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Innovation, Employment Creation and Destruction and Foreign Ownership of Firms

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Abstract

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Jelcodes:O31,F23

Innovation, Employment Creation and Destruction, and Foreign Ownership of Firms

A European Perspective

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JEL classification: O310; O330; F230

Keywords: employment; innovation; foreign ownership; Community Innovation Survey; host country effects

1. INTRODUCTION

The effects of globalisation on employment are a key issue in policy debates. Foreign-owned firms can be a source of employment growth in their host countries (Barba Navaretti, 2004; Bellak, 2004). Their market entrance and subsequent growth create new labour demand. Furthermore, foreign-owned firms may have access to new technologies provided by their parent company which increase their competitiveness and, as a result, also their demand for labour. In addition, knowledge and technologies might spill over to domestically owned firms and stimulate their growth as well. But the presence of foreign-owned firms may also have negative consequences for employment. Growth may be lower because foreign-owned firms may be able to exploit synergy effects within the company group. Compared to domestically-owned firms, employment in foreign-owned firms may also be more volatile (Scheve and Slaughter, 2004; Buch and Lipponer, 2010).

This paper wants to contribute to this discussion by disentangling the sources of employment growth in domestically owned and foreign-owned firms. We start from two basic assumptions discussed in more detail below. First, innovation and technology are major drivers for employment growth of firms (Pianta, 2005; Harrison et al., 2008; Bogliacino and Pianta, 2010). Second, innovation and technology are also key dimensions in which foreign-owned and domestically owned firms differ. There is ample evidence that multinational enterprises (MNEs) tend to possess superior intangible assets, operate more frequently in R&D-intensive sectors and employ more highly-qualified staff than domestically owned firms (Griffith and Simpson, 2001; Markusen, 2002; Bellak, 2004). Both groups may also differ in the way they create new products, in the capabilities they employ for this task, and in the means to introduce new products to the market (Sadowski and Sadowski-Rasters, 2006; Frenz and Ietto-Gillies, 2007; Dachs et al., 2008). We hypothesize that these differences, in turn, lead to differences in employment creation and destruction from innovation between the two groups.

We investigate the linkage between employment growth and innovation in foreign-owned and domestically owned firms. The paper differs in three important points from other contributions: First, we employ an econometric model that examines the effects of process and product innovation on employment at the firm level. This approach allows us to disentangle some of the employment effects at work and to relate differences in employment creation between foreign-owned and domestically owned firms to differences in innovation behaviour. This is in contrast to most studies in this area which focus on indirect employment effects in domestic firms due to spillovers that arise from to the presence of foreign-owned firms (Keller, 2010; Marin and Sasidharanb, 2010; Motohashi and Yuan, 2010). Second, unlike other studies, we do not focus on one country but scrutinize employment effects at the firm level using a large data set containing observations from 18 European countries. Finally, we provide a separate analysis for the service sector. The service sector is a major source of employment growth in industrialized countries (O'Mahony and Timmer, 2009). Studies that investigate innovation as well as multinational activities, however, often neglect service industries.[1]

The paper is organized as follows: Chapter 2 discusses theoretical linkages between innovation and employment in foreign-owned and domestically owned firms from which we draw our hypotheses presented in chapter 3. Chapter 4 describes the data set. We start our empirical analysis with descriptive statistics on employment growth and innovation for both groups of firms in chapter 5. Chapter 6 explores the econometric set-up of this study and chapter 7 presents and discusses the results. Chapter 8 draws conclusions from the analysis.

2. Background

Our research draws on two strands of literature: The first strand investigates employment impacts of innovation, and the second one deals with differences between foreign and domestically owned firms in general and in innovation in particular.

2.1. Innovation, job creation and job destruction

Innovation and employment are related through various channels, and different forms of innovation may have different effects on employment growth (Garcia et al., 2002; Pianta, 2005; Hall et al., 2008; Harrison et al., 2008). A basic distinction is between product and process innovation. Both kinds of innovation can be associated with a labour-saving effect (displacement effect) which reduces employment, and a demand-creating effect (compensation effect) which stimulates employment (see Table 1).

[1] Exceptions are Harrison et al. (2008), Hall et al. (2008) and Peters (2008). These papers study the employment effect of innovation activities for service firms in general without distinguishing between ownership of firms.

Table 1: Effects of product and process innovation on employment

	Displacement effect	**Compensation effect**
Product innovation	*Productivity effect*: New product requires less (or more) labour input (-) *Indirect demand effect*: Decrease in demand of existing substitutes (-)	*Direct demand effect*: New products increase overall demand (+) *Indirect demand effect*: Increase in demand of existing complementary products (+)
Process innovation	*Productivity effect*: Less labour input for a given output (-)	*Price effect*: Cost reduction passed on to price expands demand (+)

Employment effects of *process innovation* are closely related to productivity changes. The introduction of new production processes most often leads to an increase in productivity since process innovation allows firms to produce the same amount of output with less labour input and, ceteris paribus, lower unit costs. The extent of this negative *displacement effect* depends on the current production technology and, thus, the rate of substitution between input factors as well as on the direction of the technological change.

At the same time, the reduction in unit costs allows the innovative firm to lower its product price. In a dynamic perspective, lower prices can lead to a higher demand for the product, thus increasing output. The magnitude of this *compensation effect*, also called *price effect,* depends on the price reduction, the price elasticity of demand, the degree of competition as well as on the behaviour and relative strength of different agents such as managers and unions within the firm (Garcia et al., 2002). The higher the market power of the innovating firm, for instance, the lower the extent to which cost reductions are passed to product prices.

Product innovation spurs employment growth mainly via demand. When a new product has successfully been introduced to the market, it creates new demand for the output of the innovating firm. This *compensation effect* can either be the result of an overall market expansion, or it may come at the expense of the firm's competitors. The size of the compensation effect resulting from demand increases depends on the existence of substitutes and the reactions of competitors (see Garcia et al., 2002).

In addition to the direct demand or compensation effect, indirect employment effects from product innovation may occur as well. First, *indirect demand effects on existing products* have to be taken into account. If the new product (partially or totally) replaces the old one, labour demand for the production of the old product will decrease, and the overall effect is ambiguous for the innovating firm. However, in the case of complementary demand relationships, the new product will cause demand for existing products to rise as well, and employment will increase further. Second, the same amount of output of the new product may be produced at higher or lower productivity levels compared to the old product. That is, the new product may imply a change in production methods and input mix, which could either reduce or increase labour input (see Harrison et al., 2008). Product innovation thus could also lead to *displacement effects*, even if product innovation is not associated with simultaneous process innovation. The extent and direction of this effect has to be determined empirically.

The majority of empirical studies have found a positive relationship between *product innovation* and employment growth in manufacturing (Entorf and Pohlmeier, 1990; König et al., 1995; Reenen, 1997; Blechinger et al., 1998; Rottmann and Ruschinski, 1998; Smolny, 1998; Greenan and Guellec, 2000; Garcia et al., 2002; 2002; Hall et al., 2008; Harrison et al., 2008). Empirical evidence on the employment effects of process innovations is less clear than for product innovation. In the studies of van Reenen (1997) and Entorf and Pohlmeier (1990), the impact of process innovations turns out to be small and not significant at all. König et al. (1995), Smolny and Schneeweis (1999), Smolny (2002), Greenan and Guellec (2000) or Lachenmaier and Rottmann (2011), in contrast, report a significant positive effect of process innovations on employment growth. The latter two studies even establish that process innovation create more new employment at the firm level than product innovation. Contrarily, Blechinger and Pfeiffer (1999) find evidence of labour displacement by process innovation, the effect being more pronounced in larger firms.

2.2. Innovation, employment growth and foreign ownership

Displacement and compensation effects of innovation may differ between foreign-owned and domestically owned firms because both groups vary in important characteristics related to product and process innovation.

A first important difference refers to firm specific innovation capabilities. Foreign-owned firms often possess superior firm-specific assets such as knowledge, technologies, or brands, which domestically owned firms may not have at their disposal (Dunning, 1981; Caves, 1996 (1974); Markusen, 2002; Helpman et al., 2004). These assets also include organisational and managerial capabilities and practices (Bloom and Van Reenen, 2010).

Firm-specific assets can be transferred from the parent company to its affiliates and give foreign-owned affiliates an advantage when it comes to developing and introducing product and process innovation. These assets may allow the affiliate to develop innovations based on existing technology which may lower development costs. Moreover, foreign-owned firms may be able to introduce new products more successfully into the market and reap higher output growth from new products because they can benefit from the experiences the MNE made in other countries with similar products and technologies.

Second, empirical evidence suggests that in many countries and sectors foreign-owned firms are larger than domestically owned firms. Hence, the ability of foreign-owned firms to create employment from innovation may also be related to general advantages and disadvantages of large and small firms in the innovation process (Kleinknecht, 1989; Cohen, 1995, 2010). Large firms, in particular multinationals, can spread risks over a larger number of projects, have considerable internal funds for innovation and easier access to external finance for risky innovation projects, and may benefit from a higher degree of specialisation and a more elaborated division of labour in research, development and innovation, which is not feasible in smaller firms.

In addition, foreign-owned affiliates - as part of a multinational group - are likely to possess larger market power allowing them to withhold a larger proportion of the cost reduction. Hence, one might expect a stronger negative impact of process innovations in foreign-owned firms. As mentioned above, market power is also important for the size of the compensating demand effect. Being part of a multinational group might furthermore enable MNE subsidiaries to speed up the time in which they can react to the introduction of product innovations by competitors, reducing potential employment gains of domestic competitors.

