The Impact of Green Innovation on Employment Growth in Europe

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Contribution to the Project

The paper makes two contributions. First, it provides a survey of the literature on the link between eco-innovation and employment. It looks especially at the measurement, data and indicators used for eco-innovation used by these papers. Second, the paper provides new estimates on the link between changes in sales due to product and process innovations and a general technological advance and changes of employment. Here, the paper distinguish between "normal" product innovation and product innovation with specific eco-friendly features. In addition, process innovations are also differentiated by eco-friendly process innovation and "normal" process innovation. Finally, in order to consider the full effect of innovations on employment the paper also take into account that sales due to innovations might cannibalised sales from old products. Depending of the degree of cannibalisation the employment impact of innovation might be quite different.

The results will provide evidence for all countries for which microdata from community innovation surveys are available at the safe centre of Eurostat. Hence, the paper provides evidence for the innovation-ecoinnovation-growth link for Cyprus, Germany, France, Italy, Luxembourg, Malta, Italy, Netherlands, Portugal, Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Romania, and Slovakia. We also private estimates for groups of countries like new member states vs. old member states.

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Executive Summary

This paper defines the scope of environmental innovations and their employment effects by exploiting data from the Community Innovation Surveys for different EU member states. In particular, we compare the employment impact of product and process innovation with and without specific environmental characteristics. Hence, the paper contributes to the discussion of the impact of green innovation on employment growth in Europe.

The question how innovation affects employment is non-trivial since various channels exist through which different kinds of innovation may destroy existing jobs (displacement effects) or may create new jobs (compensation effects). In general, the majority of empirical studies finds an employment-stimulating effect of product innovation whereas the effect of process innovation is ambiguous ranging from significantly negative to positive (for early surveys see Channels and Van Reenen 2002 and Spieza and Vivarelli 2002, and also König et al. 1995, Van Reenen 1997, Greenan and Guellec 2000, Smolny 2002, Harrison et al. 2008, Hall et al. 2008, Lachenmeier and Rottmann 2011). However, up to now empirical evidence on the employment effect of environmental innovation is scarce, Bogliacino and Pianta (2010) at the sector level and Pfeifer and Rennings (2001), Rennings and Zwick (2002), Rennings et al (2004), Horbach (2010) and Horbach and Rennings (2013) at the firm level being exceptions. Most of these studies demonstrate a positive impact of eco innovation on employment.

The paper employs the latest CIS data available from EUROSTAT microdata save center for Bulgaria, Cyprus, Czech Republic, Germany, Estonia, France, Hungary, Italy, Lithuania, Luxemburg, Latvia, Malta, Netherlands, Portugal, Romania, and Slovakia. Hence, the data covers a broad range of member states from Western Europe, Southern Europe, as well as the New Member states. We estimate pooled as well as country- and sector-specific regressions for the sample of member states.

Using the results of derived conditional labor demand functions we decompose employment growth 2006 to 2008 into the contribution of several sources of employment growth. The decomposition distinguishes the employment impact of

- country-specific general productivity trends in the production of old products,
- environmental process innovation,
- process-innovation without any environmental benefits,
- the output growth of old products of non-product innovators (i.e. non-innovating companies, companies with only non-environmental process innovations or only environmental process innovations),
- the output growth due to new products with environmental friendly characteristics and,
- the output growth due to new products without environmental-friendly characteristics.

Overall, the results show that the general productivity trend has a strong negative impact on employment growth. More surprisingly, specific process innovations both with and without environmental-friendly characteristics only have a minor impact beyond the general productivity trend. The general growth in output (e.g. linked to business cycle) has the biggest impact on employment growth. Product innovations contribute significantly to employment growth even taking into account that a significant share of new products just substitutes old products. Overall, the contribution of product innovation is due to both types of new products, those with and without environmental benefits for consumers. These patterns hold both for manufacturing and service industries. However, product innovation, and especially environmental-friendly product innovation, is a far less important contributor to employment growth for services than for manufacturing.

This global picture holds for all countries albeit the paper uncovers country-specific characteristics. This country-specific pattern might be related to country-specific environmental policies, the distance of a country

to the productivity frontier, or/and the industry structure, e.g. the relative importance of car or mechanical industry within manufacturing.

From a policy point of view one should note that environmental process innovations, e.g. caused by country-specific environmental regulation policies, in all countries have either none or only a minor impact on growth beyond the general country-specific productivity trend. Hence, our result does not point towards the often feared negative employment consequences of environmental policies affecting production processes. There seems to be no significant trade-off between stricter environmental regulation of production processes and employment growth in the period 2006-2008 which is covered by our data.

In addition, product innovation is a significant driver of employment growth in all countries. Our findings illustrate that this pattern is also observed for environmental-friendly new products. However, we do not find a clear order with respect to the relative importance of both kinds of product innovations. In manufacturing in some countries (e.g. Germany, Slovakia, Czech Republic) the employment impact of new products with environmental-friendly characteristics even outperforms the employment impact of new products without environmental-friendly characteristics. On the contrary, this study finds a significantly larger impact of ordinary product innovation compared to environmental-friendly new products in other countries like Bulgaria, Malta or Cyprus.

The analyses provide some interesting policy insights: Overall, we do not corroborate a trade-off between employment growth and the introduction of environmentally-friendly processes (e.g. in terms of reductions of material or energy inputs, safer work environments, or negative environmental consequences of production). Hence, there seems to be some room for industrial and regulation policies to induce the increased use of environmentally-friendly production processes in manufacturing as well as in services. Even more, a stronger focus of environmental-friendly product innovation compared to non-environmental-friendly product innovation will most likely not have different employment impacts. An obvious implication then is that an industrial or environmental policy which generated more favorable conditions for environmental product innovation will not induce a reduction of a country’s ability to profit from product innovation in general with regard to employment growth. This is especially important if we take into account limits in the ability of firms and countries to generate innovation. Hence, the tradeoff between environmental regulation and employment growth seems to be small as long as the environmental policy provides a medium or long-term orientation so that firm can translate these incentives into process and product innovation with more favorable environmental characteristics. The results also show that in some countries such policies might even increase the employment impact from innovation.

This study contributes to the Central Research Question 1 of wwwforEurope by showing that environmental innovation, e.g. induced by industrial policies to reduce environmental impact of production and consumption, might not face trade-off with regard to the competitiveness of firms in terms of their ability to generate jobs. More specifically, it contributes to the Central Question 3 by showing that industrial (environmental) policies which shift the innovation focus towards environmental-friendly innovation will probably not destroy jobs but contributions to job creation at least in some member states even if we assume limits in the innovation capacity of countries and firms.

The Impact of Environmental Innovation on Employment Growth in Europe

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Abstract

This paper studies the impact of environmental innovation on employment growth using firm-level data for 16 European countries and the period 2006-2008. It extends the model by Harrison et al (2008) in order to distinguish between employment effects of environmental and non-environmental product as well as process innovation. By looking at country and sector level differences, it also generates new insights into the heterogeneity of the environmental innovation-employment growth link along different dimensions. The results demonstrate that both environmental and non-environmental product innovations are conducive to employment growth in European firms. We estimate a gross employment effect of product innovation for both types of product innovators that is very similar in nearly all countries and sectors. That is, in most cases a one-percent increase in the sales due to new products for environmental product innovators also increases *gross* employment by one percent. This implies that there is no evidence that environmentally-friendly new products are produced with higher or lower efficiency than old products. Yet, we observe differences in the contribution of environmental and non-environmental product innovation to employment growth across countries or sectors that are the result of differences in the average innovation engagement and innovation success across countries or sectors. The absolute contribution to employment growth is positive for both types of new products. However, we find mixed evidence for the relative importance. In manufacturing the contribution of environmental product innovators was larger than that of non-environmental product innovators in half of the countries. In services, however, non-environmental product innovators matters more for growth in the vast majority of countries. In contrast, environmental and non-environmental process innovation plays only a little role for employment growth.

