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Job creation in business services: innovation, demand, polarisation

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Abstract

The patterns and mechanisms of job creation in business services are investigated in this article by considering the role of innovation, demand, wages and the composition of employment by professional groups. A model is developed and an empirical test is carried out with parallel analyses on a group of selected business services, on other services and on manufacturing sectors, considering six major European countries over the period 1996-2007.

Within technological activities, a distinction is made between those supporting either technological competitiveness, or cost competitiveness. Demand variables allow identifying the special role of intermediate demand.

Job creation in business services appears to be driven by efforts to expand technological competitiveness and by the fast growing intermediate demand coming from other industries; conversely, process innovation leads to job losses and wage growth has a negative effect that is lower than in other industries. Business services show an increasingly polarised employment structure.

JEL Classification: J20, J23, O30, O33

Keywords: Business Services, Innovation, Employment

1   Introduction

In recent decades a number of service industries closely linked to business activities in the rest of the economy – *business services* – have shown a strong dynamism in terms of innovation and employment growth; they create and diffuse knowledge, are extensive users of ICTs and have a strong impact on the activity of manufacturing and other services; in this way they are emerging as potential drivers of economic growth and job creation.

A large literature has recently emerged on the importance and potential of business services in advanced economies, emphasising the outsourcing of activities from manufacturing and the rise of knowledge-based activities with a potential for spreading innovations across all the economy (see, among others, Kox, 2001; Miles, 2007).

From a European policy perspective, the growing interconnections between business services and manufacturing require a deep analysis of dynamics of these industries, in order to achieve a better calibration of industrial policies.[1]

In this article we identify the subset of service industries that share the above characteristics and contrast them with other services and manufacturing sectors, focusing on six major European countries - Germany, France, Italy, The Netherlands, Spain and the UK - over the period 1996-2007. After considering the patterns of growth for value added, employment, productivity, innovative activities and qualification of jobs in terms of professional categories, we identify the following industries as *business services:* Post and Telecommunications (NACE Division 64), Renting of Machinery and Equipment (NACE Division 71), Computer and Related Activities (NACE Division 72), Research and Development (NACE Division 73), and Other Business Activities (NACE Division 74).

While some heterogeneity exists within this group, they systematically outperform other services and manufacturing sectors in the aspects listed above (as will be shown in section 3) and share a key role as providers of high-value inputs to the rest of the economy (on this role, see Evangelista, Lucchese and Meliciani, 2011). In the six countries we investigate, this group of *business services* accounts for 14% of value added and 15% of employees in 2007, but their employment growth has been much faster than that for the whole economy.

Financial services, banking and insurance are omitted from this definition because their growth has been highly dependent - especially in some countries - on speculative bubbles that have led to the 2008 crises and job creation has been illusory. Moreover, their innovative stance has been more limited and restructuring practices were significant well before the crisis

exploded. We consider these industries in the aggregate of 'other services' as a term of comparison alongside manufacturing, for the performances of business services.

The key question we address in this article is why have business services been able to achieve such results in terms of job creation? What are the mechanisms that have supported such performances? And how do they differ from the mechanisms operating in other services and manufacturing?

The literature on structural change provides us with a strong perspective for investigating such patterns. We can expect technological change on the supply side and its growth on the demand side to be two major forces driving the business services' growth (Pasinetti, 1993).

We develop a model and carry out empirical tests that build on this approach, but also consider important novelties from different streams of research. First, from innovation studies, we adopt the distinction between innovative efforts aimed either at *technological competitiveness*, based on innovation in products and markets, or at *cost competitiveness*, relying on supplier-driven process innovations (Pianta, 2001). These strategies represent different technological trajectories that help explain the evolution of different industry groups. A large literature has shown that these strategies have contrasting effects on employment at the industry level, with the former supporting job creation and the latter leading to job losses (Pianta, 2005; Mastrostefano and Pianta, 2009; Bogliacino and Pianta, 2010).

Second, the demand side is considered; the relationship between demand, productivity and employment has mainly been studied for manufacturing industries and we are careful to consider both intermediate and final demand, and both domestic and foreign sources, in order to identify the key factors supporting employment growth. We have taken these data from Input-Output tables and especially examine business services' role in providing advanced inputs to other industries.

In fact, intermediate demand has been the fastest growing element of demand in European countries, reflecting an economic structure that has become less vertically integrated and more interdependent across sectors; business services have played a key role in this process. Moreover, the trade of intermediate goods has contributed to higher internationalisation, leading to production outsourcing and offshoring. In some service sectors internationalisation is low, foreign demand is modest and domestic markets remain crucial; the result has often been a low degree of competition and lower productivity growth. Our analysis will clarify the position of business services within this complex dynamics.

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[1] The relationship between manufacturing and associated services is quoted in the Industrial Policy flagship of Europe 2020 strategy, such as the role played by ICT and technology along the value chain.

Third, from labour market studies we consider the relevance of wage growth in order to test whether job creation in business services is affected by the 'neoclassical' trade off between wage and employment growth.

Fourth, we control for the market structure, using both a proxy of concentration (Herfindahl index) and the average firm size in the sector, in order to account for both competitive pressure and industry evolution dynamics (entry patterns, etc.).

Finally, given that recent literature has emphasised the *quality*, and not just the quantity, of employment, we consider the way employment is composed in terms of professional groups as important and examine events that have occurred in business services, comparing them to other services and manufacturing. In particular, we used data on the shares of four major professional groups – managers and professionals; clerks; craft workers; manual workers - and investigate the occupational structure's growing polarisation, with net job creation mainly in the top and bottom groups (Nascia and Pianta, 2008).

Different models are proposed in order to explain the driving forces of employment change in business services and other industry groups, highlighting mechanisms linked to technological strategies, demand dynamics and labour markets.

Empirical work and econometric tests are based on the database developed at the University of Urbino, the Sectoral Innovation Database (SID) (Lucchese and Pianta, 2011) which provides a broad description of different dimensions of industry activities. It integrates innovation data from EUROSTAT Community Innovation Surveys (CIS) with a large number of indicators on economic and demand variables from the OECD STAN database and the OECD Input-Output Tables. The SID dataset covers 22 manufacturing sectors and 17 service sectors - NACE REV.1 subsections - for six European countries - Germany, France, Italy, The Netherlands, Spain and the UK, which represent around 80% of the EU-12's value added during the two decades under consideration.

The paper is organised as follows: Section 2 reviews the existing literature on business services and employment; Section 3 offers a descriptive analysis on the dynamics of business services and their employment structure, considering the role of innovation and demand; Section 4 presents the model and the econometric strategy; Section 5 shows the results; and Section 6 provides a conclusion.