Various studies have evaluated differences in innovation between foreign-owned and domestically owned firms empirically (Ebersberger et al., 2005; Sadowski and Sadowski-Rasters, 2006; Dachs et al., 2008). These studies find a higher innovation output of foreign-owned firms in terms of sales from new products when controlling for firm characteristics. Innovative inputs, in contrast, are similar or lower for foreign-owned firms, hence, superior assets may encourage foreign-owned firms to invest less in R&D relative to domestically-owned firms (Un and Cuervo-Cazurra, 2008).

3. HYPOTHESES

We hypothesize that the differences between foreign-owned and domestically owned firms discussed above translate into differences in displacement and compensation effects and different labour market outcomes of the two groups.

Labour market outcomes of product innovation consists of three effects:

1) Following the literature, we assume that foreign-owned firms enjoy higher sales from product innovation because they can make use of superior assets for their innovation, and benefit from the experiences with the market introduction of these products in other countries. Furthermore, being part of a multinational group may imply higher market power making it more difficult for domestic competitors to react and to erode innovation benefits of foreign-owned firms. Hence, we expect the positive compensation effect and thus the job creation from new products to be larger for foreign-owned firms (H1a).

2) New products may be produced with higher efficiency than old products. We expect this productivity effect and thus the job destruction due to shifts in labour input to be larger for foreign-owned firms since they can benefit from superior production technologies and learning effects within the company group (H1b).

3) The demand effect of new products on existing products depends on the degree of complementarity between the new and the old product. The literature provides no clear evidence whether product innovation of foreign and domestic firms differ in this respect. However, in small firms with just one or a few products it is more likely that new products will replace existing ones due to capacity constraints. Hence, we suppose that the indirect employment effect due to shifts in demand for existing products is larger for foreign-owned firms (either a less negative displacement or stronger positive compensation effect; H1c).

In general, the overall employment effect of product innovation is ambiguous. Empirical evidence from other studies (see section 2.1), however, has demonstrated that the compensation effect often outweighs the displacement effect of product innovation. We therefore expect a positive link between product innovation and employment growth, which should be stronger for foreign-owned firms:

H1: Foreign-owned firms enjoy a higher employment growth from product innovation than domestically owned firms.

The overall employment impact of process innovation is likewise the combination of two effects. We suppose that foreign-owned firms, on average, enjoy higher productivity gains from new production processes than domestically owned firms, because they benefit from internal technology transfer and learning effects in the corporate network between affiliates and the parent company. This will lead to less labour input for a given output, and thus larger displacement effects from process innovation (H2a). Foreign-owned firms as part of a multinational group may also be less inclined to pass on price reductions because of their larger market power which would imply smaller compensation effects (H2b). Combining both effects, we either expect stronger job destruction or less job creation from process innovation in foreign-owned firms.

H2: Foreign-owned firms face either higher employment losses or smaller employment growth from process innovation than domestically owned firms.

The advantages of size, exchange in a multinational network and market power are, of course, not restricted to foreign multinational firms alone. Some of these advantages are also shared by domestically owned firms which are part of a (multinational) enterprise group themselves. There is evidence in the literature that domestically owned multinationals are more similar to foreign-owned firms than to unaffiliated domestically owned firms (Frenz and Ietto-Gillies, 2007; Dachs et al., 2008). Bellak and Pfaffermayr (2000), for example, examine performance gaps in sales and employment growth, export and investment propensity between foreign-owned and domestically owned firms in Austria. They find that domestic and foreign multinationals perform rather similarly and that both groups perform better than purely national firms. We can therefore assume that differences between foreign and domestically owned firms belonging to an enterprise group are smaller or even vanish than between foreign-owned firms and non-affiliated firms.

H3: Differences in employment effects between foreign-owned firms and domestically owned group firms are smaller than between foreign-owned firms and domestically owned unaffiliated firms.

There is also reason to assume that there are differences between foreign-owned firms of different home countries. First, because there are productivity differences between countries which may result in different endowments of foreign-owned firms with technology and management capabilities and different productivity levels between foreign-owned firms. Second, The subsidiary is also embedded in the norms, values and habits of its corporate group which are shaped by the home country. One example for such differences, may be the 'time horizon' of agents (Lundvall, 1998; Drejer, 2000): the Anglo-Saxon systems are characterised by a shorter time horizon in corporate governance than the Japanese and German systems, which are known for working with a quite long time horizon in investment decisions. Another potential source of variation between foreign-owned firms of different home countries are differences in the legal systems, accounting standards and codes of corporate governance between the home and host country (Buckley, 2000, p 297).

Evidence for differences between foreign-owned firms of different home countries provide, amongst others, Harris and Robinson (2003) who examine employment growth in 20 UK manufacturing industries over the period 1974-1995. Their results indicate that US owned plants performed better than domestic ones in most industries. For six industries they found no significant differences in performance, while domestically owned firms performed better in two industries. EU-owned plants outperformed domestically owned plants in only four industries. The evidence for other home countries (i.e. old commonwealth countries, South East Asian countries, and the rest of the world) was mixed, with foreign-owned firms performing better in some industries, but worse in others. Similarly, Oulton (1998) reports an productivity advantage of US affiliates compared to UK-owned establishments, but finds no difference between non-US foreign-owned establishments and UK-owned establishments. Globerman et al. (1994) and Bellak and Pfaffermayr (2000), in contrast, find no differences related to home countries.

H4: There are differences between foreign-owned firms in employment creation and destruction which are related to different home countries.

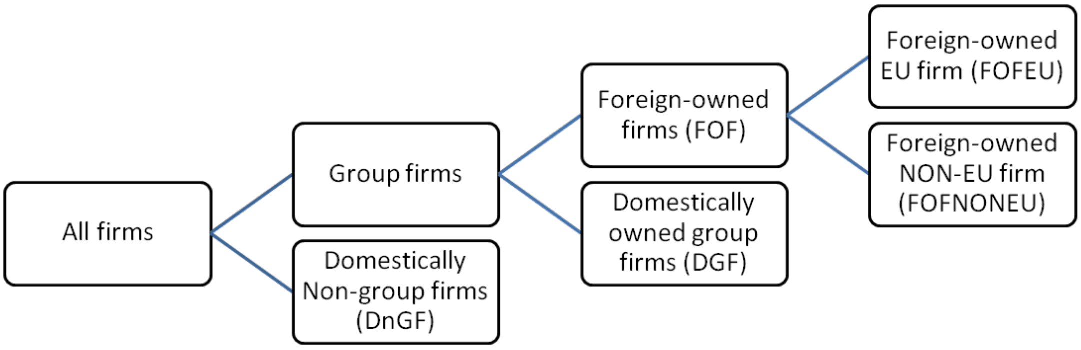
4. DATA SET

We employ data from the Community Innovation Survey (CIS) to estimate employment effects of innovation activities in foreign-owned and domestically owned firms. The CIS is a survey based on a harmonised questionnaire developed by Eurostat. It is conducted by national statistical offices or research institutes in all EU member states, Iceland and Norway. The CIS aims at assessing various aspects of the innovative behaviour and performance of enterprises and follows the definitions laid down in the OECD Oslo Manual (OECD, 2005).

EUROSTAT provides access to CIS micro data at the firm level at their premises. We use the CIS 4 sample which refers to the period 2002-2004. The sample used for this analysis includes more than 64,500 firms from 16 European countries (the distribution of firms by country and industry is provided in Table 2 and 3 in the Annex).[2]

In addition to data on sales and employment and various innovation indicators for 2002 and 2004, the CIS data contains information on whether the firm is part of an enterprise group. The questionnaire furthermore asks for the country of origin of the parent company, i.e. the country where the headquarters of the enterprise group is located. Based on these two items we distinguish the following types of foreign and domestic ownership (Figure 1):

Figure 1: Types of domestic and foreign ownership in the CIS data



Source: Own illustration

Domestically owned non-group firms (DnGF) are firms that do not belong to an enterprise group. They are domestically owned by definition. Domestically owned group firms (DGF) are firms that belong to an enterprise group whose parent company is located in the same country.[3] Foreign-owned firms (FOF) are part of an enterprise group whose parent company is located abroad, e.g. a firm domiciled in France with a parent company in Germany.

We further distinguish between foreign-owned firms from different home countries: Foreign-owned European firms (FOFEU) belong to an enterprise group with a parent company located in another European country. An example is a French firm whose parent company is located in Spain. Foreign-owned non-European firms (FOFNONEU) are part of an enterprise group with a parent company located outside Europe. An example is a firm domiciled in France with

[2] Sweden, Iceland, Finland and Lithuania could not be used due to missing information for some of the variables used in this analysis

[3] The data does not allow us to distinguish whether the domestic enterprise group is only active in its home country or a multinational group with at least one affiliate abroad.

a parent company from the US. The group of FOFNONEU is further split into foreign-owned US firms (FOFUS) and foreign-owned non-European firms from the rest of the world (FOFROW).

Prices are an important piece of information for disentangling different employment impacts. Like most other firm-level data sets, the CIS does not contain information on prices at the firm level. Instead, we employ producer price index data provided by EUROSTAT (time series DS-074564-industry) at three-digit level for NACE 15.9, NACE 24.4, and NACE 36.1, and at two-digit level for all other industries. We use the EU average price movements at the industry level measured by the producer price index for countries where no producer price index is available (in particular for SK, PT, LU, LV, EE). Due to lack of data, we apply the average producer price index for the production sector also for the service sector.

5. DESCRIPTIVE STATISTICS

A breakdown of the sample according to the ownership status reveals that the vast majority of firms in our sample are DnGF, followed by DGF (Table 4 in the Annex). DnGF also represent the vast majority of domestically owned firms in the sample (87% and 81% in manufacturing and services, respectively), and results for all domestically owned firms are very similar to the results for DnGF alone.