Keywords: Environmental innovation, employment growth, Europe

JEL-Codes: O33, J23, L80, C21, C23

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1. Motivation

Environmental innovations have been placed at the heart of the Europe 2020 strategy for smart, sustainable and inclusive growth and job creation. They are seen as key for Europe's economy to adjust to environmental and resource constraints, regain competitiveness and create new jobs. That's why the European Union launched its Eco-innovation Action Plan as part of its EU2020 strategy in July 2011. It complements the ambitions of the EU2020 Innovation Union and Resource Efficiency Flagship initiatives. The Eco-innovation Action Plan aims at boosting eco innovation[1] by different actions points such as implementing new environmental policy legislations, developing new standards, subsidies for research in eco innovation, mobilizing financial instruments for eco innovation, fostering international cooperation or promoting European innovation partnerships. Recent years have already seen a growth of eco industries.[2] However it is important to note that the EU understands environmental innovation not just as being crucial for a special industry but that all firms can and should become environmental innovators by introducing new eco-innovative approaches into their operations and by launching to the market new less environmentally damaging products and services. The Eco-innovation Action Plan thus promotes the "greening of all of the sectors".

This paper studies whether environmental innovation is conducive to stimulating employment and to what extent is has quantitatively contributed to employment growth in European countries in the period 2006-2008. We will generate new insights into the sources of heterogeneity in the environmental innovation-employment growth links by studying different types of innovation as well as by looking at country and sector level differences.

In addition to its environmental benefits, policy hopes that eco innovations could provide an important contribution to strengthen the competitiveness of firms and, consequently, to the preservation or creation of *new* jobs. However, the question how innovation affects employment is non-trivial since various channels exist through which different kinds of innovation may destroy existing jobs (displacement effects) or may create new jobs (compensation effects). In addition, different types of innovation such as product and process innovation influence employment via different channels. This paper studies employment effects at the firm level as the main instance where these mechanisms are more or less explicitly supposed to work (Harrison et al., 2008). Tab. 1 provides a brief overview of how different kinds of innovation might affect employment. Employment effects of process innovation are closely related to productivity changes. New production processes most often leads to labor productivity improvements since they allow firms to produce the same amount of output with less labor input and, ceteris paribus, lower unit costs. The size of this effect depends on the current production technology and direction of the technological change. A key open question is here whether environmental process innovations are associated with the same increase in labor productivity and thus reduction in unit costs are non-environmental process innovations. At the same time, firms can pass on lower unit costs to their product prices. In a dynamic perspective, lower prices can lead to a higher demand for the product, thus increasing output. The magnitude of this price effect

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1 We use the term environmental innovation, eco innovation and green innovation interchangeably.

2 The EU estimates a €319 billion turnover of eco industries and an employment of 3.4 million people in 2008 which has increased by 0.6 million jobs between 2004 and 2008 (see EU (2011), http://ec.europa.eu/environment/ecoap/ about-eco-innovation/policies-matters/eu/772_en.htm).

depends on the price reduction, the price elasticity of demand, the degree of competition as well as on the behavior and relative strength of different agents such as managers and unions within the firm (Garcia et al., 2004). Product innovation boosts employment growth mainly via demand. Demand for the new product can either be the result of an overall market expansion, or it may come at the expense of the firm's competitors. And therefore, the size of this effect depends on the demand elasticity, the existence of substitutes and the reactions of competitors (see Garcia et al., 2004). A priori it is unclear whether and to what extent demand effects might differ for new products with and without environmental benefits for the consumer. Firm-level demand for environmental product innovations might be higher if there is less competition in the market for environmental products and services. On the other hand, eco innovations might be sold at higher prices if demand elasticity is relatively low and this might lead to less output and thus employment. In addition, indirect demand effects on the innovative firm's existing products have to be taken into account as the new products might (partially or totally) replace the old ones. 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. Finally, 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 labor input. This effect is called productivity effect of product innovation (Harrison et al., 2008). [3]

Table 1 **Effects of product and process innovation on employment at the firm level**

	Employment-reducing effects (displacement effects)	**Employment-creating effects (compensation effects)**
Product innovation	*Productivity effect of product innovation*: New products require less (or more) labor 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 of process innovation*: Less labor input for a given output (-)	*Price effect*: Cost reduction passed on to price expands demand (+)

Source: Dachs und Peters (2014).

In a nutshell, the total effect of each type of innovation is not explicitly inferable and depends on a number of firm-, sector- as well as country-specific factors. As a consequence it has to be determined empirically. In general, the majority of empirical studies finds an employment-stimulating effect of product innovation whereas the effect of process innovation is ambiguous ranging from significantly negative to positive (for early surveys see Channels and Van Reenen 2002 and Spieza and Vivarelli 2002, and also König et al. 1995, Van Reenen 1997, Greenan and Guellec 2000, Smolny 2002, Harrison et al. 2008, Hall et al. 2008, Lachenmeier and Rottmann 2011, Peters et al. 2013).

3 Additional employment effects of innovations exist at a sector or macro level. Additional employment effects may occur in upstream or downstream firms, e.g. if the innovative firm is able to increase its output, its suppliers also benefit and may boost their labour demand. On the other hand, competitors which cannot keep pace with the technological progress will lose market share or even disappear, implying a deterioration of jobs in those firms.

However, up to now empirical evidence on the employment effect of environmental innovation is scarce, Bogliacino and Pianta (2010) at the sector level and Pfeifer and Rennings (2001), Rennings and Zwick (2002), Rennings et al. (2004), Horbach (2010) and Horbach and Rennings (2013) at the firm level being an exception. Most of these studies demonstrate a positive impact of eco innovation on employment. Horbach (2010) shows that German firms belonging to the environmental sector are more likely to increase employment after they haved launched new environmental products. Horbach and Rennings (2013), however, could not find that environmental product innovators in Germany experience a higher employment growth than non-environmental (product and process) innovators. On the contrary, environmental process innovators show a slightly higher employment growth than the reference group of non-environmental innovators. They illustrate that this result is mainly driven by process innovations that lead to a material and energy savings. Air and water process innovations, however, where end-of-pipe technologies dominate, lead to labor downsizing. These results corroborate prior findings of Pfeiffer and Rennings (2001) who show that cleaner production is more likely to increase employment compared to end-of-pipe technologies and Rennings and Zwick (2002) who find that end-of-pipe technologies are associated with a decrease in employment for five European countries.