2 Literature review

2.1. The growth of business services

In the last decades, the weight of business services in the economy has rapidly grown. Many studies have analysed the determinants, with different levels of analysis pointing out the diversified patterns across time and countries.

Kox (2001), Kox and Rubalcaba (2007) and Miles (2007) offer an exhaustive description of channels through which business services have risen in the last decades both in terms of value added and employment growth. Their rise is related to activity outsourcing, which were previously carried out within manufacturing firms. In this case, job creation and value-added growth in the business services industry have replaced the drop in manufacturing production.

As business services emerge as independent activities, their innovative potential becomes stronger, supported by a high level of interaction between upstream and downstream firms: business services supply 'intangible assets' that contribute to specialising productive processes. The use of these inputs imply a "different way of organising social production, allowing a better spread of the advantages of knowledge specialisation, more external scale economies, and a higher-level growth path".[2] In this way, the nature of the intermediate relationships between firms seems to have changed, supporting the possible expansion of value added.

Through the use of Input-Output Tables, some exercises of decomposition have documented the importance of the role of other sectors' intermediate demand in business-service growth. Other studies have emphasised the rise of final demand, showing a further evolution of relationships between services and end users. In the 1990s, the growth of business services was also related to deregulation and privatisation of economic activities, which led to the rise of private specialised suppliers, replacing activities formerly carried out by the public sector (Kox, 2001; Pilat and Wölfl, 2005; Savona and Lorentz, 2006).

In general, the strong growth of employment in business services has often been considered a by-product of the scarce productivity performances of these sectors. 'Baumol's disease' (Baumol, 1957) argues that the shift in employment from manufacturing to services is due to the structural productivity differential between the two sectors. While some studies have

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[2] Kox and Rubalcaba (2007).

shown that these dynamics are dependent on country and sectoral conditions (Baker, 2007), 'Baumol's disease' is involved by an increasing weight of services which could reduce overall economic system growth.

The specificity of business services – which often have higher productivity performances than 'traditional' services – has been pointed out. A major factor here is the importance of knowledge and innovation in business services, often related to the application and diffusion of ICTs; the provision of business services and the vast knowledge externalities that originate from the sector may contribute to better performances in the whole economy. These aspects and the diffusion of knowledge through the relationships that are established among industries have been documented extensively in the literature (Antonelli, 1999; Camacho and Rodriguez, 2007; Evangelista et al., 2011 in this special issue).

2.2. Innovation, demand, professions and employment

The literature reviewed above explains employment growth in business services as a result of the structural change in advanced economies. However, the importance of knowledge and innovation as a source of job creation in this emerging industry requires consideration for the role that innovation plays in affecting employment. Deeply discussed since the Classical Economics era, the relationship between technological change and employment has traditionally been empirically investigated only considering the manufacturing industry, starting with the pioneering works of Freeman, Clark, and Soete (1982) and Freeman and Soete, (1987, 1994).[3]

Studies focusing on the firm level have generally found a positive relationship between innovation and job creation (see for instance Van Reenen, 1997; Piva and Vivarelli, 2005; Piva, Santarelli and Vivarelli, 2005; Evangelista and Savona, 2003; Mansury and Love, 2008). Greenan and Guellec (2000) however find that the positive employment impact of product and process innovation at the firm level disappears at industry level (where only new products lead to new jobs).

In fact, innovative firms face no demand constraint and when they are more efficient – through either new products or processes – they can expand output and jobs also at the expense of competitors. Conversely, at the industry level the overall potential for job creation is constrained by increasing industry demand and by the dynamics of labour productivity.

Building on the Schumpeterian distinction between product and process innovation, Pianta

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[3] Surveys of current literature - with different perspectives and coverage - are in Addison and Teixeira, 2001; Acemoglu, 2002; Chennells and Van Reenen, 2002; Spiezia and Vivarelli, 2002; and Pianta,

(2001) has proposed a distinction between the strategies of *technological* or *cost competitiveness* and has suggested the need to consider demand factors for explaining employment outcomes. Such a distinction identifies the predominant orientation of sectors in terms of the nature of the innovative efforts produced. The strategy of technological competitiveness is associated with a general tendency to internal innovative activity, a prevalence of product innovations and a propensity to search for new markets; the cost competitiveness strategy is related to a prevalence of concerns about cost efficiency and labour saving process innovations. This distinction is based on the idea that the economic sectors are characterised by a different technological trajectory that shapes the perspective of sectors' growth. In fact, it is the unfolding of these trajectories that brings about a variety in growth performance of sectors and, as a consequence, a continuous change in economies' internal structure. This approach has been integrated with the consideration of demand factors, in order to account for the need of 'demand-pull' effects for creating the conditions for achieving innovations' potential and supporting job creation.

Following this approach, the technology-employment link has been investigated at the industry level by studies that have extensively used evidence from innovation surveys. Vivarelli, Evangelista and Pianta (1996) and Pianta (2000, 2001) examined the weak European job performance in the 1990s, showing it to be related to low levels of product innovation, stable wages and low-demand dynamics. Similar results are found in Antonucci and Pianta (2002) and Evangelista and Savona (2003); the latter study focuses on the employment patterns in service industries in Italy, where job creation occurs mainly in small, technology-driven firms. Mastrostefano and Pianta (2009) examine the effects on employment that result from different types of innovation, labour market factors, and demand dynamics. When the analysis of the impact of innovation on job creation is studied in the long-term, the 'neoclassical' negative relationship between wage and job growth seems to be less relevant, while the 'Schumpeterian' job creating effect on innovation's market impact emerges as a major factor.

This research has been extended to services in Bogliacino and Pianta's study (2010), where the relationship between technological regimes and patterns of employment growth is studied through the introduction of a Revised Pavitt Taxonomy. The latter is able to describe the different technological opportunities of manufacturing as well as service sectors. Again, the results show that product innovation has a positive impact on employment in Science-Based and Specialised Suppliers sectors – both in manufacturing and in services – while labour-saving effects prevail in the case of sectors more oriented towards process innovation (Scale and Information Intensive and Suppliers Dominated sectors). In identifying the mechanisms of job creation, the general distinction between manufacturing and services appears less

2005.

relevant than the specificity of each Revised Pavitt class.

Other studies have focused on the role of demand in supporting technological change and performances, showing its crucial role in creating the conditions for growth (Crespi and Pianta, 2008; Bogliacino and Pianta, 2008 and 2011).

Finally, a growing literature has addressed changes in the *relative* composition of employment by professional skills (Acemoglu, 2002). The dominant interpretation is that the emergence of new technologies has led to a pattern of *skill-biased technological change* as innovations replace unskilled labour with workers with higher competences, which are complementary to the new technologies. Job opportunities for blue collar workers in the labour market worsen and the resulting inequality is presented as a 'natural' effect of technological change.