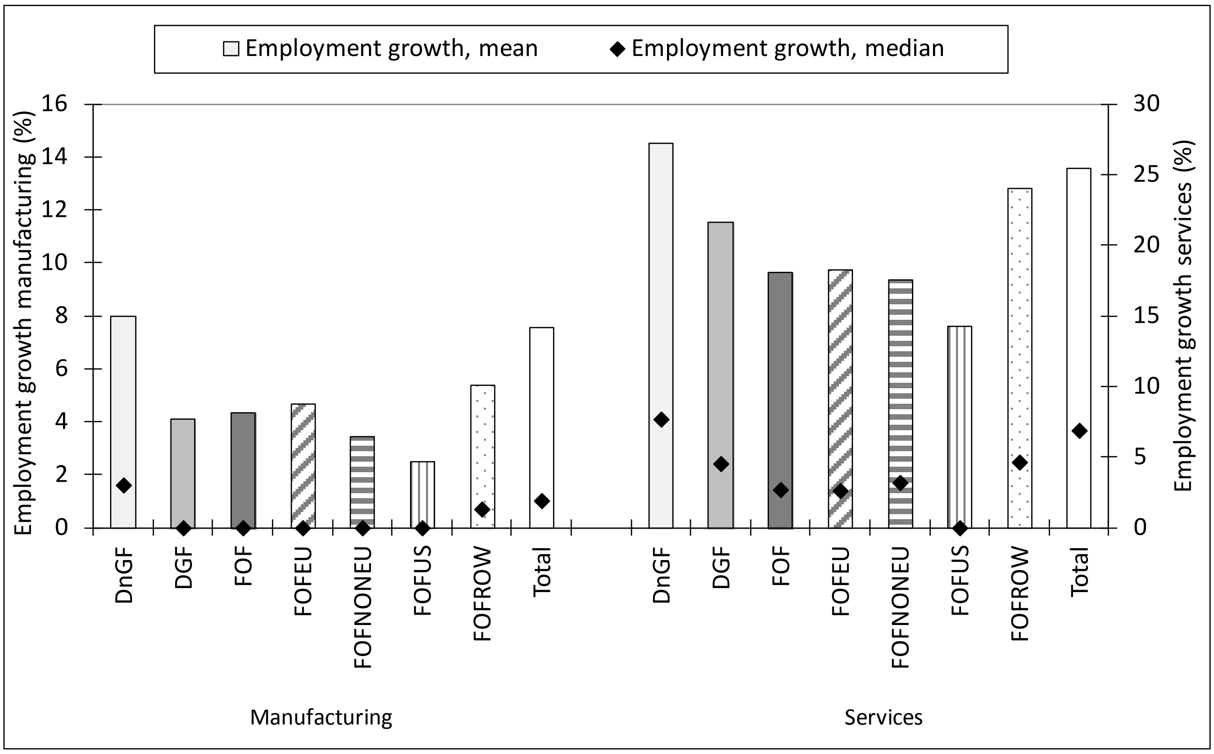
FOF are the exception in the sample. In general, their share is highest in small countries. Table 4 also indicates that foreign-owned affiliates are more frequent among service firms (9.5%) than among manufacturing firms (4.9%). The share of foreign-owned affiliates from Europe exceeds the share of foreign-owned Non-European firms in all countries.[4]

From 2002 to 2004, employment growth was fastest in DnGF. Employment grew more slowly in FOF than in DnGF, but faster in FOF than in DGF (Figure 2 and Table 5). US subsidiary firms had a considerably slower employment growth than the other sub-groups of foreign-owned firms. Figure 2 furthermore confirms the importance of the service sector for creating employment: Employment growth was higher in services than in manufacturing. Foreign-owned service firms, however, exhibited slower employment growth than DnGF and DGF in services. Though not reported here, we see this pattern for all countries.

[4] The only exception is the manufacturing sector in Greece. All figures are weighted.

One should keep in mind that these growth rates are larger than the numbers published by official statistics. This is due to the fact that (i) we can only observe surviving firms, (ii) we restricted the sample to firms with at least 10 employees and excluded certain industries, and (iii) we average the employment growth across firms instead of taking the ratio of the sum of changes in employment for all firms to the sum of employed personnel. Due to this method, average employment growth rates are influenced more heavily by very fast growing firms. The median employment growth rate, i.e. the employment growth rate experienced by the least 50 percent of firms, is much lower at 1.9% in manufacturing and 6.9% in services.

Figure 2: Employment growth by ownership, manufacturing and services, 2002-2004



Source: CIS 4, Eurostat, own calculation, weighted figures.

In addition to employment growth, Table 5 also reports descriptive statistics on innovation behaviour by ownership type. Both DGF and FOF have a higher propensity for product and process innovation than DnGF. This may reflect differences in innovation capabilities due to knowledge and technology transfer within the group but also differences in size. The difference between DGF and FOF is smaller for process than for product innovation, which is more frequent among FOF firms than among DGF and DnGF. Furthermore, the figures confirm our supposition (H1a) of higher sales growth rates due to new products for FOF (13.4% in manufacturing and 11.6% in services) than for DnGF (7.1% and 5.9%) and DGF (11.7% and 8.8%).

6. ECONOMETRIC SET-UP

To investigate employment effects of innovation we employ a model developed by Harrison et al. (2008). A main advantage of this model is that it allows us to disentangle some of the theoretical employment effects mentioned above. Furthermore, it is well-suited for analysing firm-level employment impacts of innovation using the specific information provided by CIS data. In particular, it establishes a theoretical relationship between employment growth and innovation output in terms of sales growth due to new products. The latter can be directly calculated with CIS data. This model has already been used to evaluate employment effects of innovation in a cross-country comparison for the UK, Spain, France and Germany (Harrison et al., 2008), Chile (Benavente and Lauterbach, 2007), and Italy (Hall et al., 2008), as well as to study employment effects of different types of innovations (Peters, 2008).

The model is based on a simple multi-product framework. The basic idea is that a firm can produce different products. It is further assumed that one can observe a firm *j* at two points in time *t* (= 1, 2). In *t*=1 the firm produces one or more products which are aggregated to one product which is called the "old product" or "existing product". Between *t*=1 and *t*=2, the firm can decide to launch one or more new or significantly improved products. The new product can (partially or totally) replace the old one if they are substitutes or enhance the demand of the old product in case of complementarity. To produce the different outputs, it is assumed that firms use conventional inputs labour *L* and capital *C* (and that the production function is linear homogeneous in these inputs). Moreover, specific efficiencies for the production process of both goods θ_{it} and its evolution over time are driven by the knowledge capital of the firm (which is assumed to be a non-rival input).

Based on these assumptions, Harrison et al. (2008) derive the conditional labour demand functions for each product for each point in time and, as a result, the overall employment growth rate: $l = \alpha_0 + \alpha_1 pc + y_1 + \beta y_2 + u$. Following the theoretical considerations above, employment growth *l* in the model stems from three different sources: (i) from the efficiency increase in the production of the *old* product, which negatively affects labour demand and which can be different for non-process innovators (α_0)[5] and process innovators *pc* (α_1); (ii) from the rate of change in the real production of the *old* product (y_1); (which is provoked by

[5] Efficiency gains for non-process innovators may for instance result from organisational innovation, better skilled labour, learning effect or spillover effects.

the new product to a certain degree, the induced change being negative for substitutes and positive for complements); and (iii) from starting production of the new product (positive sign). The employment effect of the latter depends on the efficiency ratio between both production technologies ($\beta = \theta_{22}/\theta_{11}$) and the real output growth due to new products (y_2).

Substituting unobserved real output growth rates by observed nominal output growth rates, Harrison et al. (2008) derive the following estimation equation which describes the relationship between employment growth, efficiency gains through process innovation and the sales growth due to new products[6]:

$$l - (g_1 - \tilde{\pi}_1) = \alpha_0 + \alpha_1 pc + \beta g_2 + v \tag{1}$$

g_1 and g_2 denote the nominal output growth (sales growth) due to old and new products, respectively, with $g_1 = y_1 + \pi_1$ and $g_2 = y_2 + \pi_2 y_2$. The variable g_2 can be calculated using CIS data by multiplying the share of sales due to new products in *t=2* with the ratio of sales in *t=2* and in *t=1* (referred to as SGRPD in the following text). g_1 can be calculated by the total sales growth rate minus the sales growth rate due to new products. π_1 measures the (unobserved) price growth rate of old products at the firm level. π_1 is proxied by $\tilde{\pi}_1$ the price growth rate of old products at the industry level. π_2 denotes the price difference between the new and the old product in relation to the price of the old product at the firm level. The new error term *v* equals $v = -E(\pi_1 - \tilde{\pi}_1) - \beta\pi_2 y_2 + u$. In our study, all growth rates relate to the period 2002-2004.

One problem that arises in this model is the fact that the sales growth rate from new products g_2 is correlated with the error term *v*. An appropriate econometric method to deal with such an endogeneity problem is to use instrumental variable techniques. The instruments should be correlated with the sales growth due to new products (i.e. innovation success), but not correlated with the error term (in particular it has to be uncorrelated with the relative price difference of new to old products). We use three dummy variables as instruments that have been found to be important in explaining innovation success: a dummy variable that indicates

[6] Since the coefficient of the real output growth y_1 is equal to one, it can be substracted from *l*. y_1 is not observed in the data but proxied by $g_1 - \tilde{\pi}_1$. For more details see Harrison et al. (2008) and Peters (2008).

whether the firm does R&D continuously (RDCONT); a variable that indicates whether the product innovation was aimed at increasing the product range (RANGE; measured on a 4 point scale), and a dummy variable that equals 1 if clients have been a high-to-medium sized information source of innovation. These instruments are similar to the ones proposed by Harrison et al. (2008). We have tested and proved their non-weakness and validity by checking the F-statistic from the first stage regression, the Kleibergen-Paap tests on weak instruments and underidentification, the Sargan-Hansen J-Test on overidentifying restrictions for overall instrument validity and the difference-in-Sargan C-Test on the instrument validity of single instruments.[7]

7. ECONOMETRIC RESULTS

7.1. Employment growth in foreign-owned and domestically owned firms

We first look at employment growth in FOF assuming the effect of innovation on employment to be the same for all firms. We build on equation (1) and additionally allow the efficiency increase α_0 to vary across countries, industries, size classes and ownership types by including corresponding dummy variables. Size is measured as number of employees at the beginning of the observed period in 2002. We distinguish three sizes classes: 10-49 (SMALL), 50-249 (MEDIUM) and more than 249 employees (LARGE).[8] The results for manufacturing and services are given in Table 6 in the Annex.

