ISSN 1974-4110

Università
degli Studi di Urbino
"Carlo Bo"

Facoltà
di Economia

www.econ.uniurb.it

WP-EMS
Working Papers Series in
Economics, Mathematics and Statistics

"JOB CREATION IN BUSINESS SERVICES: INNOVATION, DEMAND, POLARISATION "

- Francesco Bogliacino, (European Commission)
- Matteo Lucchese, (U. Urbino)
- Mario Pianta, (U. Urbino)

WP-EMS # 2011/07

Job Creation in Business Services: Innovation, Demand, Polarisation

Francesco Bogliacino[a], **Matteo Lucchese**[b] **and Mario Pianta**[b]

[a] *European Commission, Joint Research Center- Institute for Perspective Technological Studies, Sevilla; Universidad EAFIT, Rise Group, Medellin*

[b] *University of Urbino*

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 that in other industries. Business services show an increasingly polarised employment structure.

JEL codes: *J20, J23, O30, O33*

Keywords: *Business Services, Innovation, Employment,*

Francesco Bogliacino, e.mail: francesco.bogliacino@gmail.com. Address for correspondence: European Commission – JRC – IPTS, Calle Inca Garcilaso, 3; 41092 Seville (Spain). Tel: +34/954488479 Fax: +34/954488326

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.[1]

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).

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 e the UK - over the period 1994-2007. After consideration of the patterns of growth of value added, employment, productivity, of the innovative activities carried out and of the qualification of jobs in terms of professional categories, we identify the following industries as *business services:* Post and Telecommunications (Nace 64), Renting of Machinery and Equipment (71), Computer and Related Activities (72) Research and Development (73) and Other Business Activities (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 that for the whole economy.

Financial services, banking and insurance are left out of 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 explosion of the crisis. 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 that technological change on the supply side and growth of on the other demand side are two major forces driving the growth of business services (Pasinetti, 1993).

We develop a model and carry out empirical tests that build on this approach, but consider also 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

---

[1] This paper builds on a presentation to the workshop "Business services for innovation, internationalisation and growth", held at the University of Rome La Sapienza, 2-3 December 2010. We thank Rinaldo Evangelista, Valentina Meliciani and the participants for their comments.

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 derive these data from Input-Output tables and explore in particular the role that business services have as providers of 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 has played a key role in this process. Moreover, the trade of intermediate goods has contributed to higher internationalisation, leading to outsourcing and offshoring of production. In some service sectors internationalization 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.
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 (Herfindal index) and a measure of the average size of the firm in the sector, in order to account for both competitive pressure and industry evolution dynamics (entry patterns and so on).
Finally, from the recent literature that has emphasised the *quality* – and not just the quantity – of employment, we consider the importance of the composition of employment by professional groups and explore what has happened in business services compared to other services and manufacturing. In particular, we use data on the shares of four major professional groups – managers and professionals; clerks; craft workers; manual workers - and investigate the growing polarisation of the occupational structure, 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 on 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 cover 22 manufacturing sectors and 17 service sectors - NACE REV.1 subsections - for six European countries - Germany, France, Italy, The Netherlands, Spain e the UK, which represent about 80% of value added of EU12.
The paper is organizes 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. Section 6 concludes.

2. A review of the literature

The growth of business services

In the last decades, the weight of business services in the economy has rapidly grown. Many studies have analyzed 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 the process of outsourcing of activities which were previously carried out within manufacturing firms. In this case, job creation and value added growth in business services industry have replaced the fall in production in manufacturing.
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 supplies "intangible assets" that contribute to the specialization of productive processes. The use of these inputs imply a "different way of organising social production, allowing a better spread of the advantages of knowledge specialization, more external scale economies, and a higher-level growth path"[2]. In this way, the nature of the intermediate relationships between firms comes out changed, supporting the possible expansion of value added.
Through the use of Input-Output Tables, some exercises of decomposition have documented the important the role of intermediate demand from other sectors in the growth of business services. Other studies have emphasizes the rise of final demand, showing a further evolution of relationships between services and end users. In the 1990's, the growth of business services has also been related to deregulation and privatization of economic activities, which has led to the rise of private specialized 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 shown that this dynamics is dependent on country and sectoral conditions (Baker, 2007), the implications of "Baumol's disease" are that a rising weight of services could reduce the growth of the economic system as a whole.
The specificity of business services – that often have productivity performances higher 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 large 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 by a large literature (Antonelli, 1999, Camacho and Rodriguez, 2007 and Evangelista et al., 2011 in this special issue).

Innovation, demand, professions and employment

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

[2] Kox and Rubalcaba (2007).
[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, 2005.