More recent studies focused on the ability of computers to replace routine-task workers, while activities such as decision making (by managers) and menial jobs (such as cleaning, by the least-skilled workers) cannot be automated. The outcome is a polarised employment structure where the share of middle skills is falling (Autor et al., 2003; Autor et al., 2006; Autor and Dorn, 2010; Moose and Manning, 2007).

A more detailed investigation has used data on employees by professional qualifications in 36 manufacturing and service industries for five EU countries, considering four professional groups: Managers, Clerks, Craft workers and Manual workers (Nascia and Pianta, 2008).

Distinct patterns emerge when industries are grouped based on their patterns of technological change, i.e. *technological competitiveness* in high innovation industries and *cost competitiveness* in traditional sectors. The overall skill intensity is substantially higher in the former industry group, and from 2000 to 2003 a clear employment polarisation pattern emerged, with more jobs being created for managers (+2% a year) and manual workers (+1.2%) and job losses for clerks (-0.2%) and skilled workers (-2%). Rather than a linear shift from low-skilled jobs to high-skilled, white collar employment, as predicted by the skill-biased hypothesis, a clear polarisation pattern is found. When the determinants of employment changes are explored separately in the four professional groups, different relationships emerge. Product innovation and higher education lead to more jobs for high-skill categories; process innovation and cost-reduction strategies destroy jobs for craft workers (*ibid.*).

Four main lessons can be drawn from such different streams of literature. First, the industry level is particularly appropriate to investigate the innovation-employment link as it is able to take into account the overall patterns of structural change and the demand constraint that operates for industries. Second, there is a need to break down technological change into different strategies – *technological vs. cost competitiveness* – which have contrasting effects on employment. Third, the very relationships defined by models need be adapted to the specificities of industry groups characterised either by different technological trajectories or by

the particular nature of business services. Fourth, the quality of jobs has to be taken on board in the analysis, with attention to the professions and skills present in jobs created and lost. The approach we will follow herein will be based on these lessons from recent literature..

3   Empirical evidence

Job creation in services is not uniform. If we examine employment growth from 1996 to 2007 in the six major European economies (Germany, France, UK, Italy, Spain and The Netherlands) a substantial divide emerges between traditional and business-service activities. In Graph 3.1., services are grouped by Trade and Leisure (NACE Divisions 50-55), Transport and Storage (NACE Divisions 60-63), Finance, Insurance and Real Estate (NACE Divisions 65-70) and Business Services (NACE Divisions 64, 71-74): the latter grow twice as much as other services do, while the rising weight of finance in the economy is not matched by a rapid growth in employment. The variability within macro sectors is however not negligible: in business services, Post and Telecommunications have experienced void employment dynamics, while Computer and Related Activities grew 7% per year on average among the countries considered. Other Business Activities (NACE Division 74), which represents more than half of employment of all business services, grew 5%.

This pattern looks stable among the countries: business services show higher dynamics than overall services; the gap is marked for Germany, where their growth is twice as much as the growth in the whole service sector. The higher services' growth rates as a whole in Spain and Italy are associated to the late development of the tertiarisation process. A more detailed picture for each service industry is provided in the Appendix.

Graph 3.1. Compound annual rates of employment growth from 1996 to 2007. Averages among countries and sectors.
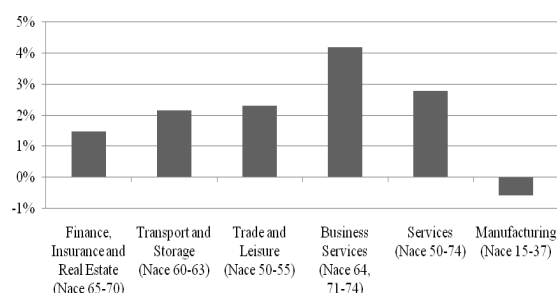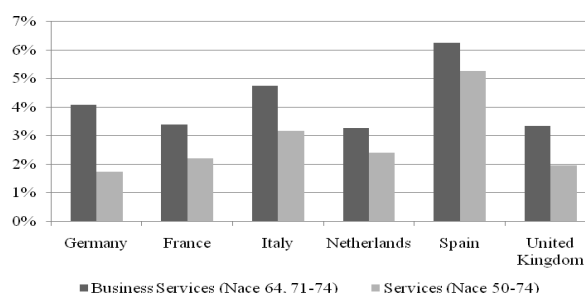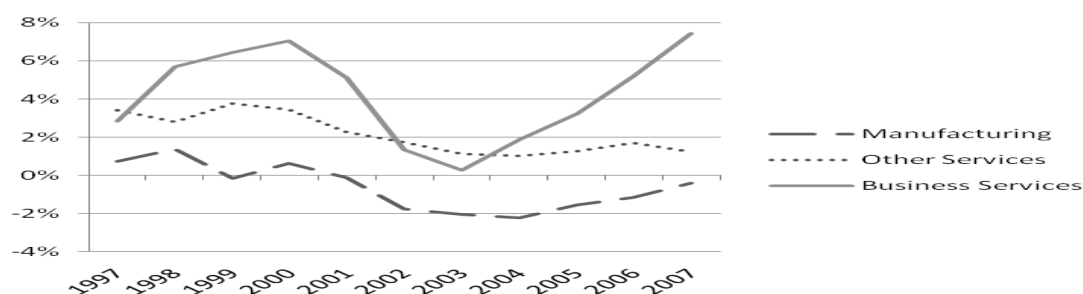
Source: SID database

Graph 3.2. explores the employment dynamics from 1996 to 2007, considering the trend of the manufacturing sector, overall services and business services. Their dynamics appear to be similar, although the performance of manufacturing is strickingly lower than that of services: from 2000 to 2007, the European manufacturing system has destroyed a large quantity of jobs, replaced by a recovery in service and (especially) business services industries. The latter have strongly suffered the economic crisis from 2000 to 2003 and have not returned to rapid growth until 2007.