The econometric results reveal a significantly smaller employment growth rate for FOF compared to DnGF. This holds even when we control for initial firm size. In manufacturing, the employment growth rate is also significantly smaller for DGF than for DnGF. This is in line with the descriptive results of Figure 2. FOF in manufacturing, but not in services, behave very much like DGF. FOF in services, in contrast, exhibit significant lower growth rates compared to DGF. Moreover, econometric results reveal that DGF create less employment growth than DnGF in manufacturing, but not in service industries.

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[7] The tests are explained in more detail in the notes of Table 6.

[8] Note that the estimation equation is specified in growth rates, i.e. in first differences. This implies that time-invariant firm-specific (observable and unobservable) effects in the employment levels are already eliminated. However, the inclusion of industry, country and ownership dummies enlarge the flexibility of the specification by allowing for an unspecified form of heterogeneity in the growth rates between industries, countries and ownership types.

Employment growth of FOF also depends on the home country of the parent company. In manufacturing, European FOF grew more slowly than FOF having a parent company in the US or in the rest of the world. In services, FOF from the US create significantly less employment than European FOF. Compared to FOF from the rest of the world, employment growth of European FOF is lower.

Estimation results further show that successful product innovations are significantly related to employment growth. A higher sales growth rate due to product innovations (SGRPD) is associated with a higher employment growth rate. From the coefficient we can infer that an increase in sales growth due to new products of 1% leads to an increase in *gross* employment by 1% in manufacturing. The corresponding coefficient in services is significantly smaller than one which implies that new products are produced with a higher efficiency than old products. At the same time, one must take into account that product innovations can displace existing products to a considerable extent which is captured by g_1. Estimation results for the net employment effect of product innovations will be discussed below.

Process innovations (PC) are significantly associated with employment reduction in manufacturing, but not in the service sector. We can deduct from this result that the negative displacement effect of process innovations outweighs compensation effects in manufacturing, resulting in a negative employment effect. Conversely, the results suggest that service firms tend to pass on productivity gains derived from innovations to a larger extent which may be a result of less market power of service firms on average. However, this result might also partly be driven by the fact that process innovations in services are more difficult to identify than in manufacturing. Services are often customised to specific demands so that a clearly structured production process is lacking in many cases.

7.2. Innovation-induced employment growth by ownership type

We now relax the assumption that the effect of innovation on employment is the same for all firms and ask whether and how the observed differences in employment creation between foreign-owned and domestically owned firms are related to differences in process and product innovation. We examine this question by running separate regressions for each type of ownership (Table 7 and 8 in the Annex).

The results corroborate a positive impact of sales growth due to new products (SGRPD) on gross employment (compensation effect) for DnGF, DGF and FOF. In the model, the coefficient measures the productivity effect of new products. A value of less than one indicates that new products are produced more efficiently than old ones. A corresponding one-sided t-test shows that in manufacturing the coefficient is significantly smaller than 1 for FOF from NON-EU countries (p-value: 0.035) but not for DnGF and DGF. Thus, FOF were able to produce their new products with a significantly higher efficiency than domestically owned firms, implying less employment growth and confirming H1b. Note that the period 2002-2004 was characterized by a recession in many countries. Another reason for this result could be that globally active multinational firms are exposed to a higher cost pressure in recession periods so that they target efficient production of new products more heavily.

In services, we can only partly confirm H1b. The coefficient is likewise significantly smaller than 1 (p-value: 0.054) in FOF, but not for DGF, implying that the productivity (employment) effect is larger (smaller) for FOF than for DGF. Compared to DnGF, the productivity effect is larger for FOF, but statistically not significantly different. In contrast to manufacturing, productivity effects are especially large for FOF from EU countries.

For process innovation (PC) we find that ownership status and the home country of the parent company matters for employment. Process innovations are responsible for a significant labour reduction only in DnGF and in non-European FOF. As stated in H2a, we find the average efficiency gain of new production technologies (α_1) to be significantly larger for non-European FOF than for DnGF and for DGF. However, we cannot confirm H2a for European FOF. The results furthermore show that the efficiency gains for European FOF in services are nearly two times larger than for domestic firms though none of the effects is statistically significant.

7.3. Disentangling general productivity trends, demand effects, process and product innovation

The model estimates in section 7.2 does not allow us to separately identify the compensation effect of process innovation and the demand effect on existing products of product innovation which are both captured by g_1. In order to evaluate the contribution of process and product innovation to employment growth, Harrison et al. (2008) suggest an alternative way of presenting these results which allows to separate the effects of product and process innovations from effects arising from general demand and productivity trends. They suggest to decompose the average employment growth in the following way:

$$l = \underbrace{\hat{\alpha}_0}_{1} + \underbrace{\hat{\alpha}_1 pc}_{2} + \underbrace{\left[1 - I\left(g_2 > 0\right)\right]\left(g_1 - \tilde{\pi}_1\right)}_{3} + \underbrace{I\left(g_2 > 0\right)\left(g_1 - \tilde{\pi}_1 + \hat{\beta} g_2\right)}_{4} + \hat{v} \qquad (2)$$

I(·) is a so-called indicator function. It is 1 if the condition in brackets is fulfilled and 0 otherwise. Thus, employment growth can be decomposed into four terms:

1. The first term measures the change in employment due to *general industry and country specific productivity trends* in the production of *old* products. Here, general means that these effects are not attributable to process or product innovation. They rather reflect the effects of organisational change, corporate restructuring, acquisitions of firms, changes in human capital endowment, training, productivity effects from spillovers etc.

2. The second term presents the productivity or displacement effect of *process innovations* related to the production of *old* products.

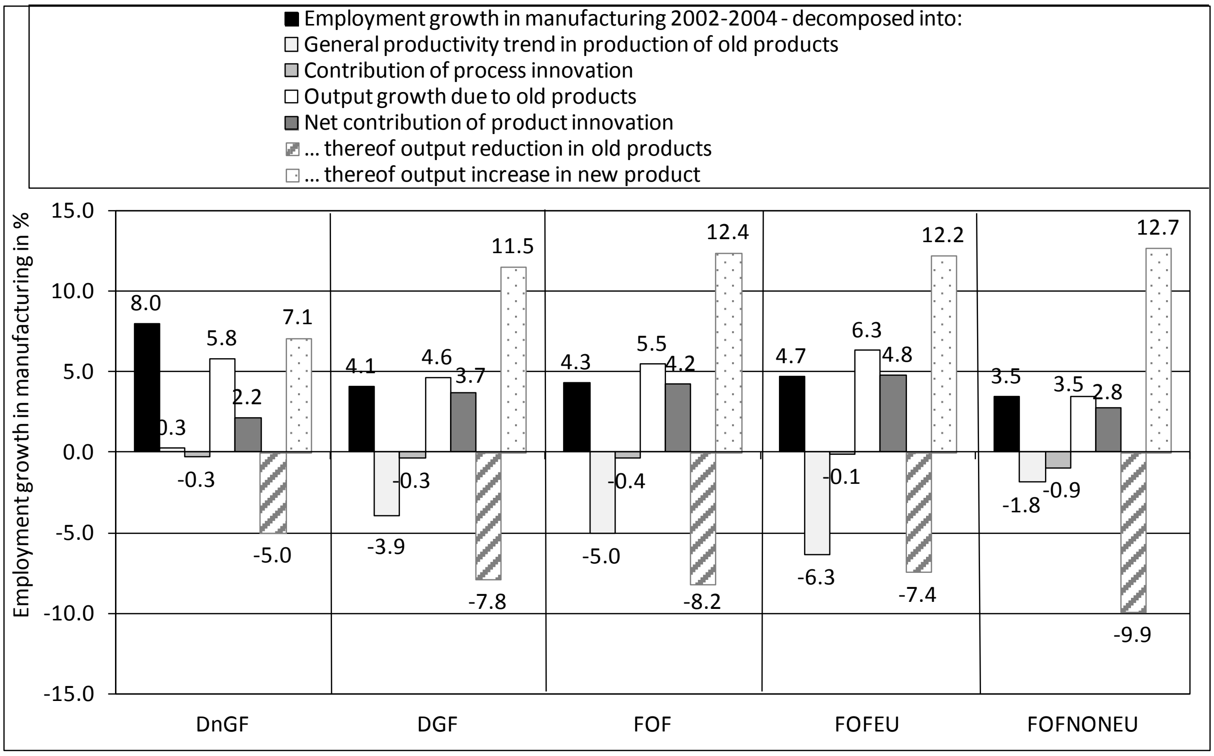
3. The third term captures the employment change associated with *output growth of old products* for firms that do *not* introduce new products. That is, the third component accounts for changes in employment growth due to shifting demand for the existing product. This shift in demand can be the result of price reductions, cyclical impacts, rivals' product innovations, changes in consumers' preferences etc.

4. The fourth term summarises the *net* contribution of *product innovation* to employment for product innovators. In this case, this effect results from increases in the demand for the new product and possible shifts in demand for the old one.