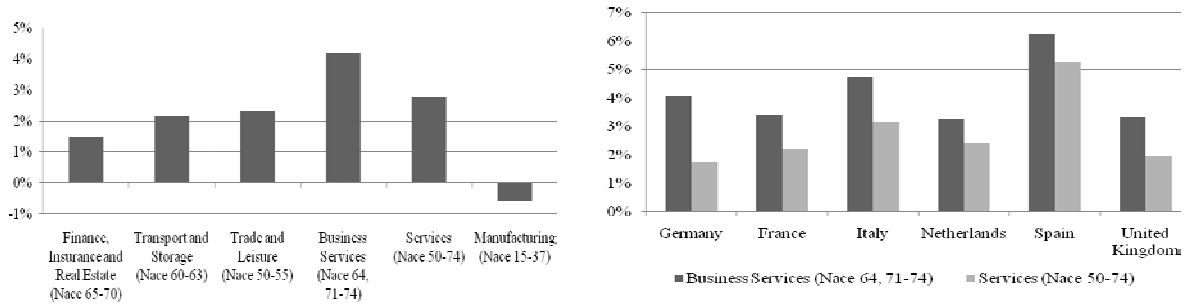
Studies focusing on the firm level have generally found a positive relationship between innovation and job creation (see for instance Van Reenen, 1997; Piva and Vivarelli, 2005; Piva, Santarelli and Vivarelli, 2005; Evangelista and Savona, 2003). Greenan and Guellec (2000) however find that the positive 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 the growth of industries' demand and by the dynamics of labour productivity.
Building on the Schumpeterian distinction between product and process innovation, 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 characterized by a different technological trajectory that shapes the perspective of growth of sectors. 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 the internal structure of economies. This approach has been integrated with consideration of demand factors, in order to account for the need of "demand pull" effects for creating the conditions for achieving the potential of innovations 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 form innovation surveys. The weak European job performance of the 1990s have been examined by Vivarelli, Evangelista and Pianta (1996) and Pianta (2000, 2001) showing that it was associated 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. In Mastrostefano and Pianta (2009), the effects on employment that result from different types of innovation, labour market factors, and demand dynamics are explored. When the analysis of the impact of innovation on job creation is studied in the long period, the "neoclassical" negative relation between wage and job growth seems to be less relevant, while the "Schumpeterian" job creating effect of the market impact of innovation emerges as major factor.
This investigation has been extended to services in Bogliacino and Pianta (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 Specialized 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 relevant that 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 bias technological change* as innovations replace unskilled

labour with workers with higher competences, which are complementary to the new technologies. The job opportunities for blue collars in the labour market worsen and the resulting inequality is presented as a 'natural' effect of technological change.
More recent works focused on the ability of computers to replace routine workers' tasks, 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; Author 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).
When industries are grouped on the basis of their patterns of technological change - *technological competitiveness* in high innovation industries, and *cost competitiveness* in traditional sectors - distinct patterns emerge. The overall skill intensity is substantially higher in the former group of industries and between 2000 and 2003 a clear pattern of polarization of employment emerges, with job increases for managers (+2 per cent a year) and manual workers (+1.2 per cent) and job losses for clerks (-0.2 per cent) and skilled workers (-2 per cent). Rather than a linear shift from low skilled jobs to high skilled white collar employment, as predicted by the skill bias hypothesis, a clear pattern of polarisation is found. When the determinants of employment changes are explored separately in the four professional groups, different relationships emerge. Product innovation and high 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* - that 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 in the rest of this article will be based on these lessons from recent literature.

3. The 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 services activities. In Graph 3.1, services are grouped in Trade and Leisure (Nace 50-55), Transport and Storage (60-63), Finance, Insurance and Real Estate (65-70) and Business Services (64, 71-74) sectors: 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 of employment. The variability within macro sectors is however not negligible: in business services, Post and Telecommunications have experienced a null dynamics of employment while Computer and Related Activities have grown at 7% per year on average among the countries considered. Other Business Activities (Nace 74), which represents more than half of employment of all business services, have grown at 5%.
This pattern looks stable among countries: business services show a 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 rates of growth of services as a whole in Spain and Italy are associated to the late development of the process of tertiarisation. A more detailed picture for each service industry is provided in the Appendix.

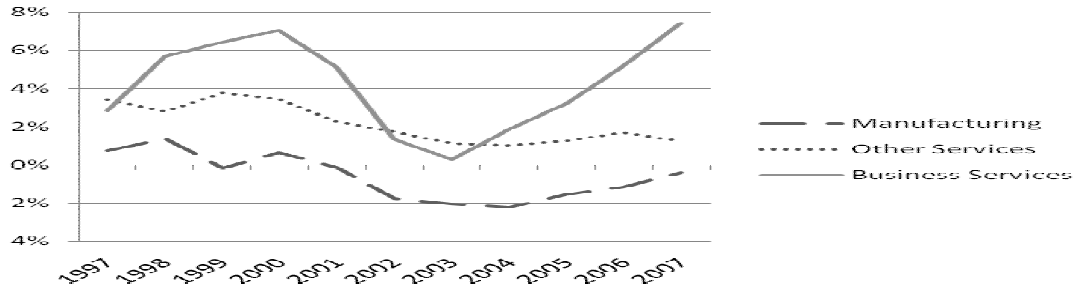
Graph 3.1. Compound Annual Rates of Growth of Employment from 1996 to 2007. Averages among countries and sectors.



Source: SID database

Graph 3.2 explores the dynamics of employment from 1996 to 2007, considering the trend of the manufacturing sector, the overall services and business services. Their dynamics looks similar, although the performance of manufacturing is strikingly 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 in 2000-2003 and have returned to rapid growth until 2007.

Graph 3.2. Annual Rates of Growth of Employment. Average values among countries.