In contrast to the latter studies which have estimated reduced form equations (mainly on a dummy variable indicating the change in employment), we employ and estimate a more structural approach by using the model recently proposed by Harrison et al (2008). This multi-product model was originally used to estimate the effect of product and process innovation on employment growth. It is tailor-made for analyzing employment effects of innovation using the information provided in the Community Innovation Surveys (CIS) in Europe. We extend this model by distinguishing both the effect of environmental and non-environmental product as well as process innovation. We make use of the CIS2008 data spanning the period 2006-2008 as it includes information on environmental innovation in Europe. We will estimate the model at three different levels: (1) at the pooled level using data for 16 European countries; (2) at the country level; and (3) at the sector level distinguishing five sectors (high-, medium-, low-technology manufacturing, knowledge-intensive services and less knowledge-intensive services). By that we generate new insights into the link between environmental innovation and employment growth in Europe and shed light on potential heterogeneity in this relationship by studying different types of innovation as well as by looking at country and sector level differences.

The outline of this paper is as follows: We will briefly outline the theoretical and econometric model used in the empirical part of the paper in section 2. Section 3 introduces the data set and we explain the empirical implementation and estimation method in section 4. The empirical analysis starts with some descriptive statistics on environmental and non-environmental innovation and employment growth in Europe in section 5. The subsequent section 6 presents the econometric evidence on the employment effects of environmental and non-environmental innovations in European firms. Finally, section 7 summarizes the key findings and draws some policy conclusions.

2. Theoretical and Econometric Model

Our empirical analysis is based on the model developed by Harrison et al. (2008). It establishes a theoretical relationship between employment growth and different kinds of innovation output at the firm level. The main virtue of the model is that we can disentangle some of the theoretical employment effects explained above. Moreover, it is particularly suited for examining firm-level employment impacts of innovation using the specific information provided by CIS data. In the original model, employment effects of product innovation (sales growth rate due to new products which can be calculated from CIS data) and process innovation (yes/no) have been studied for four European countries, the UK, Spain, France and Germany (Harrison et al 2008). Since its release, the model has already been used to assess employment effects in other countries like Chile (Benavente and Lauterbach 2007), Italy (Hall et al. 2008), China (Mairesse et al. 2011), Latin America (Crespi and Tacsir 2011, Crespi and Zuniga 2012) or European services (Peters et al. 2013). It has also been used to investigate employment effects of different types of innovations (Peters 2008) and to compare whether employment creation due to innovation differs between domestic and foreign-owned firms (Dachs and Peters 2014). The aim of this paper is to slightly extend this model by additionally differentiating between environmental and non-environmental product and process innovation.

We briefly sketch the basic idea of the model following Peters et al. (2013). For more details, see Harrison et al. (2008). The model employs a simple multi-product framework. That is, it is assumed that a firm can produce different products.[4] A firm j is observed at two points in time t (= 1, 2). In t=1 the firm produces one or more products which are aggregated to one product and which are labelled as the "old product" or "existing product". Between t=1 and t=2, the firm can decide to introduce one or more new or significantly improved products, either with or without environmental benefits to the consumers. But let's first summarize them as just the "new product". 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. In order to produce the different outputs, we assume the following production function for product *i* in time *t*:

(1) $$Y_{it} = \theta_{it} F\left(C_{it}, L_{it}, M_{it}\right) e^{\eta + \omega_{it}} \quad i = 1,2; t = 1,2$$

The conventional production function F is linear homogeneous in the conventional inputs labour L, capital C and material M. Moreover, the output depends on specific efficiencies for the production process of both goods at each point of time θ_{it}. It is 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:

(2) $$l = \alpha + y_1 + \beta y_2 + u\,.$$

From equation (2) it can be deducted that in the model the employment growth l stems from three different sources, that is

- from the efficiency increase in the production of the old product, which negatively affects labour demand (α).

[4] In the following the term product always comprises both goods and/or services unless stated otherwise.

- from the rate of change in the real output of the old product (y_1). This change in the output production of old products might be provoked by the firm's own new product to a certain degree, the induced change being negative for substitutes and positive for complements. But it also captures demand shifts due to general business cycle effects, changes in consumer preferences or new products and processes that have been introduced by rivals, or in upstream or in downstream firms.[5]
- from starting production of the new product (positive sign). The employment effect of the latter depends on the efficiency ratio between both production technologies ($\beta = \theta_{11}/\theta_{22}$) and the real output growth due to new products (y_2).

Efficiency gains in the production of the old product may for instance result from process innovation, organizational innovation, better human capital endowment, training, within-firm learning effects, spillover effects, mergers and acquisitions, and so on. Since the increase in efficiency is likely to differ for non-process innovators and process innovators, Harrison et al. (2008) suggested separating the effect of process innovation from the other sources of efficiency improvements. We extend this idea and estimate separately employment effects that originate from efficiency improvements in producing existing products as a result of environmental and non-environmental process innovations. In order to capture differences in employment growth due to environmental and non-environmental product innovations, we furthermore differentiate between the real output growth due to new environmental products new products ($y_{2,ENV}$) and non-environmental products ($y_{2,NE}$). This leads to the following equation:

(3) $$l = \alpha_0 + \alpha_1 pc_{ENV} + \alpha_2 pc_{NE} + y_1 + \beta_{ENV} y_{2,ENV} + \beta_{NE} y_{2,NE} + u \ .$$

α_0 measures efficiency improvements for firms without process innovation. α_1 and α_2 account for additional efficiency improvements in the production of the old product for firms having environmental and non-environmental process innovation, respectively. $\beta_{ENV} = \theta_{11}/\theta_{22,ENV}$ measures the efficiency ratio of the production technologies for producing the old and new environmental product. A value of less than 1 indicates that new environmental products are produced with higher efficiency and thus less labor than the old product. Similarly for $\beta_{NE} = \theta_{11}/\theta_{22,NE}$.

Following Harrison et al. (2008) and substituting unobserved real output growth rates by observed nominal output growth rates, we derive the following estimation equation which describes the relationship

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[5] In addition to employment effects that we observe in the innovating firm, additional employment effects of innovations may occur in rival firms or upstream and downstream firms. If, e.g., the innovative firm is able to increase its output, its suppliers also benefit and they may boost their labour demand. On the other hand, competitors which cannot keep pace with the technological progress will lose market share or even disappear, implying a deterioration of jobs in those firms. With the exception of firm exiting the market due to own unsuccessful innovation or rivals' innovation and innovative firms entering the market, our estimation accounts for these effects. However, due to data constraints, we cannot further disentangle these effects.

between employment growth, efficiency gains through environmental and non-environmental process innovation and the sales growth due to new products with and without environmental benefits[6]:

(4) $$l-\left(g_1-\tilde{\pi}_1\right)=\alpha_0+\alpha_1 pc_{ENV}+\alpha_2 pc_{NE}+\beta_{ENV}g_{2,ENV}+\beta_{NE}g_{2,NE}+v\ .$$

g_1, $g_{2,ENV}$ and $g_{2,NE}$ denote the nominal output growth (sales growth) due to old and new products with and without environmental benefits, respectively, with $g_1=y_1+\pi_1$ and $g_{2,k}=y_{2,k}+\pi_{2,k}y_{2,k}$ for $k=ENV,NE$. The variable $g_{2,k}$ can be calculated using CIS data (see section 4). 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. Since data sets usually do not include information on firm-level price changes, π_1 is proxied by $\tilde{\pi}_1$ which is the price growth rate of old products at the industry level. $\pi_{2,k}$ 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 is

$$v=-E\left(\pi_1-\tilde{\pi}_1\right)-\beta_{ENV}\pi_{2,ENV}y_{2,ENV}-\beta_{NE}\pi_{2,NE}y_{2,NE}+u\ .$$

One problem that arises in this model is the fact that the sales growth rate from new products 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 explain in section 4 in more detail how we empirically address this problem by using an instrumental variable estimation approach.