The final term is the residual term which is zero by definition. A dissection of the average employment growth can be obtained by inserting the average shares of innovators from the sample, the average price growth rates, and the estimated coefficients into the equation.

Figure 3 depicts the decomposition of employment growth in manufacturing by type of ownership. The general productivity trend exerts a considerable negative influence on employment in DGF and FOF. Both, DGF and FOF experience a much higher general productivity increase than DnGF which leads to a decrease in employment by roughly 4% in DGF and 5% in FOF between 2002 and 2004. For all three groups of firms another small negative effect of around 0.3 to 0.4% on employment comes from process innovations.

Figure 3: Decomposition of employment growth by ownership, manufacturing, 2002-2004



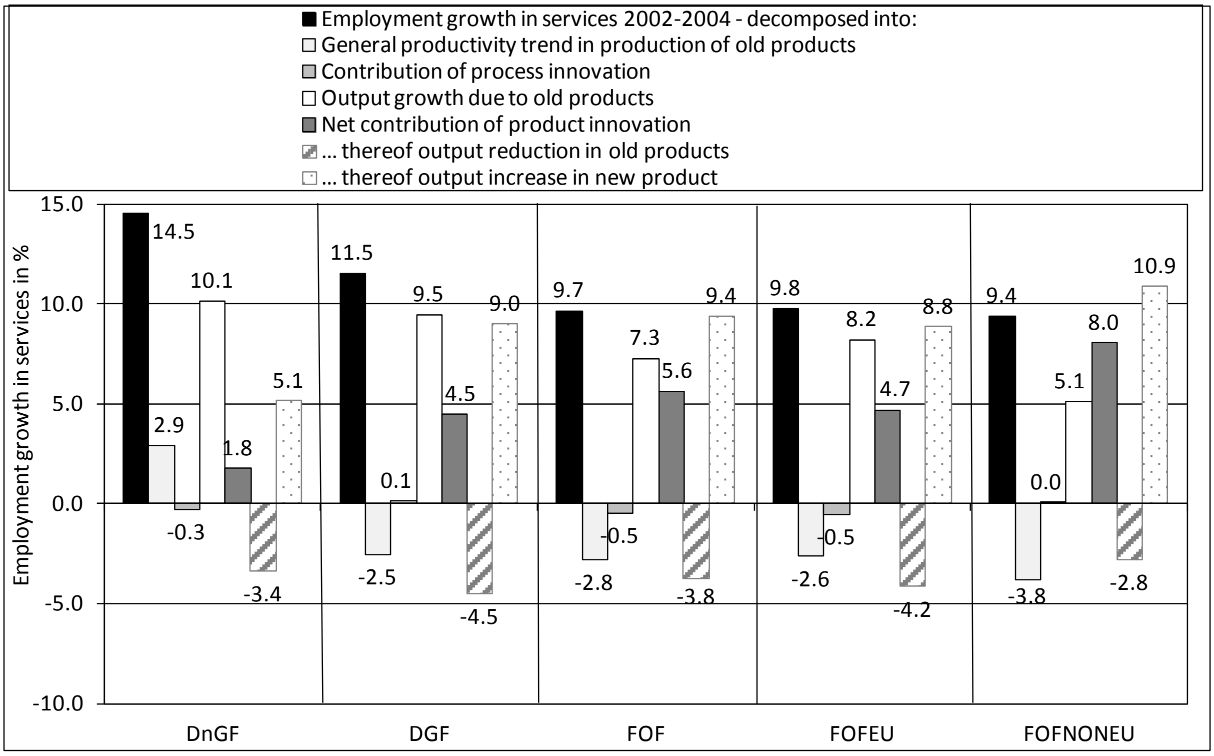
Source: CIS4, Eurostat, own calculation.

The effects of general productivity trends and process innovation on employment, however, are outweighed in each sub-sample by the compensation effect – the employment-creating effects of growth in demand for old and new products. Comparing old and new products, it turns out that output growth of old products contributes more to employment than product innovation in all sub-samples. A similar result was found by Harrison et al. (2008) for Spain and the UK, whereas product innovation contributed more to employment in Germany and France. In absolute terms, employment creation due to the demand for old products is highest for European FOFs (6.3%), closely followed by DnGF (5.8%). In DGF demand growth for old products spurs employment by 4.6%.The main difference between FOF, DnGF and DGF can be found in the contribution of product innovation to employment growth. In FOF-EU, new products contribute more to employment growth than in DGF and DnGF.

This indicates that foreign-owned firms from other European countries generate more employment growth than domestically owned firms with product innovation which supports H1. However, H1 is only partly supported for non-European FOF. They create more employment growth due to product innovation than DnGF, but not than DGF.

Figure 4 depicts the results of the decomposition of employment growth for service industries. The general pattern is the same as for manufacturing: We observe strong employment losses due to general productivity increases in FOF and DGF. In contrast, unaffiliated firms have still unexploited efficiency gains which can be inferred from the positive general productivity effect. Employment grows in all sub-samples of foreign-owned and domestically owned firms because employment losses by general productivity increases are overcompensated by the effects from output growth for old products and by the contribution of product innovation. Like in manufacturing, process innovation contributes only little to employment changes in services. This result is the same for all types of ownership.

Figure 4: Decomposition of employment growth by ownership, services, 2002-2004



Source: CIS4, Eurostat, own calculation.

General productivity gains (and thus corresponding labour savings) are smaller in services than in manufacturing. Like in manufacturing, however, FOF benefit much more from general productivity gains than DnGF. But in contrast to manufacturing, non-European FOF exhibit stronger general productivity gains in services than European FOF.

Moreover, old products contribute on average more to employment growth than new products, except for non-European FOF. The importance of demand growth for old products in employment creation is lower for FOF than for DnFG and DGF in services. On the other hand, new products have an even higher absolute and relative contribution to employment growth for both Non-European and European FOF which is in line with H1.

To sum up, the analysis supports H1 which assumes that FOF experience a higher employment growth from product innovation. We also find support for H2 in the results. H2 states that FOF also have a larger employment reduction from process innovation than DnGF and DGF.

Hypothesis H3 states that employment effects in DGF are more similar to the effects we observe in FOF than in DnGF. In manufacturing and in services, employment losses in FOF and DGF due to general productivity increases are higher than in DnGF. FOF and DGF, however, also generate more employment by product innovation than DnGF. Similarities between DnGF and DGF and dissimilarities between DGF and FOF are larger in the service sector, in particular when looking at output growth from old products, which is considerably higher for DGF than for FOF. Altogether, the results support H3 for manufacturing and for service industries.

Finally, H4 states that the country of origin of the foreign-owned firm matters for employment growth. In manufacturing, the results reveal that European FOF grow more slowly than firms from North America. In turn, subsidiaries of European MNEs tend to perform better than subsidiaries of MNEs from the rest of the world. In services, there is no such clear pattern. We therefore find support for H4 only for manufacturing.

8. Discussion and Conclusions

Understanding how foreign-owned and domestically owned firms transform innovation into employment is essential for an evidence-based discussion of the effects of globalisation.

We have examined the short-term effects of product and process innovation on employment. We demonstrated that foreign-owned firms experience higher employment losses than domestically owned firms due to process innovation and to general productivity increases which cannot be attributed to product or process innovation. Foreign-owned firms seem to be more willing to use new management practices, new organisational concepts, corporate restructuring or other productivity-enhancing measures than domestically owned firms.

Foreign-owned firms, however, compensate these losses by employment-creating effects of product innovation and higher sales from old products. Employment gains from product innovation are higher in foreign-owned firms, but nevertheless smaller than the losses from general productivity changes. This is partly due to the fact that new products compete with old products, and product innovation erodes sales from existing products. This effect is stronger in foreign-owned firms.

Displacement and compensation effects of innovation are stronger in foreign-owned firms than in domestically owned firms. In analogy to Joseph Schumpeter's (1942) famous notion, we may say that "creative destruction" is higher in foreign-owned than in domestically owned firms. This is an important finding, in particular for countries with a high share of foreign direct investment. It may be even more significant if we assume that employment creation by product innovation and employment destruction by process innovation and general productivity changes may differ during the various stages of business cycles. A paper by (Lucchese and Pianta, 2012) provides evidence that the effects from product innovation on employment creation are much greater in upswings than in downswings of the business cycle, while the opposite is true for labour saving process innovations and other measures to increase productivity which prevail over product innovation in downswings.

These results add a dynamic perspective to the findings of this paper. If we look at employment fluctrations of foreign-owned and domestically owned firms over the business cycle, we may find that foreign-owned firms may create more employment than domestically owned firms in an upswing, but also destroy more in a downswing. This may explain the finding that average net employment growth - the sum of the employment effects illustrated in Figure 3 and 4 - is lower in foreign-owned firms compared to domestically owned firms. The years 2002 – 2004 were a period of economic downturn in many countries.

The lack of a dynamic perspective is a limitation of our analysis. Moreover, the results only take into consideration employment changes which happen in the same 3-year period as the innovation. Additional effects of new products and processes that occur in later periods are excluded. Given that foreign-owned firms are more innovative and gain higher returns from product innovation, such effects are likely.

Another limitation is that the data does not consider technology diffusion from foreign-owned firms to domestically owned firms which may increase productivity and spur product innovation in the host country. The effects of foreign presence on growth may be considerably higher when spillovers are accounted for in the analysis. Moreover, we cannot account for additional employment effects that may occur in upstream or downstream firms. If the innovative firm is able to increase its output, all its suppliers benefit and this may stimulate their labour demand as well.

Future research thus should focus on the long-term effects of foreign innovation activity on employment. This long-term view is particularly important for innovations new to the market, which may unfold their potential only after years. A second promising line of research could be to investigate displacement and compensation effects over time.