Graph 3.2. Annual rates of employment growth. Average values among countries.
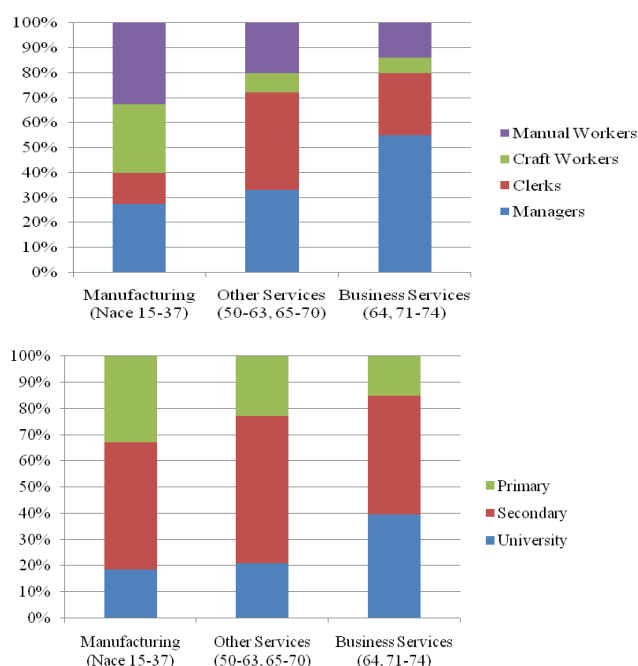

Source: SID database

Looking at Graph 3.2., three phases of development can be identified: from 1996 to 2000 there is a strong employment growth in services, pushed by job creation in business services; from 2000 to 2003 the destruction of employment in manufacturing is not counterbalanced by a growth of employment in services; from 2003 to 2007 manufacturing reduces its job losses and a strong divergence emerges in the formation of employment between traditional and business services. The dynamics of business services seem to be more subject to the economic cycle than other services, as Kox and Rubalcaba (2007) have suggested: this

seems to be due to the high integration of business services with the manufacturing sector and to a high level of labour flexibility.

The different growth of services brings about a change in the qualitative development of jobs offered.[4] Many studies have in fact focused on a change in the composition of skills required following the structural change process.

Look at the composition of employment by professions (Graph 3.3.) in 2000. Manufacturing and services are characterised by a different composition: services are marked by a higher share of Managers and Clerks while Craft and Manual workers constitute the greater part of manufacturing employment. Educational levels distribution is obviously related to differences in professions. A general process of up-skilling is present in all sectors, although the differences between manufacturing and services seem to be less relevant. Additional evidence on the employment change rates in each of the four professional groups is provided in the Appendix.

Graph 3.3. Composition of employment in 2000 by professions and by education. Averages across countries.

Source: SID database

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[4] Due to the availability of data for professions and educations, five countries are considered here (The Netherlands are excluded) for a reduced period of time, from 2000 to 2003. Professions are grouped by Managers and professionals, Clerks, Craft Workers and Manual Workers (based on the International Standard Classification of Occupations ISCO88 COM nomenclature at one digit level). Educational levels are classified by university, secondary and primary education (according to the ISCED nomenclature at one digit level).

Besides these patterns concerning the quantity and quality of employment, it is also important to consider how demand evolves. Business services are strongly dependent on intermediate demand, while other services rely on final consumption and manufacturing industry shows equal share of intermediate demand and exports. The evidence is provided in Graph A3 in the Appendix. These different demand patterns have important consequences on our explanation of employment growth determinants in business services as opposed to the rest of the economy.

4   The model and econometric strategy

This section explores the factors contributing to job creation in Europe, linking supply and demand factors. The potential for job growth can be reduced by the occurrence of restrictive conditions on demand which sharpen the results of the technological competition among firms and sectors. Through the information drawn from the Input/Output Tables from OECD, we can break down the different demand components and study their impact on employment growth.

The innovative activity of sectors is investigated by considering the dominance of a strategy based on *technological* and *cost competitiveness* (Pianta, 2001). These strategies are supposed to have contrasting effects on employment. On the one hand, technological competitiveness, rooted in quality advantages and the introduction of new products, opens up new opportunities for demand and employment growth, although this effect can be counterbalanced by the formation of monopoly rents that can reduce the creation of value added. On the other hand, cost competitiveness, based on process innovation, engenders productivity improvements which are largely due to job losses. A positive effect on employment can also result from reduced prices that can stimulate new demand. However, the prevailing of the first strategy over the latter is generally supposed to provide higher job creation opportunities.

Employment growth is also dependent on *the dynamics of demand*. When its composition is considered (household and intermediate consumption, investments, and exports), different competitive regimes are acknowledged. The manufacturing sector is associated with a strict international competition which asks for a continuous search for higher levels of productivity in order to sustain exports growth. Service sectors are related to internal demand and to the process of rising fragmentation of production where competitive pressure is obviously

reduced.

Interestingly, the Sectoral Innovation Database links all of these factors in a single framework.

4.1. Methodology

The following equation is estimated:

$$emp_{it} = \alpha_0 + \alpha_1 tc_{it} + \alpha_2 cc_{it} + \alpha_3 d_{it} + \alpha_4 w_{it} + u_{it} \qquad (1)$$

where *emp* is the sector's employment level, *tc* represents the accumulated knowledge related with technological competitiveness strategy, *cc* is cost competitiveness, *d* is demand and *w* is the wage; *i* and *t* stands for industry and time, respectively. The model is estimated at industry level for various countries so the individual observation is a certain industry in a given country. Our main object is to identify the effect of technology and demand. A typical issue is that the error term *u* may be correlated with the regressors, because of time-invariant effects or issues of simultaneity and/or omitted variables.

If we think of variables in the log scale, we know that by taking the differences we approximate the rate of change. Through this transformation we eliminate the individual time-invariant effect (we also control for all time-invariant characteristics, such as country-level institutional determinants which are likely to play a role) and we can exploit the lag structure to avoid simultaneity.

Technically, we take long differences (e.g. Caroli and Van Reenen, 2001; Piva *et al.,* 2005), i.e. differences over a large time span, in order to soften considerably the autoregressive pattern, which would weaken the validity of the lags. As the log difference approximates the rate of variation, making the average is just a linear transformation of it (not affecting the main estimators' properties), we calculate average rate of change which allows us to merge the different data sources, which have slightly different time spans.

The model is adjusted for heteroscedasticity (robust estimation) and intra-group correlation at the industry level, checking for intra-sectoral heterogeneity.

Moreover, weighted regressions are used since industry data are typically grouped data of unequal size; this provides us with more time-wise stability.

