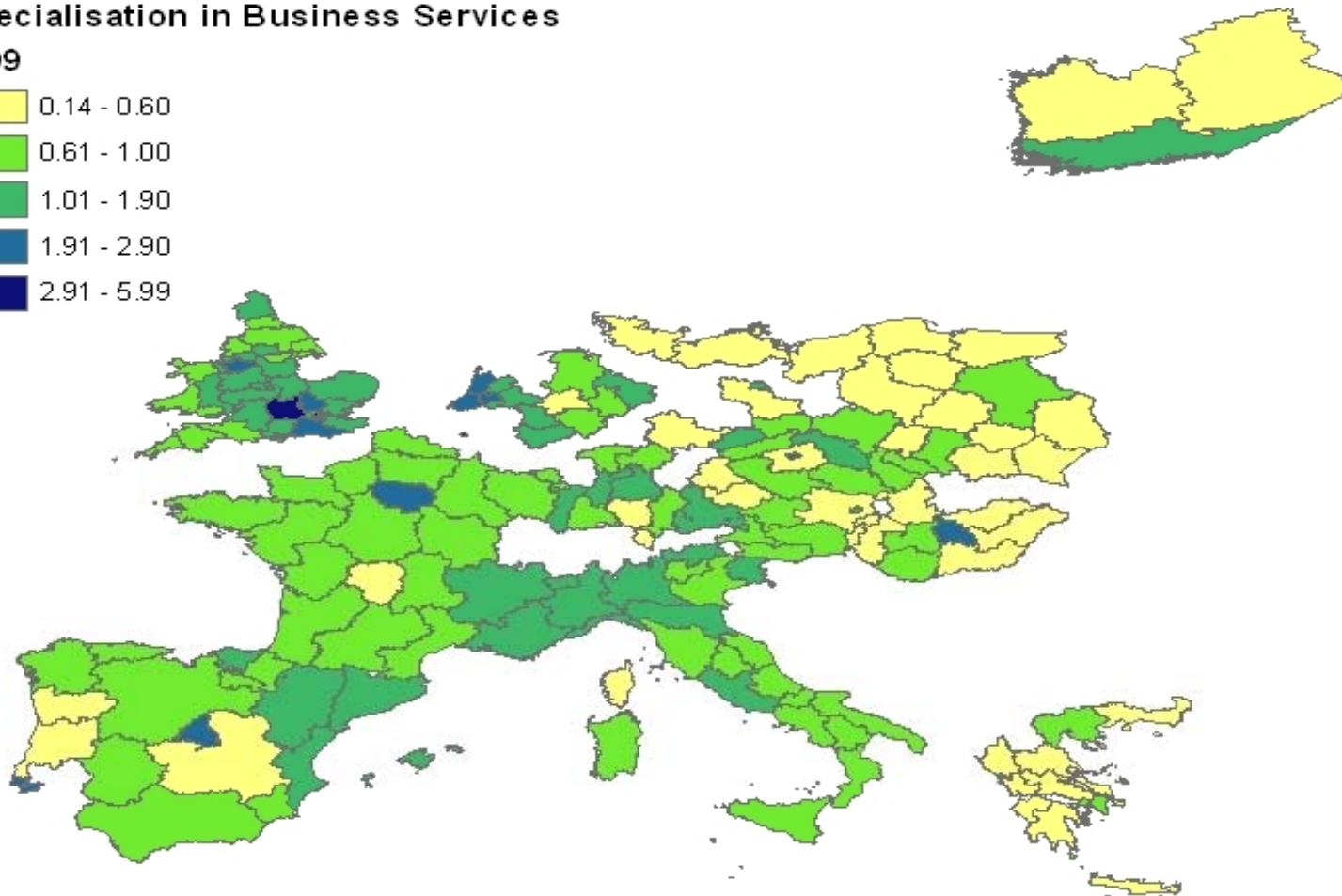
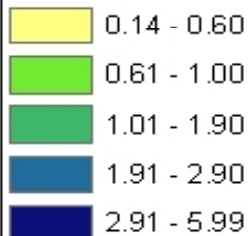
...the least BS specialised NUTS2 regions