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ANNEX

Table 2: CIS4 sample by country

		Manufacturing		Services	
Country	**Abb.**	**Number**	**in %**	**Number**	**in %**
Bulgaria	BG	4,171	10.19	2,798	11.79
Czech Republic	CZ	2,614	6.39	1,176	4.96
Denmark	DK	623	1.52	641	2.70
Estonia	EE	840	2.05	473	1.99
Spain	ES	8,056	19.69	2,882	12.15
France	FR	6,379	15.59	4,811	20.28
Greece	GR	227	0.55	169	0.71
Hungary	HU	1,717	4.20	805	3.39
Italy	IT	6,801	16.62	3,663	15.44
Luxembourg	LU	165	0.40	311	1.31
Latvia	LV	761	1.86	447	1.88
Norway	NO	1,532	3.74	1,135	4.78
Portugal	PT	2,055	5.02	1,167	4.92
Romania	RO	3,272	8.00	2,447	10.31
Slovenia	SI	715	1.75	331	1.40
Slovakia	SK	993	2.43	470	1.98
Total		40,921	100.00	23,726	100.00

Source: CIS 4, Eurostat. Unweighted figures, own calculation.

Table 3: CIS4 sample by industry

Manufacturing			Services		
Industry	**NACE**	**in %**	**Industry**	**NACE**	**in %**
Food / beverages / tobacco	15-16	13.46	Wholesale	51	40.18
Textile / leather	17-19	15.41	Transport / storage / post	60-63	25.5
Wood / paper / printing	20-22	12.41	Telecommunication	64	2.93
Chemicals	23-24	5.82	Banks / insurances	65-67	10.09
Plastic / rubber	25	4.8	Computer and related activ.	72	9.68
Non-metallic	26	5.82	Research and development	73	2.67
Basis metals	27-28	12.66	Technical services	74.2 +74.3	8.94
Machinery	29	8.21			
Electrical	30-33	9.25			
Vehicles	34-35	5.53			
Nec	36	6.64			
Total		100.00			100.00

Source: CIS 4, Eurostat. Unweighted figures, own calculation.

Table 4: CIS4 sample by ownership type

Country	DnGF	DGF	FOF	FOFEU	FOF NON-EU
Manufacturing					
Bulgaria	93.1	3.1	3.7	2.8	1.0
Czech Republic	81.2	6.8	12.0	10.2	1.8
Denmark	52.8	39.7	7.6	4.7	2.8
Estonia	72.8	15.0	12.2	10.7	1.4
Spain	88.8	7.8	3.3	2.5	0.8
France	65.6	25.3	9.1	5.8	3.3
Greece	89.2	8.7	2.1	0.7	1.4
Hungary	85.5	4.9	10.1	8.0	2.2
Italy	88.3	9.3	2.5	1.5	1.0
Luxembourg	58.1	18.2	23.6	17.4	6.3
Latvia	94.4	2.4	3.2	2.5	0.7
Norway	57.8	34.4	7.8	6.3	1.5
Portugal	88.4	7.5	4.1	2.9	1.2
Romania	95.1	2.2	2.6	2.1	0.6
Slovenia	67.3	26.8	5.9	5.3	0.6
Slovakia	78.2	7.5	14.3	13.1	1.2
Total	*83.1*	*12.0*	*4.9*	*3.4*	*1.5*
Services					
Bulgaria	92.5	2.6	4.8	3.6	1.2
Czech Republic	74.3	10.1	15.6	12.5	3.1
Denmark	43.1	38.0	18.9	10.7	8.2
Estonia	66.6	18.6	14.8	12.9	1.9
Spain	82.9	10.6	6.5	4.6	1.9
France	72.2	18.7	11.3	7.3	4.0
Greece	81.0	19.5	8.3	6.2	2.1
Hungary	79.4	6.1	12.8	10.5	2.3
Italy	41.2	14.2	6.4	4.0	2.4
Luxembourg	84.0	16.7	42.1	32.3	9.8
Latvia	52.1	2.8	13.2	11.4	1.8
Norway	78.6	20.0	17.9	13.8	4.1
Portugal	93.4	13.8	7.6	5.8	1.8
Romania	73.3	2.6	4.1	3.0	1.1
Slovenia	72.6	15.9	10.8	6.7	4.2
Slovakia	100.0	7.7	19.7	17.8	1.9
Total	*73.3*	*17.3*	*9.5*	*6.6*	*2.9*

Source: CIS 4, Eurostat. Weighted figures, own calculation.

Table 5: Descriptive statistics by ownership type

	Total	DnGF	DGF	FOF	FOF-EU	FOF-NONEU
Manufacturing						
Employment growth*	7.547 *[1.923]* (22.534)	7.982 *[3.030]* (22.998)	4.085 *[0.000]* (19.636)	4.313 *[0.000]* (20.127)	4.685 *[0.000]* (20.475)	3.451 *[0.000]* (19.269)
Productivity growth*	5.650 *[2.413]* (30.672)	5.160 *[1.661]* (30.929)	7.317 *[5.306]* (29.002)	9.878 *[6.718]* (29.797)	10.358 *[7.415]* (30.088)	8.752 *[5.495]* (29.084)
Sales growth*	12.062 *[6.438]* (36.344)	12.156 *[6.275]* (36.791)	10.579 *[6.584]* (33.077)	14.100 *[8.668]* (36.250)	14.912 *[9.103]* (36.649)	12.200 *[7.907]* (35.235)
Sales growth due to old products*	4.080 *[2.480]* (39.648)	5.027 *[2.952]* (39.871)	-1.088 *[-0.397]* (37.226)	0.692 *[1.139]* (40.436)	2.412 *[1.752]* (40.552)	-3.336 *[-1.817]* (39.890)
Sales growth due to new products*	7.982 *[0.000]* (24.368)	7.130 *[0.000]* (23.557)	11.667 *[0.000]* (27.475)	13.408 *[0.000]* (27.985)	12.500 *[0.000]* (26.666)	15.5356 *[0.000]* (30.761)
Price growth*	4.361 *[2.424]* (9.141)	4.634 *[2.481]* 9.655)	2.838 *[2.271]* (4.958)	3.458 *[1.848]* (7.522)	3.596 *[1.848]* (7.722)	3.133 *[1.800]* (7.026)
Innovator	0.359	0.321	0.534	0.569	0.552	0.609
Process innovator	0.292	0.264	0.426	0.448	0.443	0.460
Product innovator	0.222	0.187	0.375	0.438	0.420	0.482
thereof:						
Process innovator only	0.137	0.134	0.159	0.131	0.133	0.127
Product innovator only	0.067	0.058	0.108	0.121	0.109	0.148
Prod. and process innovator	0.155	0.129	0.267	0.317	0.310	0.334

Continued on next page

Services						
Employment growth*	13.551 *[6.897]* (29.776)	14.530 *[7.692]* (30.410)	11.546 *[4.545]* (28.012)	9.656 *[2.703]* (27.312)	9.776 *[2.632]* (26.713)	9.378 *[3.206]* (28.637)
Employment growth*	13.551 *[6.897]* (29.776)	15.041 *[7.692]* (30.410)	12.017 *[4.545]* (28.012)	9.945 *[2.703]* (27.312)	9.941 *[2.632]* (26.713)	9.954 *[3.206]* (28.637)
Productivity growth*	4.867 *[2.198]* (30.779)	3.862 *[1.357]* (30.235]	6.500 *[4.108]* (30.813)	9.668 *[4.128]* (34.135)	9.689 *[5.952]* (33.252)	9.621 *[0.938]* (36.074)
Sales growth*	16.943 *[9.950]* (39.067)	16.732 *[9.577]* (38.715)	16.794 *[10.695]* (38.136)	18.845 *[10.186]* (43.203)	18.879 *[10.370]* (41.402)	18.767 *[9.340]* (47.051)
Sales growth due to old products*	9.976 *[6.595]* (41.729)	10.808 *[6.941]* (41.460)	7.965 *[6.620]* (41.089)	7.205 *[3.627]* (44.629)	7.467 *[4.404]* (42.217)	6.610 *[2.121]* (49.680)
Sales growth due to new products*	6.967 *[0.000]* (23.856)	5.924 *[0.000]* (22.223)	8.829 *[0.000]* (25.814)	11.640 *[0.000]* (30.635)	11.412 *[0.000]* (31.026)	12.157 *[0.000]* (29.739)
Price growth*	4.680 *[2.271]* (8.756)	5.233 *[2.271]* (9.780)	2.814 *[2.271]* (3.565)	3.802 *[2.271]* (6.075)	3.943 *[2.271]* (6.251)	3.483 *[2.271]* (5.648)
Innovator	0.309	0.270	0.414	0.423	0.423	0.423
Process innovator	0.255	0.226	0.341	0.322	0.326	0.312
Product innovator	0.178	0.146	0.253	0.296	0.290	0.309
thereof:						
Process innovator only	0.131	0.124	0.161	0.127	0.133	0.114
Product innovator only	0.055	0.045	0.072	0.101	0.097	0.111
Prod. and process innovator	0.124	0.101	0.180	0.195	0.193	0.199

Source: CIS 4, Eurostat. * Figures reported are average growth rates, median growth rates in brackets and standard deviations in parentheses. Weighted figures. Own calculation.