The baseline model becomes:

$$\Delta emp_{it} = \alpha_1 \Delta tc_{it} + \alpha_2 \Delta cc_{it} + \alpha_3 \Delta d_{it} + \alpha_4 \Delta w_{it} + \Delta u_{it} \qquad (2)$$

where the dependent variable is the rate of growth of employment, the variation in the knowledge stock associated with the technological strategies can be proxied by flows

variables coming from innovation surveys, demand growth is measured through the growth rate of different sources of demand, *w* is the growth rate of labour compensation per employee and the last part is the error term, in which the individual time-invariant effects are eliminated. Following our conceptual framework, we expect the following relationships to emerge:

1) Proxies for technological competitiveness (the share of firms indicating clients as source of innovation and the share of firms internal source as determinants for innovation) are expected to have a positive effect on job growth. Employment growth is stimulated by the greater demand for new products; the positive effect of the new demand is supposed to prevail on the effects of reduced production due to forming possible monopoly rents in the consumer market and/or replacing effects for old products;

2) Indicators of cost competitiveness (the share of firms aiming to reduce labour costs and the share of firms who indicate suppliers as source of innovation) are expected to have direct labour saving effects. The effect on prices due to increased productivity can however partially or totally overcome the reduced employment that derives from recourse to a strategy based on process innovations.

3) Demand variables are expected to have a positive effect on employment; however, while exports are supposed to drive productivity and employment growth in manufacturing, employment growth in services is prevalently associated with the growth of intermediate and household consumption. In sectors where the role of new information technologies is more intensive and a sustained growth in terms of value added can be observed, economic growth is principally linked to changes in the production structure that leads to high intermediate demand from the rest of the economy: 70% of business-service demand only comes from other sectors.

In terms of control variables, we expect an inverse relationship between wages (labour compensation growth rate per employee) and employment creation. Labour demand can increase when labour costs decrease.

We also ran further robustness checks to control for the market structure of industries; we expect concentration to be negatively related with growth, through a standard lack of competitive pressure effect. We also add a control for the firm's average size in the sector: we expect it to be negatively correlated with growth for the most dynamic industries, where jobs are disproportionately created by new (and usually very small) firms (Haltiwanger et al., 2010).

4.2. Data

The analysis considers six countries, Germany, France, Italy, The Netherlands, Spain and the United Kingdom for 21 manufacturing and 17 service sectors.

The model is distinctly examined for manufacturing and services sector. In order to differentiate the dynamics of services, we isolate the effects of business services from other services. Industries classified as 64 and 71 to 74 by NACE Rev. 1.1 form the first category, while industries 50, 51, 52, 55, 63, and 65 to 67 are classified as other services. Whenever we want to separate the effects among groups of industries we run the regressions on the overall database but allowing for different coefficients. Although the estimates are exactly the same as those obtained from regressions over the different groups of observations, the estimates are more efficient if we use the overall sample, given the number of the degrees of freedom.

We believe the time structure deserves a specific comment. We merge three different data sources (STAN OECD database for employment growth, OECD I-O Tables for demand variables and CIS data for innovation measures). Having three waves of Input/Output available (1995, 2000 and 2005) allowed us to consider the demand growth rates for two periods, 1995-2000 and 2000-2005. In fact, the employment trend described in Section 3 suggests that business cycle impact should remain in the data. We decided not to include the 2001-2003 recession and focus on two periods of employment growth. We excluded CIS3 data and focused on the impact of innovation variables in CIS2 and CIS4 on employment performance in 1996-2000 and 2003-2007 (in order to consider a lag in the impact of innovation).

The temporal structure is shown in the following table:

Table 1. The database structure

Type of variable	Reference years	
	Period 1	**Period 2**
Innovation activities	CIS2, 1994-1996	CIS4, 2002-2004
Employment growth (growth rates)	1996-2000	2003-2007
Industries' demand (growth rates)	1995-2000	2000-2005
Wage	1996-2000	2003-2007

As we can see, data from Innovation surveys always precede data on employment; with regards to demand, data for the first time started one year before, and data for the second period finished two years before.

As a further check, the possibility of multicollinearity is checked through the Variance-Inflation-Factor (VIF) analysis. A preliminary analysis on the distribution of variables has allowed possible extreme values to be dropped. Moreover, only the significant differences of variables are considered. The presence of outliers does not affect the values of coefficients in every model.

The technological proxies extracted from the extensive information in CIS are chosen

depending on availability (in order to avoid gaps in the dataset, especially with regards to service industries) and low number of outliers.

5 Results

5.1. Baseline regressions

First, we ran a general regression with the baseline model.

Table 2. The general model
Source: SID. Dependent variable: rate of change in total employment. Standard errors are robust and clustered by industry, reported in brackets. [*] is significant at 10% level, [**] at 5% and [***] at 1% level. Weights are the number of employees.

	WLS
Share of firms that indicate internal source for innovation	0.043 [0.019][*]
Share of firms that innovate to reduce labour cost	-0.042 [0.017][**]
Average rate of growth of labour compensation per employee	-0.477 [0.163][***]
Export growth rate	0.037 [0.027]
Intermediate demand growth rate	0.202 [0.051][***]
Household consumption growth rate	0.074 [0.032][**]
Constant	0.433 [0.560]
Observations	349
F-test (*P* value)	9.31 (0.000)
R2	0.236

As we can observe, the technological and cost competitiveness effect is comparable in magnitude but with negative sign. An increase by one in the share of firms indicating internal sources for innovation will add 0.04 percentage points to the average employment growth, while the opposite will happen if the share of firms that choose labour saving strategy increases by one point.

Intermediate demand has the highest impact: 1% increase raises by one fifth of percentage point the annual compound rate of employment. Household consumption had the lowest impact, while export is not significant.

The wage term has a negative impact, through a standard labour-demand effect.

The first differentiation that we want to examine is between manufacturing and services. The results are in Table 3. If we use similar proxies for technological strategies in both manufacturing and services we can observe that variables are non-significant for manufacturing.[5] Other proxies that better fit the type of innovation of manufacturing industries, such as those focusing on the relationship with clients and suppliers in the search process clearly make the technological-cost competitiveness distinction emerge.

Table 3. Manufacturing versus services
Source: SID. Dependent variable: rate of change in total employment. Standard errors are robust and clustered by industry, reported in brackets. [*] is significant at 10% level, [**] at 5% and [***] at 1% level. Regression was ran on the overall sample with coefficient differentiated between manufacturing and services. Weights are the number of employees.

	Manufacturing	Services
Share of firms that indicate clients as source of innovation	0.033 [0.015]**	
Share of firms that indicate suppliers as source of innovation	-0.052 [0.021]**	
Share of firms that indicate internal source for innovation		0.082 [0.025]*
Share of firms that innovate to reduce labour cost		-0.058 [0.35]**
Average growth of labour compensation per employee	-0.600 [0.142]***	-0.416 [0.158]*
Export growth rate	0.049 [0.039]	-0.004 [0.031]
Intermediate demand growth rate	0.016 [0.042]	0.232 [0.068]***
Household consumption growth rate	0.026 [0.019]	0.093 [0.057]*
Constant	0.316 [0.377]	
Observations	349	
F-test (P value)	9.31 (0.000)	
R2	0.236	

When different variables are introduced for manufacturing and services, innovation strategies are qualitatively different but quantitatively comparable in their effects through the two groupings. Indeed, technological and cost competitiveness are well captured respectively through the share of firms indicating clients and those indicating suppliers as source of innovation. A t-test of the difference of impact between the manufacturing and services proxy

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[5] The results are available from the author upon request.

does not reject the hypothesis of a zero difference at 5% confidence level. This is a main result of the analysis conducted using SID data (Bogliacino and Pianta, 2010 and 2011); its validity is confirmed in this paper.