3. Data

In order to investigate the impact of environmental and non-environmental innovation on employment, we make use of the Community Innovation Survey (CIS) for 16 European countries. Based on a harmonized questionnaire, the CIS is a written survey that collects information about firm's innovation activities. It is carried out in all European member states, and comparable surveys are nowadays likewise conducted in many other OECD countries, except for the US. The foundations of the CIS are laid down in the Oslo manual published by OECD and Eurostat (2005, first published in 1993). The Oslo manual suggests a unique definition of innovation and gives recommendation on innovation indicators as well as on the survey methodology. The survey started in 1993 (CIS 1) and up to 2005 (CIS 4) it was conducted every fourth year. From that time onwards it has been shifted to a biennial rhythm, and the surveys are now labelled according to the year the data is related to, i.e. the survey conducted in 2007 and 2009 are called CIS2006 and CIS2008, respectively. The surveys are carried out by national statistical offices or research institutes under the coordination of Eurostat. Most but not all of the EU member countries provide access to their

[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).

national micro data via Eurostat's Safecenter in Luxembourg. Data at the micro level are accessible at Eurostat's Safecenter from CIS3 onwards.[7]

The CIS2008 includes a set of questions on the introduction of innovations with environmental benefits, its motives and impact. Up to now, these questions have only been asked in the 2009 survey. Hence, our analysis is restricted to one cross-section which covers the three-year period 2006-2008.

In each country, the CIS is a stratified random sample with size and industry serving as stratification variables. The target population covers all legally independent enterprises[8] with 10 or more employees having their headquarters in the corresponding country, and the population is stratified into three size classes: firms with 10-49, 50-249 and 250 and more employees. With respect to industry coverage, the CIS target population covers manufacturing and most but not all market services. For stratification purposes, NACE rev.2 two-digit industries are used.[9] However, for estimation purposes, we aggregate them to 11 manufacturing and 8 service industries. In manufacturing, the aggregated industries we are accounting for are food (Nace rev.2 10-12; FOOD), textiles (13-15; TEXT), wood, paper and pulp (16-18, WOOD), chemicals (20-21, CHEM), plastics (22; PLAS), non-metallic minerals (23; NONM), basic metals (24-25; BASM), machinery (28, 33; MACH), electrical engineering (26-27, ELEC), motor vehicles (29-30, VEHI), and manufacturing n.e.c (31-32, NEC). Service sectors that are jointly covered in all member states are wholesale (46; WHOLE), transport (49-53, 79; TRANS), information and telecommunication (61-63; TELE), financial intermediation (64-66, FIN), technical services (71-72; TECH), consultancies (69-70, 73; CON), other business related services (74, 78, 80-82; OBRS) and media (58-60, MEDIA).

Our final sample comprises 16 European countries, among them 8 countries from West Europe (Germany, France, Italy, the Netherlands, Cyprus, Portugal, Malta, Luxemburg) and East Europe (Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Romania, Slovakia) each.[10] In total, we have 64,969 observations, of which 54.4% (35,330) belong to manufacturing and 45.6% (29,639) to services. Table 3 in the Table Appendix presents the distribution of firms by country, separately for manufacturing and services. France has the largest share in both manufacturing (17.7%) and service (19.8%) samples, in manufacturing followed by Italy (16.2%), Bulgaria (14.4%) and Portugal (9%). In services, Bulgaria, the Netherlands and Italy make up another significant proportion of the sample, each representing at about 13-12% of the observations. Despite its large country size, German firms, for instance, just represent 6% and 4.7% of the samples. This can be traced back to the voluntary character of the survey in Germany. In order to account for differences in the sample rate (ratio of the number of observations in the sample to the target population by stratum) across countries, weighting factors have been used throughout the empirical analysis for descriptive statistics and estimations. Weighting factors are provided by Eurostat.

The majority of sampled firms are small firms with 10-49 employees as can be gathered from Table 4. More than three out of four firms belong to the smallest size category in both manufacturing (76.3%) and services

7 The latest surveys CIS 2010, conducted in 2011, is not yet accessible at Eurostat.

8 The terms enterprise, firm and company are used interchangeably throughout the text.

9 Actually, three size classes and the 2-digit industry classification scheme constitute the minimum requirement for stratification. Countries are allowed to use a more fine-grained stratification scheme within this framework.

10 Data for Spain, Norway, Slovenia, Ireland and Sweden are available at Eurostat but could not be exploited due to missing information for at least one the variables used in the empirical analysis.

(78.9%). Only 4% (manufacturing) and 3% (services) of the firms are large, meaning that that employ 250 and more people. However, Table 4 also reveals considerable heterogeneity in the size distribution across countries. For instance, in manufacturing the share of large firms varies between 1.7% (Cyprus) and 19.3% in Germany. The proportion of medium-sized firms even ranges from 11.5% (Italy) to 50.9% (Lithuania). This again calls for using weighting factors in the empirical analysis.

Finally, Table 5 depicts the distribution of firms by industry. In manufacturing, food, textiles, wood, basic metals and machinery make up a significant proportion of firms, each representing about 12-15% of the observations. In total, 65% of the firms belong to these five industries. All other six manufacturing industries account for about 4.2 to 7.5% each. In services, the majority of firms belong to wholesale (about 35.7%) and trade (20.6%). Telecommunication, financial intermediation and technical services account for about 8.5-10% each.

4. Empirical Implementation

4.1 Model Specification

Our empirical analysis is based on the econometric model proposed by Harrison et al. (2008). According to the model, we choose EMP as dependent variable. EMP is defined as $l-(g_1-\tilde{\pi}_1)$. l denotes the growth rate in employment (head counts) between 2006 and 2008 from which we subtract the real output growth due to old products $(g_1-\tilde{\pi}_1)$ since the coefficient is supposed to be one.[11] g_1 denotes the sales growth rate between 2006 and 2008 that is due to old products and $\tilde{\pi}_1$ is the price growth rate of old products at the industry level during that period. More details on the calculation are given in Table 2.