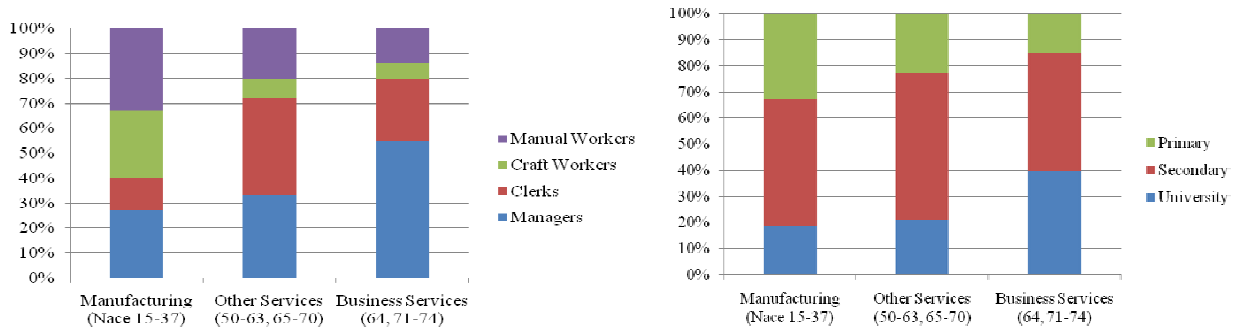
Source: SID database

Looking at Graph 3.2, three phases of development can be identified: from 1996 to 2000, there is a strong growth of employment 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 seems 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 requested,

[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 in the classes of Managers and professionals, Clerks, Craft Workers and Manual Workers (based on the International Standard Classification of Occupations ISCO88 COM nomenclature at

following the process of structural change.
Look at the composition of employment by professions (Graph 3.3) in 2000. Manufacturing and services are characterized 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 the manufacturing employment. The distribution of the educational levels is obviously related to the 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 rates of change of employment 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

Besides these patterns concerning the quantity and quality of employment, it is important to consider also the evolution of demand. 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 the determinants of employment growth 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 components of demand 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 the reduction of prices that can stimulate new

---

one digit level). Educational levels are classified in university, secondary and primary education (according the ISCED nomenclature at one digit level).

demand. However, the prevailing of the first strategy over the latter is generally supposed to provide higher opportunity of job creation.
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 the competitive pressure is obviously reduced.
It is a peculiarity of the Sectoral Innovation Database making it possible to link the totality of these factors in a single framework.

4.1. Methodology

The following equation is estimated:

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

where *emp* is the employment level of sector, *tc* represents the accumulated knowledge related with technological competitiveness strategy, *cc* the one associated with cost competitiveness, *d* is demand and *w* is the wage; *i* and *t* stands for industry i and time t. 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 at variables in log scale we know that by taking the differences we approximate the rate of change. By means of this transformation we eliminate the individual time invariant effect (we control also 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. difference 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, and making the average is just a linear transformation of it (not affecting the main properties of the estimators), 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 heteroschedasticity (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:

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

where the dependent variable is the rate of growth of employment, the variation in the stock of knowledge 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 rate of growth of the labour compensation per employee and the last part is the error term, in which the individual time invariant effects are eliminated.
Following from 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 reduction of production due to the formation of possible monopoly rents in the consumer market and/or the substitution 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 an increase of productivity can however overcome partially or totally the reduction of 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 tied to changes in the production structure that leads to high intermediate demand from the rest of the economy: the 70 % of demand of business services comes just from other sectors.
In terms of control variables, we expect an inverse relationship between wages (the rate of growth of the labour compensation per employee) and employment creation. Labour demand can increase when labour costs decrease.
We run also further robustness checks where we 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 add also a control for the average size of the firm in the sector: we expect it to be negatively correlated with growth for the most dynamic industries, where the job creation comes disproportionately from 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 explored for manufacturing and services sector; in order to differentiate the dynamics of services, we isolate the effects of business services from other services. In the latter category falls the industries classified as 64 and 71-74 by Nace Rev. 1.1. 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, because of the number of the degrees of freedom.
The time structure deserves a specific comment. We merge three different sources of data (STAN OECD database for employment growth, OECD I-O Tables for demand variables and CIS data for innovation measures). The availability of three waves of Input/Output (1995, 2000 and 2005) makes it possible to consider the growth rates of demand for two periods, 1995-2000 and 2000-2005. In fact, the trend of employment described in section 3 suggests keeping in mind the impact of the business cycle in the data. We decide to avoid the 2001-2003 recession and focus on two periods of growth of employment. We exclude data of CIS3 and focus 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 here]

As we can see, data from Innovation surveys always precede data on employment; with regards to demand, data for the first time start one year before and data for the second period finish two years before.
As a further check, the possibility of multicollinearity is checked through the VIF analysis. A preliminary analysis on the distribution of variables has allowed dropping possible extreme values. Moreover, only the significant variations of variables are considered. The presence of outliers does not affect the values of coefficients in every model.
The technological proxies extracted from the large information in CIS are chosen depending on availability (in order to avoid holes in the dataset, especially with regards to service industries) and low numbers of outliers.

5. Results

5.1. Baseline regressions

We first run a general regression with the baseline model.