Adding 1% to the share of firms that choose technological competitiveness translates into a higher employment growth rate of +0.03% for manufacturing and +0.08% for services. Increasing the share of firms who opt for cost competitiveness by 1%, subtracts around 0.05-0.06 percentage points from the employment growth rate.

The demand effect is largely confined to services, since for manufacturing they are never significant (meaning that the effect is captured by productivity): again the largest impact comes from intermediate demand, where 1% increase in demand adds 0.23% to the average employment growth rate.

5.2. Capturing the peculiarity of business services

In the following Table we extend the baseline model to account for the heterogeneity between manufacturing, business services and the rest of the service sector.

Table 4. The role of business services
Source: SID. Dependent variable: rate of change in total employment. Standard errors are robust and clustered by industry, reported in brackets. [*] is significant at 10% level, [**] at 5% and [***] at 1% level. Regression was ran on the overall sample with coefficient differentiated between manufacturing, business services and other services. Weights are the number of employees.

	Manufacturing	**Business services**	**Other services**
Share of firms that indicate clients as source of innovation	0.029 [0.015][*]		
Share of firms that indicate suppliers as source of innovation	-0.054 [0.021][**]		
Share of firms that indicate internal source for innovation		0.068 [0.036][*]	0.034 [0.024]
Share of firms that innovate to reduce labour cost		-0.040 [0.065]	-0.059 [0.032][*]
Average rate of growth of labour compensation per employee	-0.598 [0.146][***]	-0.561 [0.163][*]	-0.601 [0.114][***]
Export growth rate	0.047 [0.040]	-0.068 [0.052]	-0.046 [0.023][*]
Intermediate demand growth rate	0.003 [0.043]	0.245 [0.122][**]	0.270 [0.059][***]

Household consumption growth rate	0.027 [0.020]	0.043 [0.066]	0.152 [0.064]**
Constant	0.583 (0.403)		
Observations	347		
F-test (*P* value)	13.06 (0.000)		
R2	0.510		

As we can observe, there are three sorts of trajectories emerging: manufacturing shows both technological and cost competitiveness, but no demand effect; business services are focused on technological competitiveness and intermediate demand is its main source of demand; and finally, other services are cost competitiveness intensive and intermediate and household demand are the main job creation drivers.

On the orders of magnitude, we can observe that rising by 1% the share of firms that choose technological competitiveness three basis point are added to the employment growth in manufacturing, and seven basis points in business services. If we were to increase the share of firms that choose cost competitiveness by 1%, around 0.05% is subtracted from the average employment growth in manufacturing and other services. Demand counteracts this direct labour saving effect in the rest of the service sector, but not in manufacturing, where this compensatory mechanism does not work, at least in the time span considered.

It is also very important to stress that this model captures the heterogeneity quite well: in fact, it is able to account for around 50% of total variance.

5.3 Controlling for market structure

In order to observe the robustness of the above specification, we used two variables that capture market structure: one was the Herfindahl[6] index calculated at a two-digit level; the second one is the average firm size.

While average firm size can be drawn from CIS, the Herfindahl index is taken from the EU-KLEMS database (see O'Mahoni et al., 2008). For some sectors, Herfindahl estimates are provided at a three-digit level. In order to obtain data at two digits, we weighted data at three digits with the respective share of production for the sector total.

To avoid potential multicollinearity problems, we eliminated the non-significant demand variables from the regressions. We maintained intermediate demand given that we did not wish to completely eliminate demand from the manufacturing equation.

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[6] Herfindahl Index is a concentration index calculated as the sum of squares of the shares: $H = \sum_i s_i^2$

The concentration shows a negative and significant effect in manufacturing industries, indicating that rent consolidation negatively affects job creation, because competitive pressure to invest is lacking. No significant effect is found for services.

On the contrary, average firm size is showing a negative and significant impact for business services. The latter are leading the structural change process, thus the job creation effect is mainly driven by entry of new small firms, coherently with its dynamism. No significant effect is found in the other two subgroups.[7]

We summarise the effect by running the regression using the Herfindahl for manufacturing and the average firm size for services.

Table 5. The baseline model with market structure determinants
Source: SID. Dependent variable: rate of change in total employment. Standard errors are robust and clustered by industry, reported in brackets. * is significant at 10% level, ** at 5% and *** at 1% level. Regression was ran on the overall sample with coefficient differentiated between manufacturing, business services and other services. Weights are the number of employees.

	Manufacturing	**Business services**	**Other services**
Share of firms that indicate clients as source of innovation	0.038 [0.015]**		
Share of firms that indicate suppliers as source of innovation	-0.048 [0.021]**		
Share of firms that indicate internal source for innovation		0.078 [0.033]**	0.013 [0.029]
Share of firms that innovate to reduce labour cost		0.025 [0.062]	-0.035 [0.032]
Herfindahl Index	-2.493 [1.400]*		
Average firm size		-0.821 [0.343]***	-0.889 [1.152]
Average rate of growth of labour compensation per employee	-0.564 [0.139]***	-0.565 [0.152]***	-0.566 [0.155]***
Export growth rate			0.144 [0.023]*
Intermediate demand growth rate	0.059 [0.043]	0.270 [0.112]**	0.280 [0.058]***
Household consumption growth rate			0.169 [0.067]**
Constant	0.465		

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[7] These results are available from the authors upon request.

	(0.470)
Observations	302
F-test	11.13
(*P* value)	(0.000)
R2	0.524

In summary, employment in manufacturing is largely explained by the positive effect of technological competitiveness and the negative direct effect of cost competitiveness; it is also negatively affected by concentration. In traditional and finance services, dynamics are largely explained by demand evolution (and at least for the latter part, also partly artificially inflated by bubble processes).

Finally business services show a Schumpeter Mark I trajectory, where entry by new firms and product innovation are the key determinants of the sector's evolution, coupled with intermediate demand's significantly important role, related with the process of de-verticalisation and globalisation.