Our main goal and contribution is to study how product and process innovations with and without environmental benefits affects employment growth and whether there are any differences between different kinds of innovations. In general, the CIS distinguishes between product and process innovations. A product innovation is a product (incl. services) whose components or basic characteristics (technical features, components, integrated software, applications, user friendliness, availability) are either new or significantly improved. A product innovation must be new to the enterprise, but it does not need to be new to the market. A firm is called a product innovator if it has introduced at least one product innovation in the period 2006-2008 (PD). A main virtue of the CIS2008 is that it additionally allows us to distinguish environmental and non-environmental product innovators. An environmental product innovator (= green product innovator, PD_ENV) has introduced at least one new or significantly improved product or service with environmental benefits. Environmental benefits arise through the use of these products or services and might be related to a reduction in energy use, a reduction in air, water, soil or noise pollution, or an improved recycling of products after use. In contrast, a non-environmental product innovator has introduced only product innovations without any environmental benefits in the period 2006-2008 (PD_NE). In the econometric framework, however, we do not use product innovation dummies but a quantitative

[11] Instead of using $l-(g_1-\tilde{\pi}_1)$ as dependent variable, we would have got the same results if we had specified l as dependent variable and $(g_1-\tilde{\pi}_1)$ as additional explanatory variable where the coefficient is restricted to be 1. Therefore, we can still interpret the results in terms of employment growth.

measure for innovation success, that is the sales growth rate due to new products g_2. The sales growth rate due to new products (SGR_NEWPD) can be calculated as the share of sales with new products in year 2008 related to new products introduced in the three-year period 2006-2008 times the ratio of sales in 2008 to sales in 2006. We further interact this variable with PD_ENV and PD_NE to get the sales growth rate due to new products for environmental and non-environmental product innovators, SGR_NEWPD_ENV and SGR_NEWPD_NE, respectively. One drawback of the CIS2008 questionnaire is that it did not ask for the share of sales with environmental product innovations. This piece of information would have allowed us to directly measure firm's success with environmental and non-environmental product innovation and in turn the impact of each of them on employment growth. Instead, we can only distinguish between the innovation success of environmental and non-environmental product innovators, knowing that some of the product innovations of environmental product innovators do not have any environmental benefits. In this sense, the contribution of environmental product innovations will be overestimated. In a companion paper, Peters (2013) exploits a specificity of the German CIS2008 which includes this type of information.

In the econometric model, a second source of employment changes stem from efficiency increases in the production of old products. Efficiency improvements might arise due to process innovation or they might stem from other sources such as spillovers, organizational innovations, learning effects, mergers, acquisitions, sale of unprofitable business lines etc. A process innovation is defined as the implementation of a new or significantly improved production process, distribution method, or support activity for goods or services (PC). This includes significant changes in techniques, equipment and/or software used to produce goods or services. Process innovations can be intended to decrease unit costs of production or delivery, to increase quality, or to produce or deliver new or significantly improved products. The fact that process innovations can also be related to the introduction of new products creates an important empirical problem in accurately disentangling the employment effects of product and process innovation. In the survey, many firms report both kinds of activities simultaneously. For process innovators, we then do not know whether (i) all process innovations are aimed at improving the efficiency of the old products, (ii) all process innovations take place in order to produce the new product(s) or (iii) a combination of both reasons is present. We follow previous work, and define a dummy variable that takes the value 1 if the firm has introduced only process innovations but no product innovations (PCONLY). This allows us to identify the efficiency improvements in the production of old products since these process innovations must be related to the old products. For firms that do both, the effect of process innovations with respect to an increase in efficiency in the production of old products cannot be identified with the data at hand, and it is in fact captured by the sales growth due to new products.12 In the companion paper, Peters (2013) exploits a further specificity of the German CIS2008 which allows her to identify whether process innovations are related to new or old products.

As for product innovations, CIS2008 data additionally allows us to identify process innovators which have introduced new processes with and without any environmental benefits. An environmental process innovator has introduced at least one process innovation that has led to a reduction in material or energy

[12] We also experimented with an additional dummy variable that is 1 if firms do both product and process innovation. However, in most specifications it turns out to be insignificant. It is likely that this effect was in fact captured by the sales growth due to new products variable which as a quantitative variable had a much stronger explanatory power.

use per unit of output, a slimming of the CO2 footprint, a cut-back in the air, soil, water or noise pollution, a replacement of dangerous materials or an improved recycling of waste, water and materials (PC_ENV). A non-environmental process innovator has introduced new production technologies without any of these environmental benefits (PC_NE). We further interact PCONLY with PC_ENV and PC_NE. PCONLY_ENV then describes process innovators that have only introduced process innovations of which at least one had environmental benefits. In contrast, PCONLY_NE denotes process innovators that have solely implemented new production technologies among which none of them had any environmental benefits.

Besides innovation, employment growth is likely to be affected by other variables. But note, since the model is formulated in growth rates, the impact of firm-specific time-constant observable and unobservable variables on the level of employment have already been accounted for. Our choice of control variables follows Peters et al. (2013) for European service firms. That is, first, the econometric analyses controls for industry heterogeneity in employment growth rates by including a set of 11 and 8 industry dummies in manufacturing and services, respectively. Second, we control for ownership structure by including two dummy variables for firms belonging to a domestic and foreign group. The reference group consists of unaffiliated firms. Recent findings have pointed to less and more volatile employment growth in foreign-owned companies (Dachs and Peters 2014, Scheve and Slaughter 2004, Buch and Lipponer 2010).

Third, our analysis controls for size effects in employment growth by adding two dummy variables for firms with 50-249 and 250 and more employees at the beginning of the reference period in 2006. Firms with 10-49 employees present the reference category. In the past, researchers have controversially discussed whether firm size matters for employment growth. While Gibrat's law postulates that firms grow proportionally and independently of firm size (Gibrat 1934), Jovanovic (1982) argued that surviving young and small firms growth fast than older and larger ones for instance because of managerial efficiency and learning by doing. Finally, in all pooled regressions we additionally account for country-specific heterogeneity in employment growth rates by including a set of country dummies.

Table 2 **Definition of Variables**

Variables	Description
Dependent Variable	
EMP	EMP is used as dependent variable in the econometric analysis. According to the theoretical model, EMP is defined as $l-(g_1-\tilde{\pi}_1)$ which are defined as follows:
l	Employment growth rate in head counts between *t-2 (2006)* and *t (2008).* Information for both years comes from the 2008 CIS survey.
SGR_OLDPD (g_1)	Sales growth rate due to old products between *t-2 (2006)* and *t (2008)*. g_1 can be calculated as total sales growth rate *g* minus the sales growth rate due to new products g_2 (see below).
PRICE_GROWTH ($\tilde{\pi}_1$)	Price growth rate for existing products between *t-2 (2006)* and *t (2008)*. In manufacturing, we use Eurostat price deflators on producer prices for NACE rev. 2 industries at the country level. Missing values were dealt with in the following order: First, if industry-country price growth was not available, the EU average price growth at the industry level was used. If this information was also missing, the average price growth at the country level was employed. In services, we use Eurostat price deflators on producer prices for Nace rev. 2 industries 51, 52, 61, 62, 63, 71, 73, 78 and 80 (at the country level). If the price deflators were unavailable at the country level, we used the EU average price growth for these industries. If not available we use the harmonized consumer price index instead and if not available the producer price index for manufacturing at the country level.
Explanatory Variables	
SGR_NEWPD (g_2)	Sales growth rate between *t-2 (2006)* and *t (2008)* due to new products. It has been calculated by multiplying the share of sales in *t* due to new products introduced between *t-2* and *t* with the ratio of sales in *t* and *t-2.*
SGR_NEWPD_ENV ($g_{2,ENV}$)	Sales growth rate between *t-2 (2006)* and *t (2008)* due to new products for firms that have introduced at least one environmental product innovation in the period 2006-2008. Calculated as SGR_NEWPD*PD_ENV, for the definition of PD_ENV see below.
SGR_NEWPD_NE ($g_{2,NE}$)	Sales growth rate between *t-2 (2006)* and *t (2008)* due to new products for firms that have introduced only non-environmental product innovations in the period 2006-2008. Calculated as SGR_NEWPD*(1-PD_ENV).
PCONLY	Dummy variable equals 1 if a firm has introduced at least one process innovation but no product innovation in the period *t-2 (2006)* to *t (2008)* and zero otherwise.
PCONLY_ENV	Dummy variable that equals 1 if a firm has introduced only process innovations in the period *t-2 (2006)* to *t (2008)* and among the process innovations has been at least one environmental process innovation. Zero otherwise. Calculated as PCONLY*PC_ENV, for the definition of PC_ENV see below.
PCONLY_NE	Dummy variable that equals 1 if a firm has introduced only process innovations in the period *t-2 (2006)* to *t (2008)* and among the process innovations has been no environmental process innovation. Zero otherwise. Calculated as PCONLY*(1-PC_ENV).
COUNTRY	A set of dummy variables for each country in the sample. For a list of countries see Table 4.
INDUSTRY	A set of dummy variables for each industry. For a list of industries see Table 5.
OWNERSHIP	Two dummy variables indicating that in year t a firm belongs to a company group which has a domestic and foreign headquarter, respectively. The reference group consists are unaffiliated firms.
SIZE	A set of dummy variables for each size class in year t-2. We distinguish between firms with 10-