[Table 2 here]

As we can see the effect of technological and cost competitiveness is comparable in magnitude but with opposite sign. An increase by one in the share of firms indicating internal sources for innovation will add 0.04 percentage points to the average growth of employment, while the opposite will happen if the share of firms who chose labour saving strategy is raised by one point.
The demand component with the highest impact is the intermediate demand: a one percent increase raises by one fifth of percentage point the annual compound rate of employment. Household consumption has a lower impact, while export appears as non significant.
The wage term has a negative impact, through a standard labour demand effect.
A first differentiation that we want to explore is the one between manufacturing and services. We show the results in the following Table 3. If we use similar proxies for technological strategies in both manufacturing and services we can see that for manufacturing the variables are non significant,[5] while 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 here]

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 through respectively share of firms indicating clients and share of firms indicating suppliers as source of innovation. A t-test of the difference of impact between the manufacturing and services proxy do not reject the hypothesis of a zero difference at 5 percent confidence level. This is a main result of the analysis done over SID data (Bogliacino and Pianta, 2010 and 2011) and confirms its validity here.
Adding one percent in the share of firms who chose technological competitiveness translates into a higher employment growth rate of +0.03% if we consider manufacturing and +0.08% in services.

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

Increasing by one percent the share of firms who opt for cost competitiveness subtracts around 0.05-0.06 percentage points to employment growth rate.
The effect of demand is largely confined to services, since in manufacturing they are never significant (meaning that the effect is captured by productivity): again the largest impact comes from intermediate demand, where one percent increase in demand adds 0.23% to the average growth rate of employment.

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 here]

As we can see there are three sort of trajectories emerging: manufacturing shows both technological and cost competitiveness, but without demand effect; business services are focused on technological competitiveness and presents the intermediate one as the main source of demand; finally, other services are cost competitiveness intensive and with intermediate and household demand as the main drivers of job creation.
On the orders of magnitude, we can see that rising by one the share of firms who choose technological competitiveness adds 0.03 percent to the employment growth in manufacturing, and 0.07 in business services, while increasing the share of firms who choose cost competitiveness subtract around 0.05 percent to the average job 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 window considered.
It is also very important to stress that this model is capturing quite well the heterogeneity: in fact, it is able to account for around 50% of total variance.

5.3 Controlling for market structure

In order to see the robustness of the above specification we use a couple of variables that capture market structure: one is the Herfindal index calculated at two digit level; the second one is the average firm size.
While average firm size can be drawn from CIS, the Herfindal index is taken from the Eu-klems database (see O'Mahoni et al. 2008). For some sectors, estimates for Herfindal are provided at three digit level. In order to obtain data at two digits, we weight data at three digits with the respective share of production on total of sector
To avoid potential multicollinearity problems, we eliminate from the regressions the demand variables that were not significant. Of course we do not want to eliminate completely demand for manufacturing, so we keep the intermediate demand. The results are presented in the following couple of Tables, 5 and 6.

[Table 5 here]

[Table 6 here]

The concentration shows a negative and significant effect in manufacturing industries, indicating that whenever consolidation of rents occurs, this is affecting negatively job creation, because of lack of competitive pressure to invest. No significant effect comes out in services.
At the opposite, average firm size is showing a negative and significant impact for business services. The latter are leading the process of structural change, thus the job creation effect is

mainly driven by entry of new small firms, coherently with its dynamism. No significant effect comes out in the other two subgroups.
We sum up the effect by running the regression using the Herfindal for manufacturing and the average firm size for services

[Table 7 here]

Summing up we can see that 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 the dynamics is largely explained by demand evolution (and at least for the latter part, partly also artificially inflated by bubble processes).
Finally business services shows a Schumpeter Mark I trajectory, where entry by new firms and product innovation are the key determinants of the evolution of the sector, coupled with a significantly important role of intermediate demand, 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 structure of the employment and polarization. At this stage we can only talk about association and not causality chain, for two main reasons: a) on the one hand we are losing information due limited data information, the sample is significantly reduced and we face major problem to use 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). The latter allows us to collect sectoral data on professions, education of employees within each sector for 5 European countries (Nace Rev. 1) (the Netherlands is excluded) through harmonised surveys which are free from confidentiality problems. Dare are 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 four), we split the ten ISCED occupational classes into managers, clerks, crafts and manual workers.[6]
In Table 8 below we run the regression using a polarization measures, computed as the shares of managers and manual workers over the sum of the shares of clerks and crafts.
We add controls for demand and market structure. We eliminate the technological variables because, as discussed above, employment composition tends to capture the same dynamics of the accumulation of knowledge. As we stressed, this is a measure of association and not of causation, so we are not particularly scared by omitted variable problems.

[Table 8 here]

Coherently with the descriptive evidence presented in Section 3, the results show a fundamental difference between manufacturing and business services: in the former the structure of the employment is associated with the more "fordist" system in which employment growth is associated with middle range human capital. Business services behave in the other way around: their growth is concentrated into very high and very low (mainly those constrained not to be outsourced) position

[6] National Labour Force Surveys (LFS) are the main sources for data on professions in Europe, as they make available comparable and detailed information on professions broken down by sector of economic activity of employing firms (see Lucchese and Pianta, 2011).

in the job ranking and so polarization 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 significant lower association, probably due to high heterogeneity inside the group.