Table 6: Effect of foreign ownership on employment growth, 2002-2004

	Manufacturing				Services			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Const.	-14.878***	-14.062***	-14.020***	-14.015***	-11.144***	-10.338***	-10.348***	-10.375***
	(1.482)	(1.501)	(1.501)	(1.501)	(2.083)	(2.073)	(2.077)	(2.076)
Innovation								
SGRPD	0.998***	1.011***	1.011***	1.011***	0.893***	0.903***	0.903***	0.903***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.038)	(0.038)	(0.038)	(0.038)
PC	-2.171**	-1.970**	-1.970**	-1.973**	-1.5730	-1.598	-1.599	-1.603
	(0.852)	(0.851)	(0.851)	(0.851)	(1.228)	(1.228)	(1.228)	(1.228)
Ownership								
DGF	-3.407***	-2.640***	-2.632***	-2.623***	-2.396**	-1.670	-1.671	-1.689
	(0.761)	(0.813)	(0.813)	(0.812)	(1.123)	(1.155)	(1.156)	(1.154)
FOF	-3.377***	-2.204***	-	-	-5.576***	-4.862***	-	-
	(0.674)	(0.737)			(1.554)	(1.613)		
FOFEU	-	-	-2.529***	-2.518***	-	-	-4.786**	-4.804**
			(0.822)	(0.821)			(1.882)	(1.882)
FOFNONEU	-	-	-1.417	-	-	-	-5.039*	-
			(1.054)				(2.625)	
FOFUS	-	-	-	-0.932	-	-	-	-7.596*
				(1.265)				(3.979)
FOFROW	-	-	-	-2.023	-	-	-	-2.449
				(1.612)				(3.040)
Country dummies								
BG	1.711	1.507	1.4712	1.474	1.436	0.797	0.806	0.835
	(1.311)	(1.313)	(1.313)	(1.313)	(2.196)	(2.195)	(2.197)	(2.197)
CZ	9.074***	8.816***	8.798***	8.801***	9.813***	9.198***	9.204***	9.237***
	(1.310)	(1.312)	(1.312)	(1.312)	(2.192)	(2.193)	(2.194)	(2.194)
DK	26.973***	26.381***	26.332***	26.325***	20.675***	20.028***	20.043***	20.010***
	(1.803)	(1.804)	(1.806)	(1.806)	(2.368)	(2.363)	(2.372)	(2.369)
EE	3.846**	3.372*	3.356*	3.358*	3.399	2.618	2.622	2.665
	(1.780)	(1.788)	(1.788)	(1.788)	(2.856)	(2.865)	(2.865)	(2.864)
ES	9.066***	8.418***	8.379***	8.378***	9.982***	9.280***	9.290***	9.329***
	(1.259)	(1.264)	(1.264)	(1.264)	(2.289)	(2.272)	(2.279)	(2.278)
FR	13.023***	12.403***	12.356***	12.349***	12.207***	11.482***	11.494***	11.536***
	(1.472)	(1.472)	(1.474)	(1.473)	(2.214)	(2.190)	(2.193)	(2.191)
GR	12.410***	11.702***	11.654***	11.644***	12.743***	12.043***	12.053***	12.068***
	(2.426)	(2.437)	(2.439)	(2.439)	(3.0139)	(3.022)	(3.020)	(3.023)
HU	14.675***	14.359***	14.330***	14.332***	10.656***	10.037***	10.044***	10.098***
	(1.442)	(1.442)	(1.442)	(1.442)	(2.507)	(2.505)	(2.506)	(2.506)
IT	19.672***	18.998***	18.955***	18.954***	18.929***	18.171***	18.183***	18.202***
	(1.249)	(1.251)	(1.251)	(1.252)	(2.167)	(2.153)	(2.161)	(2.160)
LU	16.547***	16.193***	16.166***	16.146***	23.124***	22.338***	22.342***	22.372***
	(2.141)	(2.145)	(2.146)	(2.146)	(2.883)	(2.894)	(2.893)	(2.895)
LV	-0.969	-1.235	-1.270	-1.267	9.642**	9.016**	9.021**	9.079**
	(2.219)	(2.218)	(2.218)	(2.219)	(4.046)	(4.041)	(4.041)	(4.042)
NO	21.687***	21.025***	20.994***	20.989***	19.627***	18.799***	18.806***	18.873***
	(1.410)	(1.425)	(1.425)	(1.425)	(2.322)	(2.331)	(2.333)	(2.333)
PT	11.496***	11.006***	10.965***	10.967***	12.106***	11.380***	11.389***	11.403***
	(1.375)	(1.381)	(1.382)	(1.382)	(2.458)	(2.452)	(2.453)	(2.452)
RO	43.897***	43.839***	43.793***	43.799***	47.263***	46.790***	46.799***	46.816***
	(1.596)	(1.594)	(1.594)	(1.594)	(2.301)	(2.293)	(2.295)	(2.295)
SI	4.587**	4.481**	4.459**	4.463**	6.998**	6.263*	6.276*	6.234*
	(2.033)	(2.038)	(2.037)	(2.037)	(3.359)	(3.359)	(3.362)	(3.357)
Size dummies								
MEDIUM	-	-2.543***	-2.547***	-2.554***	-	-2.835***	-2.834***	-2.802***
		(0.482)	(0.482)	(0.482)		(0.787)	(0.787)	(0.787)
LARGE	-	-2.221***	-2.254***	-2.280***	-	-5.313***	-5.313***	-5.268***
		(0.586)	(0.586)	(0.584)		(0.936)	(0.935)	(0.938)
Industry dum.	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

Continued on next page

Table 6: Effect of foreign ownership on employment growth, 2002-2004 (cont')

R2adj	0.4159	0.4153	0.4153	0.4152	0.3456	0.3463	0.3463	0.3464
H0: ß=1	0.9086	0.6062	0.6083	0.6098	0.0049***	0.0110**	0.0110 **	0.0107**
H0: SGRNP exogenous	0.0000***	0.0000***	0.0000***	0.0000***	0.5228	0.3524	0.3522	0.3590
J-Test	0.6099	0.3670	0.3685	0.3737	0.7794	0.7213	0.7214	0.7330
C: RANGE	0.5534	0.3871	0.3873	0.3886	0.6666	0.6133	0.6148	0.6134
C:CLIENT	0.3228	0.1601	0.1610	0.1641	0.4819	0.4214	0.4217	0.4350
C: R&D	0.8879	0.8761	0.8776	0.8819	0.9292	0.9309	0.9305	0.9467
First stage statistics:								
RANGE	8.012***	8.045***	8.046***	8.044***	8.755***	8.784***	8.787***	8.787***
	(0.339)	(0.340)	(0.340)	(0.340)	(0.517)	(0.518)	(0.518)	(0.518)
RDCONT	7.088***	7.456***	7.456***	7.465***	11.529***	11.683***	11.687***	11.691***
	(1.107)	(1.037)	(1.037)	(1.037)	(1.645)	(1.655)	(1.655)	(1.657)
CLIENT	7.445***	7.525***	7.525***	7.522***	7.160***	7.196***	7.184***	7.183***
	(0.852)	(0.854)	(0.854)	(0.854)	(1.221)	(1.221)	(1.221)	(1.221)
F overall	114.59***	137.97***	133.91***	130.10***	62.09***	69.89***	67.58***	65.85***
Partial R2	0.2556	0.2531	0.2531	0.2531	0.2683	0.2670	0.2686	0.2685
H0: underident.	1077.5***	976.14***	976.03***	976.48***	511.62***	492.96***	493.10***	492.47***
H0: Weak instr.	536.21***	485.37***	485.25***	485.40***	252.29***	244.90***	245.07***	244.77***
Obs	40920	40920	40920	40920	23726	23726	23726	23726

Note: Estimates are based on pooled data. Reference country: Slovakia (SK). Method: weighted instrumental variables estimation. Standard errors in parentheses. Standard errors are robust to heteroskedasticity. ***, ** and * indicates significance at the 1%, 5% and 10% level. *Industry dummies* are included in each regression. Reported is the p-value of a test on joint significance of the industry dummies. *Instruments* for sales growth due to new products (SGRPD): RANGE (product innovation was aimed to increasing product range: measured on a 4-point Likert scale (4: high importance; 0 not important), RDCONT (dummy for continuous R&D activity) and CLIENT (dummy equals 1 if clients have been a high-to-medium-sized information source of innovation). *J-Test* reports the p-value of the Sargan-Hansen test on overidentifying restrictions. Under H0 (overall set of instruments is valid) J follows a $X^2(m)$ distribution with m as the number of overidentifying restrictions. The difference-in-Sargan C-Test reports the p-value of a difference-in-Sargan test on the validity of a single instrument. "*H0: SGRNP exogenous*" tests on the exogeneity of sales growth due to new products using a difference-in-Sargan test statistic. The test statistic is robust to violations of conditional homoskedasticity. If conditional homoskedasticity holds, it is numerically equal to a Hausman-Durbun-Wu test statistic. F*irst stage statistics*: Reported are only coefficients and standard errors of the instruments, results for the other exogenous variables in the first stage are available upon request. *F overall* reports the test statistic of an F-Test on the joint significance of all variables (exogenous and instruments) in the first stage. *Partial R2* measures the explanatory power of the instruments (it is the R2 of the first stage regression where other explanatory variables have been partialled out). "*H0: underident.*" is a test on whether the equation is identified, i.e., that the excluded instruments are relevant meaning correlated with the endogenous regressors. Reported is the heteroskedasticity-robust Kleibergen-Paap (2006) rk LM statistic which follows here a $X^2(3)$-distribution. Weak instruments can lead to a large relative bias of IV compared to the bias of OLS. "*H0: weak instr.*" tests the null hypothesis that the instruments are weak, more precisely that the maximal relative bias of IV is larger 5%. Reported is the heteroskedasticity-robust Kleibergen-Paap rk Wald F statistic. The critical value is 13.91 (critical value is for the Cragg-Donald F statistic and i.i.d. errors; see Cragg and Donald 1993, Stock and Yogo 2005 and Baum et al. 2007).

Source: CIS 4, Eurostat, own calculation.