Ukm2	Eastern Scotland	1.20
Ukd4	Lancashire	1.20
be31	Prov. Brabant Wallon	1.20
es21	Pais Vasco	1.19
itd5	Emilia-Romagna	1.18
Dec	Saarland	1.16
itd2	Provincia Autonoma Trento	1.15
itc2	Valle d'Aosta	1.15
nl12	Friesland (NL)	1.14
uke2	North Yorkshire	1.11
ite1	Toscana	1.10
itd4	Friuli-Venezia Giulia	1.09
Ukk4	Devon	1.09
gr3	Attiki	1.08
Ded3	Leipzig	1.07
ukc1	Tees Valley and Durham	1.06
pl12	Mazowieckie	1.06
fi18	Etela Suomi	1.05
Ukg2	Shropshire and Staffordshire	1.05
nl34	Zeeland	1.04
at31	Oberosterreich	1.04
itd3	Veneto	1.02
dea4	Detmold	1.02
ite2	Umbria	1.01
pt3	Region Autonoma da Madeira (PT)	1.00

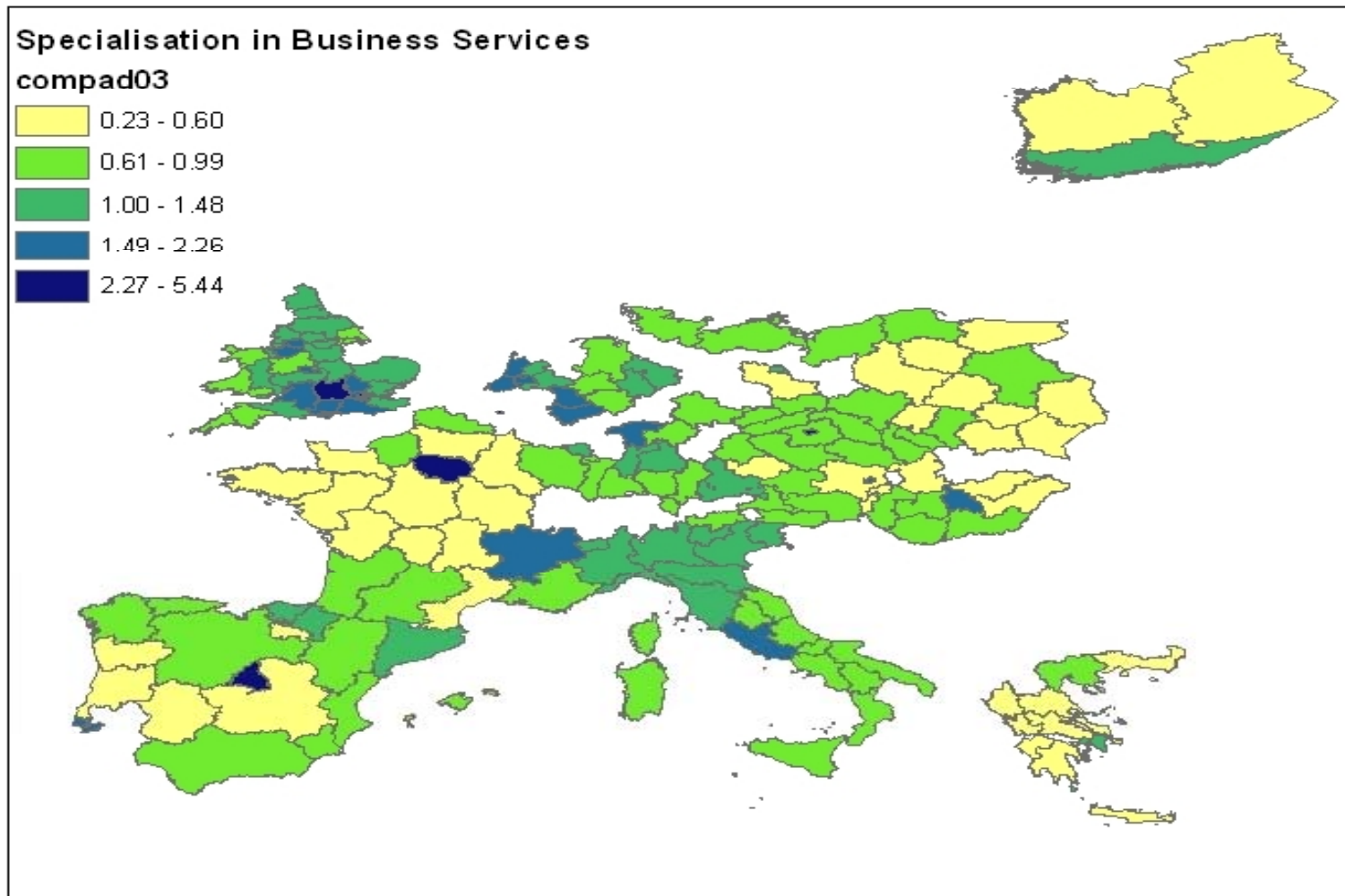
Specialisation in BS in the EU regions - 1999