	49 (reference), 50-249 and 250 and more employees.
Instrumental Variables	
RANGE	Variable that indicates whether the product innovation was aimed at increasing the product range in the period 2006-2008. Variable measured on a 4 point scale: 3=high importance, 2=medium, 1= low and 0=not relevant.
R&D	Dummy variable that equals 1 if the firm carries out R&D continuously in the period 2006-2008.
CLIENT	Dummy variable that equals 1 if clients have been a high-to-medium important information source for innovation in the period 2006-2008.
ENV_REG	Dummy variable that equals 1 if the enterprise introduces environmental innovation in response to existing environmental regulations or taxes on pollution.
ENV_AGREE	Dummy variable that equals 1 if the enterprise introduces environmental innovation in response to voluntary codes or agreements for environmental good practice within its sector.
Additional explanatory variables only used in the reduced form regression	
PD	Dummy that equals 1 if the firm has introduced at least one product innovation in the period 2006-2008. A product innovation is the market introduction of a new good or service or a significantly improved good or service with respect to its capabilities, such as improved software, user friendliness, components or sub-systems. The innovation (new or improved) must be new to the enterprise, but it does not need to be new to the firm's sector or market.
PC	Dummy that equals 1 if the firm has introduced at least one process innovation in the period 2006-2008. A process innovation is the implementation of a new or significantly improved production process, distribution method, or support activity for firm's goods or services.
ENV	Dummy variable that equals 1 if the firm has introduced at least on environmental product innovation (PD_ENV) or one environmental process innovation (PC_ENV) in the period 2006-2008.
PD_ENV	Dummy variable that equals 1 if the firm has introduced at least on environmental product innovation (PD_ENV) in the period 2006-2008. An environmental product innovation is defined as new or significantly improved products or services with any of the following three environmental benefits through the use of these products/services: (1) reduced energy use, (2) reduced air, water, soil or noise pollution, and (3) improved recycling of product after use.
PD_NE	Dummy variable that equals 1 if the firm has introduced product innovations without any environmental benefits in the period 2006-2008.
PC_ENV	Dummy variable that equals 1 if, during the period 2006-2008, the firm has introduced at least one innovation that had any of the following environmental benefits: (1) reduced material use per unit of output, (2) reduced energy use per unit of output, (3) reduced CO2 footprint, (4) reduced air, soil, water pollution or noise production, (5) replaced dangerous materials and (6) recycled waste, water or materials.
PC_NE	Dummy variable that equals 1 if the firm has introduced process innovations without any environmental benefits in the period 2006-2008.
ORGA	Dummy variable that equals 1 if a firm has undertaken at least one organizational innovation in the period *t-2 (2006)* to *t (2008)* and zero otherwise. Organizational innovations capture changes in firm's business processes (including knowledge management), workplace organization and external relations.

4.2 Estimation Method

We estimate equation (4) using an instrument variable estimation approach. The IV estimator is a solution to the problem that two of our key variables, the sales growth rate due to new products for environmental and non-environmental product innovators ($g_{2,ENV}$ and $g_{2,NE}$), should be endogenous due to a measurement error. The instruments should be correlated with the sales growth due to new products (i.e. innovation success), but not correlated with the error term. That means in particular that the instrument has to be uncorrelated with the relative price difference of new to old products. Our IV strategy uses three instruments that have already been proven to be valid instruments in prior studies (see Harrison et al. 2008, Peters 2008, Hall et al. 2009, Dachs and Peters 2014, Peters et al. 2013). Our first instrument is RANGE, a variable that measures whether the product innovation was aimed at increasing the product range (measured on a 4 point scale). The variable is an indicator of the extent to which firm's product innovation is associated with horizontal as opposed to vertical product differentiation and doesn't imply any particular direction of the changes in prices (Harrison et al. 2008). The second and third instrument that we use are two dummy variables that indicate whether the firm carries out R&D continuously (R&D) and whether clients have been a highly or medium important information source of innovation (CLIENT). In addition to these three instruments used in prior studies, we employ two additional instruments that are particularly related to environmental innovation. The instruments are dummy variables that indicate whether the enterprise has introduced environmental innovation in response to existing environmental regulations or taxes on pollution (ENV_REG) or to voluntary codes or agreements for environmental good practice within its sector (ENV_AGREE). They turn out to be correlated with endogenous variables and it seems unlikely that they are linked to any particular direction of price changes. We have tested the validity and non-weakness of the instruments with a number of different tests that we will explain in more detail in section 6.

5. Descriptive Statistics

This section presents some descriptive statistics on the main variables used in the empirical analysis. Table 7 reports the share of firms with product, process and organizational innovation in general whereas Table 8 depicts the share of firms with environmental product and process innovations. Table 9 and Table 10 complement this picture by illustrating the occurrence of different types of environmental process and product innovations, respectively. All four tables report corresponding shares for the pooled sample as well as by country. All figures are weighted and refer to the period 2006-2008.

39% of all European manufacturing firms have introduced at least one product or process innovation. This proportion is significantly smaller in services with about 28%. In both sectors we find process innovators (31% and 21%) to be more frequent than product innovators (28% and 19%) though the data reveal some country heterogeneity with respect to the relative importance of process innovation. That is, in Germany, Hungary and Netherlands we find the share of product innovators to be higher in both sectors and this pattern also holds for manufacturing firms in Latvia and service firms in Bulgaria and Luxemburg. Roughly three out of ten innovators have focused their innovation strategy solely on improving their production technologies which corresponds to 10.6% of all firms in manufacturing and 8.6% in services. In contrast, 20.5% of all manufacturing firms have introduced both types of innovation simultaneously compared to

12.7% in services (not reported in table). This emphasizes the problem stated above of accurately disentangling the effect of both types of innovation.

In manufacturing roughly six out of ten process innovators indicated that at least one of their process innovations has been associated with environmental benefits. This corresponds to a share of 19.2% of all firms having environmental process innovations. Overall, improved recycling has been the most environmental benefit (12.8%), followed by a reduction in pollution (11.8%) and energy use (10.5%). At the country level, though, we observe a large heterogeneity in the relative importance of different types of environmental benefits. Compared to environmental process innovators, environmental product innovators are less frequent among overall product innovators. Nearly five out of ten product innovators in manufacturing have introduced at least one product innovation with environmental benefits. This implies a share of environmental product innovators of about 13.5% in manufacturing. Interestingly, all three types of environmental benefits that clients can reap through the use of new products are almost equally present, ranging between 9% (reduction in energy use) and 8% (improved recycling).