6. Conclusions

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, combining attention to technological change on the supply side, and to the sources of demand. The analysis of the role of technological change has confirmed the presence of two contrasting effects. First, industries where a strategy of technological competitiveness 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 large literature reviewed in section 2 and here they are systematically compared first between manufacturing and services as a whole, and then considering business services on the one hand and other services on the other. In all cases we have found that these relationships hold. The nature of the impact of technological change on jobs is the same in all industries, with innovations focusing on new products that are capable to increase 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 appear indeed 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 in a more effective way these contrasting patterns in manufacturing and service industries; 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 case of manufacturing and by aim to reduce labour cost in the case of services.
Structural change, however, is not the result of developments on 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).
It is on the demand side that the strongest differentiation between manufacturing, business services and other services emerge. In explaining industries' employment growth, we have shown that manufacturing job decline is 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 for the competitiveness of the whole economic system (Evangelista, Lucchese, Meliciani, 2011).

Other services show a role of different demand sources: by far, demand is the main driver of job growth, contrasted with a technological dimension which is mainly labour saving, being focused on cost competitiveness.
The mechanisms of job creation in business services therefore appear distinct relatively 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 employment growth of business services.
When we control for market structure we see that in manufacturing concentration is negatively associated with job growth, 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 see that there is a clear distinction between manufacturing and services. Using four occupational categories (share of managers, of clerks, of crafts and of manual workers) we built a measure of polarization 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 in other services. These effects capture the different skill composition required by the technology set available in manufacturing (more fordist like) and in the new business services, where ICT is prominent.

References

Acemoglu, D., 2002. Technical change, inequality and the labour market, Journal of Economic Literature, 40,1, 7-72.

Addison, J. and Teixeira, P., 2001. Technology, employment and wages. Labour, 15, 2:191-219.

Antonelli, C., 1999. The Microdynamics of Technological Change. Routledge, London.

Antonucci T., Pianta M., 2002. The employment effects of product and process innovations in Europe. International Review of Applied Economics, vol. 16, pp. 295-308.

Autor, D., Levy, F. and Mundane, R. (2003) The Skill Content of Recent Technological Change: An Empirical Investigation*, Quarterly Journal of Economics*, 118, 1279-1333.

Autor, D., Katz, L. and Kearney, M. (2006) The Polarization of the U.S. Labour Market*, NBER Working Paper*, No. 11986.

Autor, D. and Dorn, D. 2010 The Growth of Low-Skill Service Jobs and the Polarization of the U.S. Labor Market. MIT Working Paper, August 2010

Baker, D., 2007. The impact of business-services use on client industries: evidence from input output data, in: Rubalcaba, L., Kox, H. (Eds), Business Services in European Economic Growth, Palgrave MacMillan, New York, pp. 97-115.

Baumol, W.J. (1967) *Macroeconomics of Unbalanced Growth: the Anatomy of Urban Crisis*, American Economic Review, vol. 57, pp. 415–426.

Bogliacino, F. and Pianta, M., 2008. The impact of R&D and innovation on economic performance and employment: a quantitative analysis based on innovation survey data. European Commission-Joint Research Centre, Institute for Prospective Technological Studies (IPTS-Seville) Report (J03/32/2007), 2008.

Bogliacino, F., Pianta, M., 2010. Innovation and employment: a reinvestigation using revised Pavitt classes. Res. Policy. 39, 799-809.

Bogliacino, F. and Pianta, M., 2011. Engines of growth. Innovation and productivity in industry groups. Structural Change and Economic Dynamics, 22, 41–53.

Camacho, J.A., Rodriguez, M., 2007(a). Integration and diffusion of KIS for industry performance, in: Rubalcaba, L., Kox, H. (Eds), Business Services in European Economic Growth, Palgrave MacMillan, New York, pp. 128-143.

Chennels, L. and Van Reenen, J. 2002. Technical change and the structure of employment and wages: a survey of the microeconometric evidence, in Greenan, L'Horty and Mairesse (Eds.), 175-224

Crespi, F., Pianta, M., 2008. Demand and innovation in productivity growth. International Review of Applied Economics, 22, (6):655-672.

Evangelista, R., Lucchese, M., Meliciani, V., 2011. Business Services, Innovation and Sectoral Growth, paper submitted to Struct. Change Econ. Dyn.

Evangelista, R., Savona, M. 2003. Innovation, employment and skills in services. Firm and sectoral evidence. Struct. Change Econ. Dyn. 14, 449-474.

Fagerberg, J., Mowery, D. and Nelson, R. (Eds.) 2005. The Oxford Handbook of Innovation. Oxford: Oxford University Press

Freeman, C., Clark, J. and Soete, L., 1982. Unemployment and Technical Innovation. London: Pinter.

Freeman, C. and Soete, L. (Eds.) 1987. Technical Change and Full Employment. Oxford: Blackwell.

Freeman, C. and Soete, L., 1994. Work for all or mass unemployment? London: Pinter.

Greenan, N. Guellec, D., 2000. Technological innovation and employment reallocation. Labour, 14, 4, 547-590.