5.4 Controlling for occupational structure

An interesting insight that we can add using SID is the relationship between the employment structure and polarisation. At this stage we can only discuss association and not the causality chain, for two main reasons: a) on the one hand, we are missing information due to limited data, the sample is significantly reduced and we were confronted by a major problem related to using the lag structure to identify effects; b) on the other hand, it is really problematic to identify causality chains; both phenomena are influenced by technology (Acemoglu, 2002) and quantity and quality of labour are interrelated.

Data on Professions composition of sectors include measures drawn from the national Labour Forces Surveys (LFS). It allows us to collect sectoral data on professions, education of employees within each sector for five European countries (NACE Rev. 1) (The Netherlands is excluded) through harmonised surveys that do not have confidentiality problems. Data were collected from 2000 to 2003. The former is associated with the first period and the latter with the second one in our SID database. As we discussed above (see footnote 4), we divided the 10 International Standard Classification of Occupation (ISCO) occupational classes into managers, clerks, crafts and manual workers.[8]

In Table 6, we ran the regression using a polarisation measure, computed as the shares of managers and manual workers in total employment over the total number of shares of clerks

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[8] National Labour Force Surveys (LFS) are the main sources of data on professions in Europe, as they provide comparable and detailed information on professions categorised by of employing firms' economic activity sector (see Lucchese and Pianta, 2011).

and crafts workers.

We added controls for demand and market structure. We eliminated the technological variables because, as discussed above, employment composition tends to capture the same dynamics as knowledge accumulation. As we stressed, this is a measure of association and not of causation, so we are not particularly concerned about omitting variable problems.

Table 6. Employment growth and polarisation
Source: SID. Dependent variable: Rate of change in total employment. Standard errors are robust and clustered by industry, reported in brackets. * is significant at 10% level, ** at 5% and *** at 1% level. Regression was ran on the overall sample with coefficient differentiated between manufacturing, business services and other services. Weights are the number of employees.

	Manufacturing	**Business services**	**Other services**
Polarisation	-0.935 [0.204]***	0.690 [0.181]**	-0.318 [0.150]**
Herfindahl Index	-3.110 [1.380]***		
Average firm size		1.279 [0.112]	-0.097 [1.279]
Average rate of growth of labour compensation per employee	-0.562 [0.169]***	-1.604 [0.419]***	-0.566 [0.155]***
Export growth rate			-0.056 [0.154]
Intermediate demand growth rate	0.095 [0.047]*	-0.145 [1.136]**	0.179 [0.078]**
Rate of growth of household consumption			0.138 [0.115]**
Constant	0.465 (0.470)		
Observations	148		
F-test (*P* value)	14.74 (0.000)		
R2	0.616		

Coherently with the descriptive evidence presented in Section 3, the results show a fundamental difference between manufacturing and business services: in the former the employment structure is associated with the more 'fordist' system in which employment growth is associated with middle-range human capital. Business services behave in the reverse manner: their growth is concentrated into a very high and a very low (mainly those constrained not to be outsourced) position in the job ranking and as such, polarisation is strongly associated with structural change towards those industries (for an explanation of the technological determinants see Autor and Dorn, 2010 and Nascia and Pianta, 2008).

Other services show a pattern similar to manufacturing but with a significantly lower

association, probably due to high heterogeneity inside the group.

6   Conclusions and policy implications

Building on the well-documented differences between manufacturing, business services and other services in terms of structural change, we have shown that business services have outperformed job creation in other economic activities in major European countries over the last two decades. Other services show heterogeneous patterns, ranging from employment growth in selected niches to job losses due to restructuring in retail trade, banking and financial activities. Conversely, employment in manufacturing has shown a general downward trend, with few exceptions in high-innovation sectors and in the industries of greater national specialisation among European countries.

We have investigated the fundamental mechanisms leading to such patterns of structural change, paying attention both to technological change on the supply side, and to the sources of demand. Analysing the role of technological change has confirmed the presence of two contrasting effects. First, industries where a technological competitiveness strategy prevails – based on knowledge creation, product innovation and development of new markets – show strong job-creation ability. Second, industries dominated by a search for cost competitiveness – relying on acquisition of technologies from suppliers, labour saving strategies and process innovations – tend to use technologies to replace labour and show serious job losses. These findings are consistent with the extensive literature reviewed in Section 2, which we have systematically compared first between manufacturing and services overall, and then considering business services and other services independently. In all cases we have found that these relationships are maintained. The nature of the impact of technological change on employment is the same in all industries, with innovations focusing on new products that are capable of increasing employment, while new processes lead to job losses. The pace at which this happens, however, is different in business services and in the rest of the economy. The job creation mechanisms in the former indeed appear to be stronger than in the latter, and some of the limits to job creation (e.g. the negative effect of high wage growth) are weaker in business services than in other industries.

In fact, we have found that different variables capture these contrasting patterns in manufacturing and service industries in a more effective way; in the former the search for technological competitiveness is better documented by the orientation towards clients, while in the latter by the use of internal sources as main source of innovation.

Conversely, a cost-competitiveness strategy is reflected by the suppliers in the manufacturing sector and by aiming to reduce labour costs in the services sector.

Structural change, however, is not the result of developments in the supply side alone. On the demand side industries are affected by different sources of intermediate and final demand – both domestic and foreign – that grow at differing paces and shape the expansion of industries' economic activities and jobs (Pasinetti, 1981).

The strongest differentiation between manufacturing, business services and other services emerges on the demand side. In explaining industries' employment growth, we have shown that manufacturing job decline has been affected by the lack of demand.

Conversely, jobs in business services grow as a result of the strong dynamics of intermediate demand, as all industries increasingly need the research, software, consulting, accounting, communication services offered by business services. This is shaping a new pattern of inter-industry interdependencies where business services play a key role in the whole economic system's competitiveness (Evangelista, Lucchese, Meliciani, 2011).

Other services play a role in different demand sources: by far, demand is the main job growth driver, contrasted with a technological dimension which is mainly labour saving, being focused on cost competitiveness.

Job creation mechanisms in business services therefore appear distinct in relation to the rest of the economy: new knowledge and new products, fast-growing demand from other industries and greater space for wage increases characterise the business service employment growth.

When we control for market structure we see that concentration is negatively associated with job growth in manufacturing, while in business services there is a clear negative relationship between the average firm size and job growth, suggesting that the industry growth is driven by entry of new firms and growth of small ones.

Finally, when we look at the dynamics of knowledge generation and accumulation through the structure of human capital, we observe that there is a clear distinction between manufacturing and services. Using four occupational categories (share of managers, clerks, crafts and manual workers) we built a polarisation measure as the ratio of the share of top and bottom occupation (manual plus managers) over the sum of shares of crafts and clerks. The resulting variable is positively associated with job growth in business services and negatively in manufacturing and other services. These effects capture the different skill composition required by the technology set available in manufacturing (more 'Fordist') and in the new business services, where ICTs are prominent.