In services, both environmental process and product innovators are less frequent in absolute and relative terms than in manufacturing. That is, only five out of ten process innovators and four out of ten product innovators have introduced at least one innovation with environmental benefits. This corresponds to an overall share of environmental process and product innovators of about 10.7% and 7.4% in services. Like in manufacturing, improved recycling has been the most often environmental benefit of process innovation in services (6.9%), but followed by a reduction in energy (5.5%) and material consumption (4.9%). On the clients' side, energy savings most often occur (5.5%), equally followed by a reduction in pollution and improved recycling possibilities.

Interestingly, we find that the share of environmental process innovators is higher than the share of environmental product innovators in both manufacturing and services. This pattern is also consistently found in each country. Even in those countries where product innovators are more prevalent than process innovators.

Another striking result is that among environmental innovators in manufacturing, the majority of them introduce both green process and product innovations simultaneously. That is, 10.3% of firms introduce both kinds of environmental innovation, whereas 8.9% and 3.2% of firms have only environmental process and product innovation, respectively. In contrast to that, the majority of service firms focus only on environmental process innovation (5.9%). Another 4.8% of European service firms have both types of environmental innovations and 2.6% have only green product innovations.

Concerning firms that introduce only process innovations, we find a slightly higher proportion with environmental process innovation (5.7%) compared to only non-environmental process innovators (5%) in manufacturing. In services, the opposite pattern emerges. That is, 4.8% of firms are purely non-environmental process innovators while 3.8% have introduced only environmental process innovations.

Table 11 and Table 12 illustrate mean, median and standard deviation of the main quantitative variables. Displayed are the employment growth rate (l), overall sales growth rate (g) and its split into the sales growth that is due to old (g_1 /SGR_OLDPD) and new products (g_2 / SGR_NEWPD), sales growth rate for environmental and for non-environmental product innovators ($g_{2,ENV}$ / SGR_NEWPD_ENV and $g_{2,NE}$ /

SGR_NEWPD_NE), labor productivity growth rate and price growth rate. Overall employment growth was on average about 4.5% in manufacturing and 9.6% in services during the period 2006-2008. These growth rates are generally larger than the official figures released by Statistical Offices. This is due to the fact that (i) we can only observe surviving firms in the survey, (ii) we restrict our analysis to firms with at least 10 employees, 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 outliers although we already excluded all firms below the 5th and above the 95th percentile in each country. Therefore, we also provide numbers on the median employment growth that was much lower at about 0% and 2.1% in manufacturing and services, respectively. Overall, the figures are consistent with the fact that services have gained in importance in recent years and that the period 2006-2008 was characterized by an expansionary or boom period in many European countries.

During the same three-year period, nominal sales grew on average by 17.9% in manufacturing and 23.3% in services (median: 11.7% and 14.3%). In manufacturing more than half of this increase can be attributed to new products (9.6%). Old products have stimulated sales growth by 8.3%. In contrast to manufacturing, old products have contributed significantly more to sales growth than new products in services. About two thirds of the rise in sales can be attributed to demand for existing products (15.8%) whereas on average 7.4% stems from the introduction of new products. In the same period prices increased on average by roughly 7% and 8% both industries, so that growth rate in real sales was about 11% and 15% in manufacturing and services, respectively. This implies an increase in average real labor productivity of about 6.5% and 5.4% in European manufacturing and services during the three-year period 2006-2008.

Concerning the innovation success of product innovators that have launched at least one new product with environmental benefits for consumers and those without any environmental product innovations, we do not find any significant differences in European manufacturing. Sales growth due to new products is about the same for both groups of product innovators (4.8%). At the country level, though, we find some heterogeneity. In countries such as Germany, Czech Republic and Portugal environmental product innovators display higher innovation success with new products while the opposite is found in countries like Bulgaria, Cyprus, Estonia and Latvia. In contrast to manufacturing, non-environmental product innovators achieve a higher sales growth due to new products (4.5%) than environmental product innovators (3.0%) in services. This pattern consistently emerges in all European countries except for the Czech Republic and Portugal.

6. Empirical Results

In the following empirical analysis, we investigate the link between environmental innovations and employment growth at three different levels. Our first level of analysis is the pooled sample of firms across all European countries in section 6.1. In section 6.2 we examine a second step to what extent country differences exist in the way environmental innovations impact employment growth by estimating the econometric model for each country. Throughout both steps, we distinguish between manufacturing and service firms. Finally, we perform a sector-level analysis in order allow for heterogeneity in the way environmental innovation may influence employment growth across industries (section 6.3). Due to insufficient number of observations in some of the 19 industries, we will perform the sector-level analysis at a higher level of aggregation. That is, we use a broader sector classification proposed by Eurostat in order to define high-technology (High-tech), medium-technology (Medium-tech) and low-technology (Low-tech) manufacturing as well as knowledge intensive services (KIS) and less knowledge-intensive services (LKIS). The definition of the sector groups is provided in Table 23 and Table 6 provides the distribution by sector groups.

6.1 Employment Effects of Environmental Innovation in European Manufacturing and Service Firms

6.1.1 Reduced Form Regressions

Before we present results of the econometric model proposed by Harrison et al. (2008), we first provide a couple of reduced form regression results in Table 13 and Table 14 as was similarly done in previous studies. We perform unweighted and weighted OLS estimation and find the results to be similar in terms of significance though there are some differences in the estimated magnitude of the effects for the innovation dummy variables. The results show a significantly positive impact of product innovation, measured as a 0/1 variable, and of product innovation success in both sectors. Non-environmental product innovations tend to matter more for employment growth than environmental product innovations. At least the 0/1 indicator for environmental product innovation is not significant. Strikingly, process innovations likewise display a significantly positive impact on employment growth in the reduced form regressions. In services, this result is found for both types of process innovation while in manufacturing this finding is mainly driven by environmental process innovation. However, these reduced form regressions do not allow us to identify the main channels through which environmental and non-environmental product and process innovations impact employment growth and we therefore proceed with the structural approach by Harrison et al. (2008).