Haltiwanger, John C., Jarmin, Ron S. and Miranda, Javier, Who Creates Jobs? Small vs. Large vs. Young (August 2010). NBER Working Paper Series, wp16300

Kox, 2001, Sources of structural growth in business services, CBP Research Memorandum No. 12, the Hague.
Kox, H., Rubalcaba, L., 2007. Analysing the contribution of business services to European economic growth. MPRA Paper n. 2003.
Lucchese, M., Pianta, M., 2011. The Sectoral Innovation Database 1994-2009 (SID). Sources and methodologies, University of Urbino, Faculty of Economics, Discussion Paper.
Mastrostefano V., Pianta M., 2009. Technology and jobs. Economics of Innovation and New Technology, 18, 7-8: 729-742.
Miles, 2007, Business Services and their users: a literature review, in: L. Rubalcaba and H. Kox, eds, Business Services in European economic growth, Palgrave MacMillan.
Moose, M. and Manning, A. (2007) Lousy and Lovely Jobs: The Rising Polarization of Work in Britain, *Review of Economics and Statistics*, 89, 118-133.
Nascia L. and Pianta M., 2008. Skill bias or polarisation? Innovation and job growth in Europe. Paper presented at the EAEPE 2008 Annual Conference, Rome, 6-8 November 2008.
O' Mahoni, M., Castaldi, C., Los, B., Bartelsman, E., Maimaiti, Y., Peng, F, 2008. EUKLEMS - Linked data: Sources and Methods, University of Birmingham, http://www.euklems.net/data/linked/EUKLEMS_LinkedData_SourcesAndMethods_220708.pdf.
Pasinetti, L. (1993) *Structural Change and Economic Growth*, Cambridge University Press, Cambridge.
Pavitt K., 1984. Patterns of technical change: towards a taxonomy and a theory. Research Policy, 13, 343-74.
Petit P., 1995. Employment and Technological Change, in: Stoneman, P. (Ed.), Handbook of the Economics of Innovation and Technological Change, Amsterdam, North Holland, pp. 366-408.
Pianta M., 2000. The employment impact of product and process innovation, in Vivarelli and Pianta (Eds.), 77-95.
Pianta M., 2001. Innovation, Demand and Employment, in: Petit P., Soete L. (Eds.) Technology and the future of European Employment, Cheltenham, Elgar, pp. 142-165.
Pianta M., 2005. Innovation and employment, in Fagerberg, Mowery and Nelson (Eds), 568-598.
Pilat, D. and Wolfl, A., 2005. Measuring the interaction between manufacturing and services, STI Working paper 2005/5, OECD, Paris.
Piva M. and Vivarelli M., 2005. Innovation and employment, evidence from Italian microdata. Journal of Economics, 86, 1, 65-83.
Piva M., Santarelli, E. and Vivarelli, M., 2005. The skill bias effect of technological and organisational change: Evidence and policy implications. Research Policy, 34, pp. 141–157.
Rubalcaba, L., Kox, H. (Eds.), 2007. Business services in European economic growth. Palgrave MacMillan, New York.
Savona, M., Lorentz, A., 2006. Demand and technological determinants of structural change and tertiarisation - an input-output structural decomposition analysis for four OECD countries, LEM Working paper Series, 2005/25.
Spezia, V. and Vivarelli, M., 2002. Innovation and employment: a critical survey. In Greenan, L'Horty and Mairesse (Eds), 101-131
Van Reenen, J., 1997. Employment and Technological Innovation: Evidence from U.K. Manufacturing Firms. Journal of Labor Economics, 15, 255-84
Vivarelli, M., 1995. The Economics of Technology and Employment: Theory and Empirical Evidence, Aldershot: Elgar.
Vivarelli M., Evangelista R., Pianta M., 1996. Innovation and employment in the Italian manufacturing industry. Research Policy, 25,1013-1026.
Vivarelli, M. and Pianta, M. (Eds.) (2000), The Employment Impact of Innovation: Evidence and Policy, London: Routledge.

Table 1. The Database structure

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

Table 2. The general model.

Source: SID. Dependent variable: rate of change of total employment. Standard errors are robust and clustered by industry, reported in brackets. * is significant at 10% level, ** at 5 percent and *** at one percent level. Weights are number of employees.

	WLS
Share of firms who indicate internal source for innovation	0.043 [0.019]**
Share of firms who innovate to reduce labour supply	-0.042 [0.017] **
Average rate of growth of labour compensation per employee	-0.477 [0.163]***
Rate of growth of export	0.037 [0.027]
Rate of growth of intermediate demand	0.202 [0.051]***
Rate of growth of household consumption	0.074 [0.032]**
constant	0.433 [0.560]
Observations	349
F-test (pvalue)	9.31 (0.000)
R2	0.236

Table 3. Manufacturing versus services.

Source: SID. Dependent variable: rate of change of total employment. Standard errors are robust and clustered by industry, reported in brackets. * is significant at 10% level, ** at 5 percent and *** at one percent level. The regression is run on the overall sample with coefficient differentiated between manufacturing and services. Weights are the numbers of employees.

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

Table 4. The role of Business Services.

Source: SID. Dependent variable: rate of change of total employment. Standard errors are robust and clustered by industry, reported in brackets. * is significant at 10% level, ** at 5 percent and *** at one percent level. The regression is run on the overall sample with coefficient differentiated between manufacturing, business services and other services. Weights are the numbers of employees.