There are a few policy implications to stress:

a) Since intermediate demand is becoming more and more important due to globalisation processes, demand management policies are very relevant for the process of job creation. Negative shocks have stronger effects in the economy;

b) Given the entry of new firms plays an important role in the dynamics of business service employment growth, it suggests that entry barriers should be eliminated in the most dynamic parts of the economy;

c) Where cost competitiveness is stronger, policies facing labour reallocation are fundamental to soften the impact of restructuring;

d) Business service growth induces a transformation of the skill mix required by the economy, i.e. increasing polarisation and reducing middle-class jobs, which requires proper intervention of the authorities to prevent negative effects of inequality.

Acknowledgements

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Appendix

Information on employment changes for each service industry and for the all of manufacturing is provided in Graph A1 below.

Graph A1. Compound annual rates of employment growth. Averages across countries.
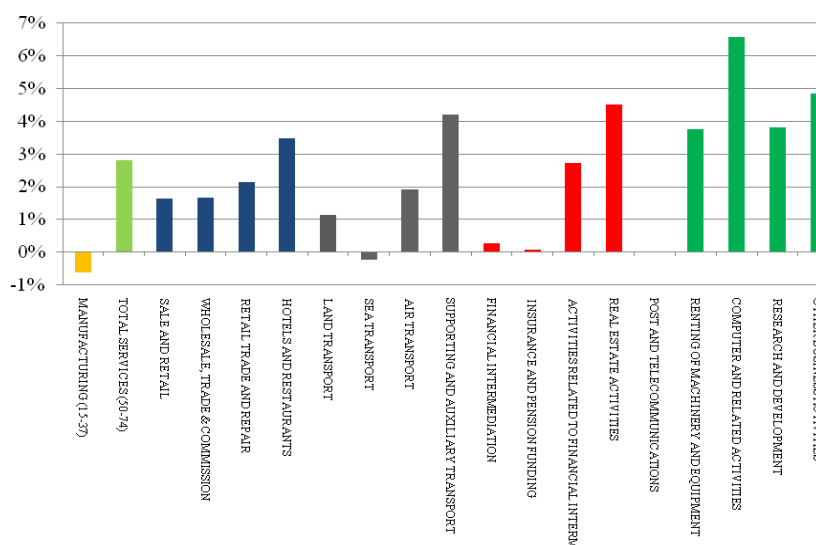
Source: SID database

The analysis of the composition of employment by professions in Graph A2 shows that business services are characterised by a strong polarisation process that is contrasting with the expected professional up-skilling process. Employment growth for manual workers in business services is due to the rise of manual workers in less-qualified and ancillary activities, together with a strong shift of employment in Post and Telecommunications industry in the United Kingdom.
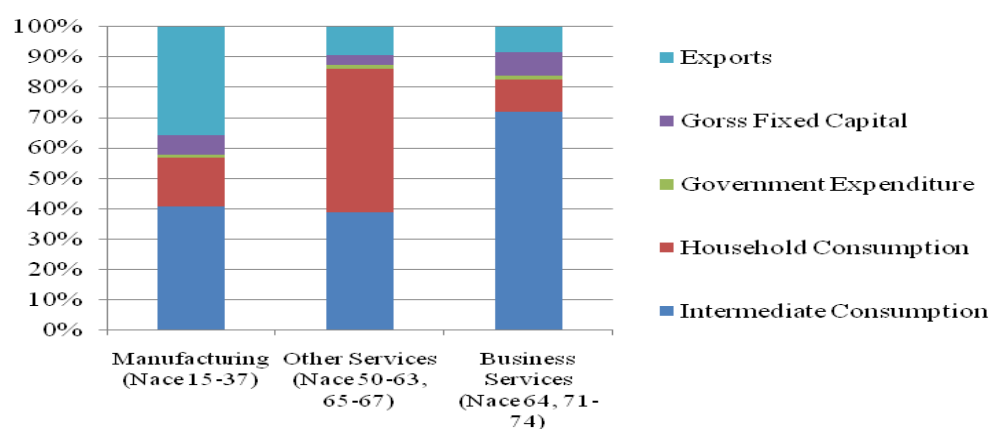
Graph A2. Changes in employment by professional groups: 2000-2003.
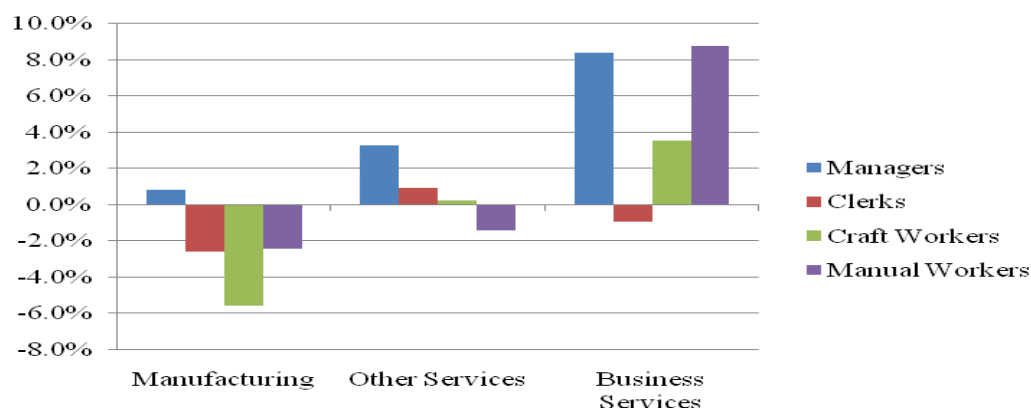
Source: SID database

Graph A3 shows the composition of demand for each macro sector. While manufacturing is characterised by a strong share of exports, traditional and finance services are related to internal demand. As expected, business services are linked to the demand for intermediate consumption, while the other components only constitute a modest share of total demand.

Graph A3. Composition of demand in 2000. Averages among countries.

Source: SID database

Abstract

The patterns and mechanisms of job creation in business services are investigated in this article by considering the role of innovation, demand, wages and the composition of employment by professional groups. A model is developed and an empirical test is carried out with parallel analyses on a group of selected business services, on other services and on manufacturing sectors, considering six major European countries over the period 1996-2007.

Within technological activities, a distinction is made between those supporting either technological competitiveness, or cost competitiveness. Demand variables allow identifying the special role of intermediate demand.

Job creation in business services appears to be driven by efforts to expand technological competitiveness and by the fast growing intermediate demand coming from other industries; conversely, process innovation leads to job losses and wage growth has a negative effect that is lower than in other industries. Business services show an increasingly polarised employment structure.

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