Specialisation in Business Services

1999



Specialisation in BS in the EU regions - 2003



The EUROSTAT REGIO database

- I. Number of persons employed at the sectoral level (NACE Rev. 1.1) for a sample of European regions at various levels of aggregation (NUTS 1 and 2) over the period 1995-2005.
- II. Sectors included (dependent variable BS_{it}): Computer and related services (K72); R&D services (K73); Other Business services (K74).
- III. Unbalanced sample of 259 NUTS2 regions in 14 countries: Austria, Belgium, Czech Republic, Germany, Spain, Finland, France, Greece, Hungary, Italy, Netherlands, Poland, Portugal, and United Kingdom over the period 1999-2003

Results

<i>Method of estimation</i>	<i>Pooled Generalised Least Squares</i>		<i>Arellano-Bond dynamic panel data estimator(differences)</i>	
Variables	Coefficient	z-ratio	Coefficient	t-ratio
Specialisation lagged			-0.393***	-3.31
Potential manufacturing demand	6.358***	9.08	16.18*	1.71
Share of population with tertiary education	0.436***	8.46	3.255***	3.71
Patents in ICT over population	0.352***	5.12	0.276***	2.95
R&D over GDP	0.172	0.27	6.519***	2.53
Population density	0.023***	5.77	5.202***	14.38
Regions with capital cities	60.99***	11.70		
	Wald $X^2=1804.34$		Wald $X^2=254.32$	
			Sargan test $X^2=3.46$	
			ArellanoBond AR(1) $z=0.46$	

Notes: Estimates are heteroscedasticity-consistent. *, **, *** indicate significant at the 10%, 5% and 1% levels respectively. Country and time dummy variables are included. Coefficients cannot be interpreted as elasticities.