	Manufacturing	**Business Services**	**Other Services**
Share of firms who indicate clients as source of innovation	0.029 [0.015]*		
Share of firms which indicate suppliers as source of innovation	-0.054 [0.021]**		
Share of firms who indicate internal source for innovation		0.068 [0.036]*	0.034 [0.024]
Share of firms who 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]***
Rate of growth of export	0.047 [0.040]	-0.068 [0.052]	-0.046 [0.023]*
Rate of growth of intermediate demand	0.003 [0.043]	0.245 [0.122]**	0.270 [0.059]***
Rate of growth of household consumption	0.027 [0.020]	0.043 [0.066]	0.152 [0.064]**
Constant	0.583 (0.403)		
Observations	347		
F-test (pvalue)	13.06 (0.000)		
R2	0.510		

Table 5. Controlling for concentration.
Source: SID. Dependent variable: rate of change of total employment. Standard errors are robust and clustered by industry, reported in brackets. * is significant at 10% level, ** at 5 percent and *** at one percent level. The regression is run on the overall sample with coefficient differentiated between manufacturing, business services and other services. Weights are the numbers of employees.

	Manufacturing	**Business Services**	**Other Services**
Share of firms who indicate clients as source of innovation	0.039 [0.014]***		
Share of firms which indicate suppliers as source of innovation	-0.048 [0.021]**		
Share of firms who indicate internal source for innovation		0.067 [0.031]*	0.014 [0.030]
Share of firms who innovate to reduce labour cost		0.044 [0.060]	-0.037 [0.033]
Herfindal index	-2.35 [1.38]*	0.673 [4.698]	-0.076 [2.161]
Average rate of growth of labour compensation per employee	-0.566 [0.138]***	-0.561 [0.163]***	-0.558 [0.173]***
Rate of growth of export			0.104 [0.056]*
Rate of growth of intermediate demand	0.062 [0.042]	0.245 [0.122]**	0.249 [0.092]***
Rate of growth of household consumption			0.188 [0.082]**
Constant	0.374 (0.449)		
Observations	302		
F-test (pvalue)	11.90 (0.000)		
R2	0.512		

Table 6. Controlling for average size.
Source: SID. Dependent variable: rate of change of total employment. Standard errors are robust and clustered by industry, reported in brackets. * is significant at 10% level, ** at 5 percent and *** at one percent level. The regression is run on the overall sample with coefficient differentiated between manufacturing, business services and other services. Weights are the numbers of employees.

	Manufacturing	**Business Services**	**Other Services**
Share of firms who indicate clients as source of innovation	0.026 [0.018]		
Share of firms which indicate suppliers as source of innovation	-0.051 [0.023]**		
Share of firms who indicate internal source for innovation		0.076 [0.022]**	0.041 [0.025]
Share of firms who innovate to reduce labour cost		0.026 [0.062]	-0.063 [0.032]*
Average size of firm	-1.268 [1.657]	-0.830 [0.341]**	-1.195 [1.211]
Average rate of growth of labour compensation per employee	-0.601 [0.147]***	-0.561 [0.163]***	-0.611 [0.110]***
Rate of growth of export			0.144 [0.023]*
Rate of growth of intermediate demand	0.020 [0.044]	0.267 [0.112]**	0.280 [0.058]***
Rate of growth of household consumption			0.169 [0.067]**
Constant	0.374 (0.449)		
Observations	347		
F-test (pvalue)	14.54 (0.000)		
R2	0.514		

Table 7. The baseline model with market structure determinants.
Source: SID. Dependent variable: rate of change of total employment. Standard errors are robust and clustered by industry, reported in brackets. * is significant at 10% level, ** at 5 percent and *** at one percent level. The regression is run on the overall sample with coefficient differentiated between manufacturing, business services and other services. Weights are the numbers of employees.

	Manufacturing	Business Services	Other Services
Share of firms who indicate clients as source of innovation	0.038 [0.015]**		
Share of firms which indicate suppliers as source of innovation	-0.048 [0.021]**		
Share of firms who indicate internal source for innovation		0.078 [0.033]**	0.013 [0.029]
Share of firms who innovate to reduce labour cost		0.025 [0.062]	-0.035 [0.032]
Herfindal Index	-2.493 [1.400]*		
Average size of firm		-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]***
Rate of growth of export			0.144 [0.023]*
Rate of growth of intermediate demand	0.059 [0.043]	0.270 [0.112]**	0.280 [0.058]***
Rate of growth of household consumption			0.169 [0.067]**
Constant	0.465 (0.470)		
Observations	302		
F-test (pvalue)	11.13 (0.000)		
R2	0.524		