Table 7: Effect of innovation on employment growth by ownership type, manufacturing

	DnGF	DGF	FOF	FOFEU	FOFNONEU
Const.	-12.905***	16.762***	-18.097***	-18.244***	-18.160**
	(1.699)	(4.150)	(3.441)	(3.586)	(7.877)
Innovation					
SGRPD	1.014***	1.000***	0.947***	0.983***	0.864***
	(0.025)	(0.062)	(0.051)	(0.062)	(0.077)
PC	-1.192**	-2.065	-2.637	-0.667	-7.317**
	(0.976)	(2.018)	(1.880)	(2.101)	(3.615)
Ownership					
FOFUS	-	-	1.529	-	-
			(1.387)		
FOFROW	-	-	0.403	-	-
			(1.647)		
Country dummies					
BG	.289	5.813	3.584	3.239	5.308
	(1.477)	(4.728)	(3.914)	(4.335)	(8.459)
CZ	6.976***	10.747**	8.218***	20.004***	8.877
	(1.496)	(4.352)	(3.369)	(3.606)	(7.808)
DK	29.152***	23.459***	24.978***	20.732***	32.616***
	(2.381)	(4.402)	(3.874)	(4.611)	(7.139)
EE	2.106	3.884	9.419**	8.673**	14.159*
	(2.161)	(4.843)	(3.999)	(4.381)	(8.049)
ES	6.907***	8.570**	18.000***	17.609***	18.978***
	(1.435)	(4.227)	(3.128)	(3.387)	(6.915)
FR	10.078***	14.602***	19.308***	19.248***	19.787***
	(1.825)	(3.950)	(3.036)	(3.278)	(6.682)
GR	10.435***	9.988	21.667***	28.509***	21.268***
	(2.614)	(10.138)	(5.200)	(8.905)	(7.978)
HU	13.640***	12.357**	16.801***	14.990***	22.615***
	(1.637)	(5.190)	(3.490)	(3.735)	(8.120)
IT	17.893***	16.480***	25.401***	26.798***	23.826***
	(1.426)	(4.062)	(3.399)	(3.884)	(6.892)
LU	14.599***	18.174**	21.460***	21.849***	19.704**
	(2.894)	(5.805)	(3.981)	(4.567)	(8.035)
LV	-2.357	-5.460	0.738	-0.518	6.978
	(2.383)	(6.201)	(6.453)	(7.609)	(10.653)
NO	20.133***	21.334***	23.828***	23.063***	29.222***
	(1.750)	(4.072)	(3.569)	(3.877)	(7.972)
PT	9.705***	12.466***	13.050***	11.463**	16.539**
	(1.562)	(4.390)	(4.103)	(4.740)	(8.009)
RO	42.541***	51.391***	46.488***	44.438***	52.569***
	(1.748)	(5.570)	(4.969)	(5.118)	(12.220)
SI	5.051*	1.370	4.961	6.855	-11.304
	(2.666)	(4.403)	(4.218)	(4.444)	(12.682)
Industry dummies	0.000***	0.008***	0.000***	0.001***	0.345
Size dummies					
MEDIUM	-3.303***	-0.235	-2.106	-2.147	-2.279
	(0.559)	(1.146)	(1.518)	(1.714)	(2.587)
LARGE	-2.568***	-0.901	-2.294	-2.706	-1.008
	(0.816)	(1.189)	(1.530)	(1.795)	(2.585)
R2adj	0.402	0.479	0.527	0.519	0.552
H0: ß=1	0.5762	0.9937	0.2957	0.7881	0.077*
H0: SGRNP exog.	0.0000***	0.0078***	0.0449**	0.0257**	0.9440
J-Test	0.3798	0.4104	0.8965	0.6575	0.6825
C: RANGE	0.5513	0.1857	0.6541	0.5728	0.9310
C: R&D	0.1661	0.6125	0.7204	0.3620	0.5370
C:CLIENT	0.6991	0.3976	0.8322	0.8420	0.4897

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Table 8: Effect of innovation on employment growth by ownership, manufacturing (cont')

First stage statistics:					
RANGE	8.614***	6.208***	6.910***	6.882***	7.500***
	(0.428)	(0.614)	(0.562)	(0.673)	(0.967)
R&D	7.666***	9.356***	4.574***	6.247***	3.126
	(1.353)	(1.728)	(1.539)	(1.742)	(2.426)
CLIENT	8.560***	3.536*	5.534***	4.368**	6.063***
	(1.033)	(1.833)	(1.480)	(1.730)	(2.331)
F overall	83.78***	41.55***	34.07***	25.81***	14.23***
Partial R2	0.2760	0.1870	0.2008	0.2043	0.2021
H0: underident.	686.946***	256.872***	493.903***	372.211***	131.285***
H0: Weak instr.	355.087***	101.486***	181.270***	124.833***	75.632***
Obs	28804	7483	4633	3269	1364

Notes: see Table 6.

Source: CIS 4, Eurostat, own calculation.

Table 8: Effect of innovation on employment growth by ownership, services

	DnGF	DGF	FOF	FOFEU	FOFNONEU
Const.	-8.850***	-14.717**	-19.487***	-22.870***	12.271
	(2.411)	(6.487)	(5.066)	(5.475)	(12.249)
Innovation					
SGRPD	0.879***	1.012***	0.822***	0.795***	0.897***
	(0.049)	(0.062)	(0.111)	(0.143)	(0.103)
PC	-2.268	0.806	-3.698	-4.016	0.348
	(1.567)	(2.052)	(3.040)	(3.866)	(4.741)
Ownership					
FOFUS	-	-	-1.588	-	-
			(3.738)		
FOFROW	-	-	3.138	-	-
			(3.394)		
Country dummies					
BG	0.009	-5.262	3.092	4.865	-21.592
	(2.528)	(8.748)	(6.137)	(6.859)	(14.423)
CZ	7.781***	8.868	15.507***	19.202***	-16.665
	(2.579)	(7.193)	(5.127)	(5.443)	(13.079)
DK	21.237***	16.828**	28.199***	31.892***	-2.488
	(2.864)	(6.733)	(5.619)	(6.282)	(12.687)
EE	0.651	5.177	8.617	10.328*	-4.944
	(3.595)	(7.708)	(5.600)	(5.860)	(12.892)
ES	8.553***	9.983	9.977	6.797	-3.994
	(2.629)	(7.073)	(6.627)	(7.219)	(12.587)
FR	9.636***	13.855**	15.782***	20.841***	-17.913
	(2.642)	(6.455)	(5.307)	(5.560)	(12.801)
GR	10.720***	14.125*	14.443*	17.030**	-14.357
	(3.555)	(8.453)	(7.953)	(8.273)	(22.413)
HU	8.659***	11.719	14.787***	16.154***	-11.477
	(2.920)	(9.281)	(5.767)	(6.208)	(13.391)
IT	17.498***	18.697***	18.981***	27.333***	-21.771*
	(2.503)	(6.613)	(6.798)	(7.918)	(13.002)
LU	19.587***	15.184*	29.480***	31.784***	1.778
	(3.637)	(8.313)	(5.975)	(6.403)	(14.937)
LV	7.650	21.877**	12.986	13.192	0.603
	(4.697)	(9.136)	(8.506)	(9.002)	(16.477)
NO	18.214***	18.012***	24.156***	25.216***	0.298
	(2.872)	(6.735)	(5.624)	(6.066)	(12.952)
PT	11.029***	13.257*	6.394	11.125	-26.046
	(2.901)	(6.813)	(6.746)	(6.887)	(17.370)
RO	45.872***	45.238***	49.302***	52.269***	19.694
	(2.617)	(8.816)	(6.214)	(6.876)	(14.314)
SI	5.538	10.033	3.759	1.913	-18.694
	(4.018)	(8.172)	(9.647)	(11.017)	(19.361)
Size dummies					
MEDIUM	-3.212***	-3.510**	-0.133	-1.136	1.828
	(0.946)	(1.678)	(2.320)	(2.885)	(3.416)
LARGE	-6.472***	-6.958***	-0.983	-1.901	1.196
	(1.073)	(1.691)	(2.836)	(3.547)	(4.395)
Industry dummies	0.0001***	0.0128**	0.4951	0.6794	0.0495**
R2adj	0.3336	0.3810	0.3884	0.4078	0.4085
H0: ß=1	0.0139**	0.8439	0.1083	0.1506	0.3163
H0: SGRNP exog.	0.5721	0.0015***	0.6005	0.9221	0.3845
J-Test	0.4168	0.5369	0.2825	0.2026	0.8376
C: RANGE	0.6394	0.8441	0.1141	0.0767*	0.5530
C: R&D	0.3609	0.5083	0.2346	0.6386	0.5796
C:CLIENT	0.2447	0.3266	0.4236	0.2237	0.6606

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Table 8: Effect of innovation on employment growth by ownership, services (cont')

First stage statistics:					
RANGE	8.716***	8.842***	9.720***	9.486***	10.523***
	(0.692)	(0.893)	(1.399)	(1.785)	(1.740)
R&D	12.759***	9.281***	12.539***	10.123**	16.253***
	(2.309)	(2.241)	(4.216)	(4.995)	(6.055)
CLIENT	9.143***	3.242*	4.015	5.702	-0.005
	(1.583)	(1.765)	(3.886)	(4.752)	(4.459)
F overall	39.04***	28.93***	16.19***	12.19***	8.83***
Partial R2	0.2846	0.2377	0.2659	0.2425	0.3284
H0: underident.	294.948***	199.764***	80.005***	55.819***	41.381***
H0: Weak instr.	142.463***	109.669***	38.846***	25.539***	21.103***
Obs	15488	5340	2938	2097	841

Notes: see Table 6.

Source: CIS 4, Eurostat, own calculation.

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