Summary and preliminary discussion

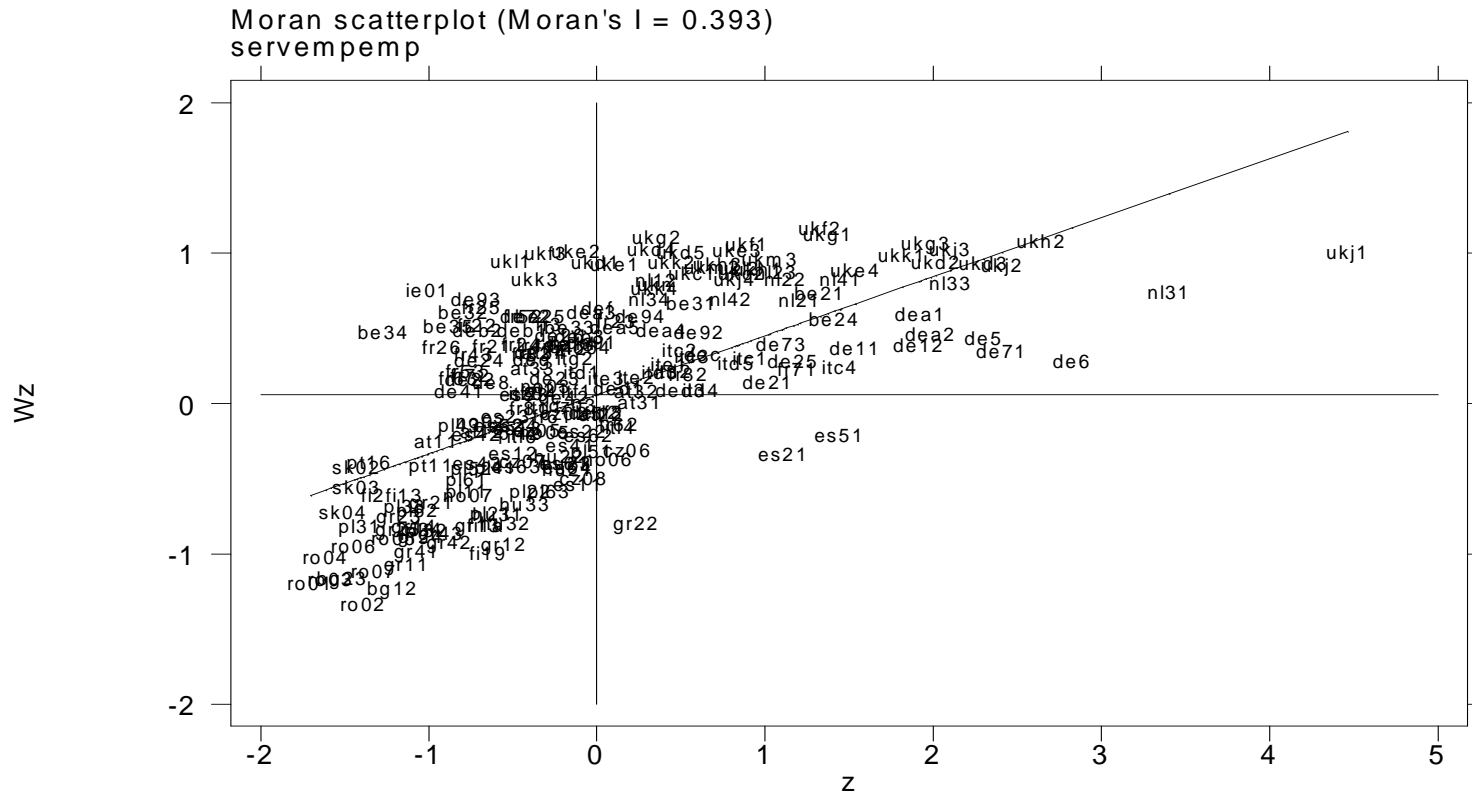
- I. Knowledge intensive services (BS) concentrate in - but are not only an exclusive of - capital cities regions
- II. The sectoral structure of industry affects regional BS specialisation (Manufacturing still matters!)
- III. Technology and human capital regional availability are both a necessary condition to BS growth

Next steps and research agenda

- I. Testing for spatial effects in services' specialisation
- II. Refining the indicators for human capital and technology intensity (Eurostat EU CIS4-5)

Spatial correlation (Moran's Scatterplot) (I)

Figure 3: Specialisation in BS across European regions: Local Spatial Autocorrelation (Moran Scatterplot - Moran's I = 0.393)



Source: EUROSTAT Regio database

Notes: Distance band between 0.0 and 7.0; Regions with capital cities have been excluded.

z = vector of BS specialisation (deviation from the regional mean)

Wz = Spatial lag of BS specialisation