Table 8. Employment growth and Polarization

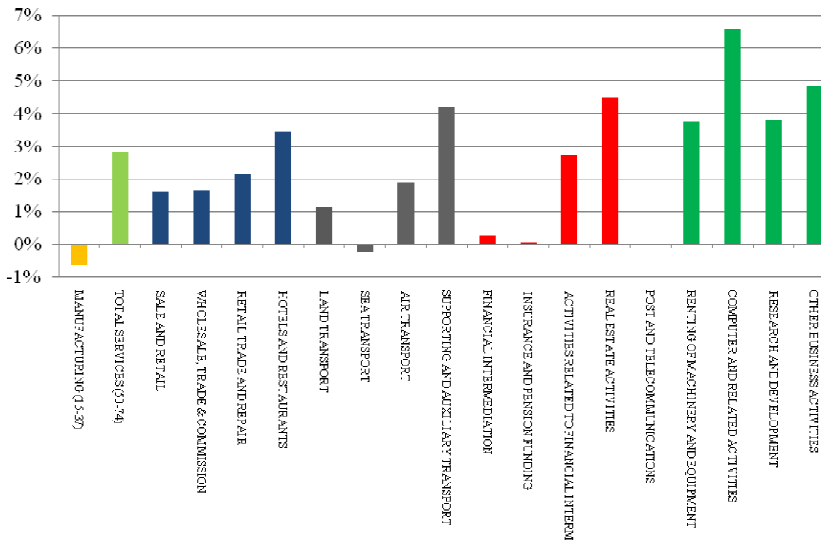
Source: SID. Dependent variable: rate of change of total employment. Standard errors are robust and clustered by industry, reported in brackets. * is significant at 10% level, ** at 5 percent and *** at one percent level. The regression is run on the overall sample with coefficient differentiated between manufacturing, business services and other services. Weights are the numbers of employees.

	Manufacturing	**Business Services**	**Other Services**
Polarization	-0.935 [0.204]***	0.690 [0.181]**	-0.318 [0.150]**
Herfindal Index	-3.110 [1.380]***		
Average size of firm		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]***
Rate of growth of export			-0.056 [0.154]
Rate of growth of intermediate demand	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 (pvalue)	14.74 (0.000)		
R2	0.616		

Appendix

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

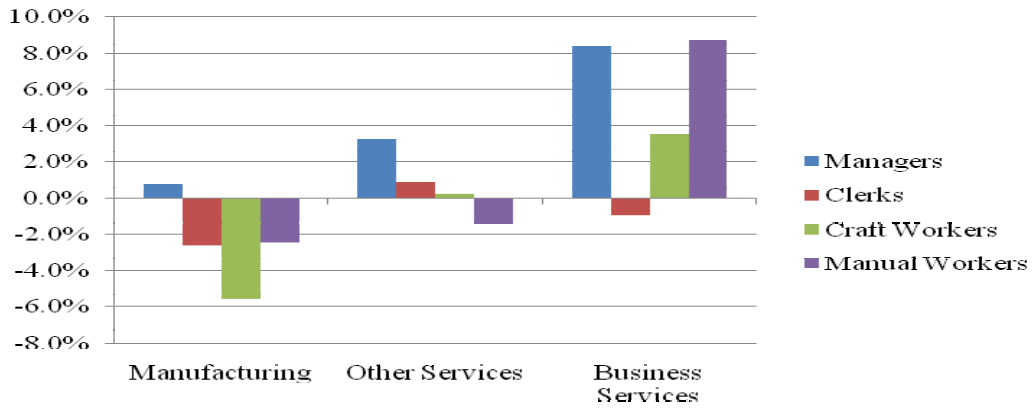
Graph A.1. Compound Annual Rates of Growth of Employment. Averages across countries.



Source: SID database

The analysis of the composition of employment by professions in Graph A.2 reveals that business services are characterized by a strong process of polarization that is contrasting with the expected process of up-skilling of professions. The growth of employment 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 A.2. Changes in employment in professional groups, 2000-2003.

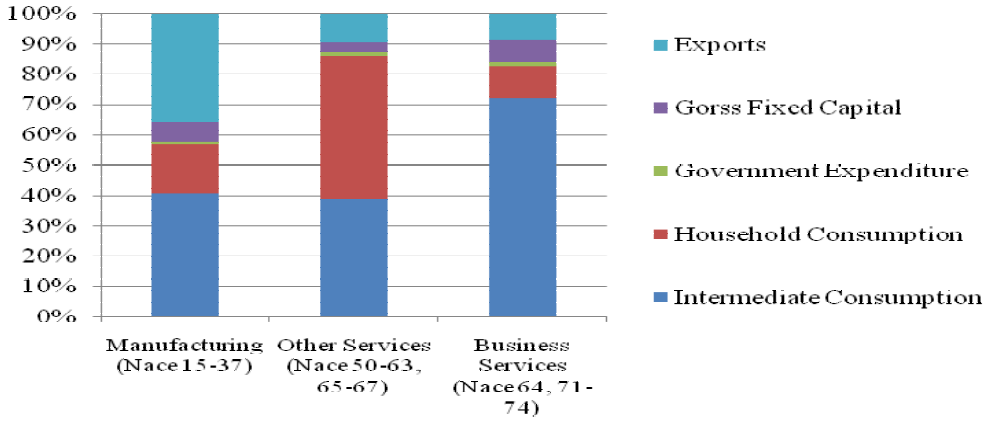


Source: SID database

Graph A.3. shows the composition of demand for each macro sector. While the manufacturing is characterized 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 others components constitute only a modest share of total demand.

Graph A.3. Composition of demand in 2000. Averages among countries.



Source: SID database