6.1.2 Structural Model Approach

Table 15 depicts the results for employment effects of environmental innovation among European manufacturing and service firms. We mainly present weighted IV estimation results throughout the empirical analysis. As argued in section 3 and 4 this estimation method seems to be the most adequate for the data set at hand and the empirical model applied. For comparison purposes, we also show unweighted IV regression results. Using a difference-in-Hansen C test, the results indeed reject the null hypothesis that the sales growth due new products variable is exogenous, both in the weighted and unweighted regression. Though OLS results are not shown here, the endogeneity problem seems to lead to a downward bias of the estimated effect and hence to an overestimation of the productivity effect of new products as the IV results (around 1.0) are larger than the OLS estimates (around 0.88 in manufacturing and 0.84 in services). [13] In order to rely on and interpret the IV estimates, of course one has to check whether the instruments are non-weak and valid. In order to evaluate our IV strategy we therefore perform a series of tests. Regarding the concern of weak instruments, our first stage regression results show that the three instruments in

[13] Unweighted and weighted OLS results are not shown but are available upon request.

specifications (1) to (3) and five instruments in specification (4) are significantly correlated with the endogenous variable(s) in both sectors. This is true for all instruments, except for R&D in the first stage equation of SGR_NEWPD_NE in manufacturing. Furthermore, the F-test of excluded instruments always yields a statistic that is clearly larger than 10. In addition to this rule of thumb for non-weak instruments, we report the Kleibergen-Paap LM test on underidentification. The null hypothesis of underidentification is rejected likewise indicating that the excluded instruments are correlated with the endogenous regressors. Finally, we report the Cragg-Donald F test and Kleibergen-Paap F test on weak instruments.[14] Weak instruments can lead to a large relative bias of IV compared to the bias of OLS in case of endogenous variables. The null hypothesis of weak instruments is also rejected. In addition to non-weakness, we check for validity of instruments using the Hansen J-Test on overidentifying restrictions for overall instrument validity and the difference-in-Hansen C-Test on the instrument validity of single instruments.[15] Overall instrument validity cannot be rejected and each of the single instruments passes the test on exogeneity. The same diagnosis can be made for the manufacturing sector. Thus, weighted IV regressions seem to provide consistent and reliable results. So what do we find?

The econometric results impressively show that successful product innovation is conducive to employment growth in both manufacturing and service firms. This effect remains highly significant across different estimation methods and model specifications. In both sectors we also find the stimulating effect of product innovation success to hold for both types of product innovators: environmental and non-environmental ones (model 4 and 8). Remember that the coefficient of the sales growth due to new products variable measures efficiency differences between the old and new products. Values smaller than one indicate new products are produced with higher efficiency and thus less labor than old products. A value of one implies that old and new products are produced with the same efficiency and that there are no additional productivity effects of new products. It turns out that the coefficient tends to be slightly smaller than one in most regressions, however, for the preferred weighted IV regressions t-tests never reject the null hypothesis that the coefficient is smaller than one. Thus an increase in sales growth due to new products of 1% leads to an increase in *gross* employment by 1%. Furthermore, using t-tests we do not find significant differences in the way product innovation success affects employment growth between environmental and non-environmental product innovators, neither in manufacturing nor in services. At the same time, product innovations are likely to replace existing products to a considerable extent which is captured by g_1 and which might lead to labor displacement. We present estimation results for the net employment effect of product innovation when we talk about the decomposition of employment growth below.

Process innovation is associated with significant productivity gains and thus displacement of labor in manufacturing. The employment growth rate is about 2.5 percentage points smaller for pure process innovators than for non-innovators. More striking is the results that this effect is mainly driven by non-

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14 Kleibergen and Paap (2006) suggested a test on whether the equation is identified, i.e., that the excluded instruments are relevant meaning correlated with the endogenous regressors. H0 states that the equation is underidentified. The reported heteroskedasticity-robust Kleibergen-Paap rk LM statistic follows a $X^2(m+1)$-distribution with m the number of overidentifying restrictions. Both the Cragg-Donald and Kleibergen-Paap F statistic tests the null hypothesis that the instruments are weak, more precisely that the maximal relative bias of IV is larger than p%. The Cragg-Donald test assumes i.i.d. errors while the Kleibergen-Paap test is robust to heteroskedasticity. For more details, see notes of Table 15.

15 We use the Hansen statistic instead of the Sargan statistic since we estimate heteroskedasticity-robust or clustered standard errors. In contrast to the Hansen statistic, the Sargan statistic is not consistent if heteroskedasticity is present.

environmental process innovators. In this group we find a highly significant negative impact of process innovation on employment growth (-4%) whereas we cannot corroborate any labor displacement of process innovation for environmental process innovators. In services, process innovation has a much smaller impact. It is significantly negative in the unweighted regression but becomes insignificant in the weighted estimates. This confirms prior findings for the service sector that mainly report no effect of process innovation in the service sector.[16] Our results further show that there are no significant differences between environmental and non-environmental process innovators in services. The differences in the impact of process innovation on employment in both sectors might be partly driven by the fact that process innovation in services is usually more difficult to identify than in manufacturing as was argued in the papers cited above. In many cases services are customized to specific demands and lack a clearly structured production process.

6.1.3 Contribution of Innovation to Employment Growth

One flaw is that the model estimates do not allow us to directly disentangle the compensation effect of process innovation and the demand effect of product innovation on existing products which are both captured by g_1. This would require additional demand data. However, what we can do is to look at the contribution of innovation to employment growth for different types of firms in the following way:

$$
\begin{aligned}
l = \underbrace{\hat{\alpha}_0}_{1} + \underbrace{\hat{\alpha}_1 pc_{ENV}}_{2} + \underbrace{\hat{\alpha}_2 pc_{NE}}_{3} + \underbrace{\left[1 - I\left(g_{2,ENV} > 0 \,\&\, g_{2,NE} > 0\right)\right]\left(g_1 - \tilde{\pi}_1\right)}_{4} \\
+ \underbrace{I\left(g_{2,ENV} > 0\right)\left(g_1 - \tilde{\pi}_1 + \hat{\beta}_{ENV} g_{2,ENV}\right)}_{5} + \underbrace{I\left(g_{2,NE} > 0\right)\left(g_1 - \tilde{\pi}_1 + \hat{\beta}_{NE} g_{2,NE}\right)}_{6} + \hat{v}
\end{aligned}
\tag{5}
$$

Equation (5) is an extension of the decomposition of average employment growth proposed by Harrison et al. (2008). $I(.)$ denotes the indicator function. It is 1 if the condition in brackets is fulfilled and 0 otherwise. Thus, $I\left(g_{2,ENV} > 0\right)$ and $I\left(g_{2,NE} > 0\right)$ indicate environmental and non-environmental product innovators and $1 - I\left(g_{2,ENV} > 0 \,\&\, g_{2,NE} > 0\right)$ equals 1 for non-product innovators. Based on this decomposition we can identify six terms that contribute to average employment growth:

1. *General industry-, country-, size- and ownership-specific productivity trends* in the production of *old* products, captured by $\hat{\alpha}_0$, lead to changes in employment. It is the average effect across innovators and non-innovators. The main feature of the general productivity trend is that it reflects changes in efficiency and in turn in employment that are not attributable to process or product innovation. Instead it captures the effects of training, improvements in the human capital endowment, corporate restructuring, acquisitions of firms, organizational innovation, productivity effects from spillovers etc.
2. Additional changes in efficiency and hence in employment which stem from the introduction of *process innovation* related to the production of *old* products are captured in the next two terms. The second and

[16] See Harrison et al. (2008) for CIS3 data, Dachs and Peters (2014) for CIS4 data, and Peters et al. (2013) for CIS2008 data.

third term measure the displacement effect of process innovation for old products for environmental and non-environmental process innovators, respectively.

3. The fourth component accounts for employment changes which originate from the *growth of output in old products* for firms that do *not* introduce any new products. It thus accounts for shifts in employment that are due to changes in the demand for the existing products. Changes in demand for existing products might occur because of changes in consumers' preferences, price reductions, and business cycle impacts but also because of rivals' product innovations. This term therefore also comprises the (positive or negative) externalities that arise from product innovation of other firms. The occurrence of negative externalities is known as 'business stealing' effect. Substitution between sales from old and from new products within the same firm, however, is included in the next two terms.

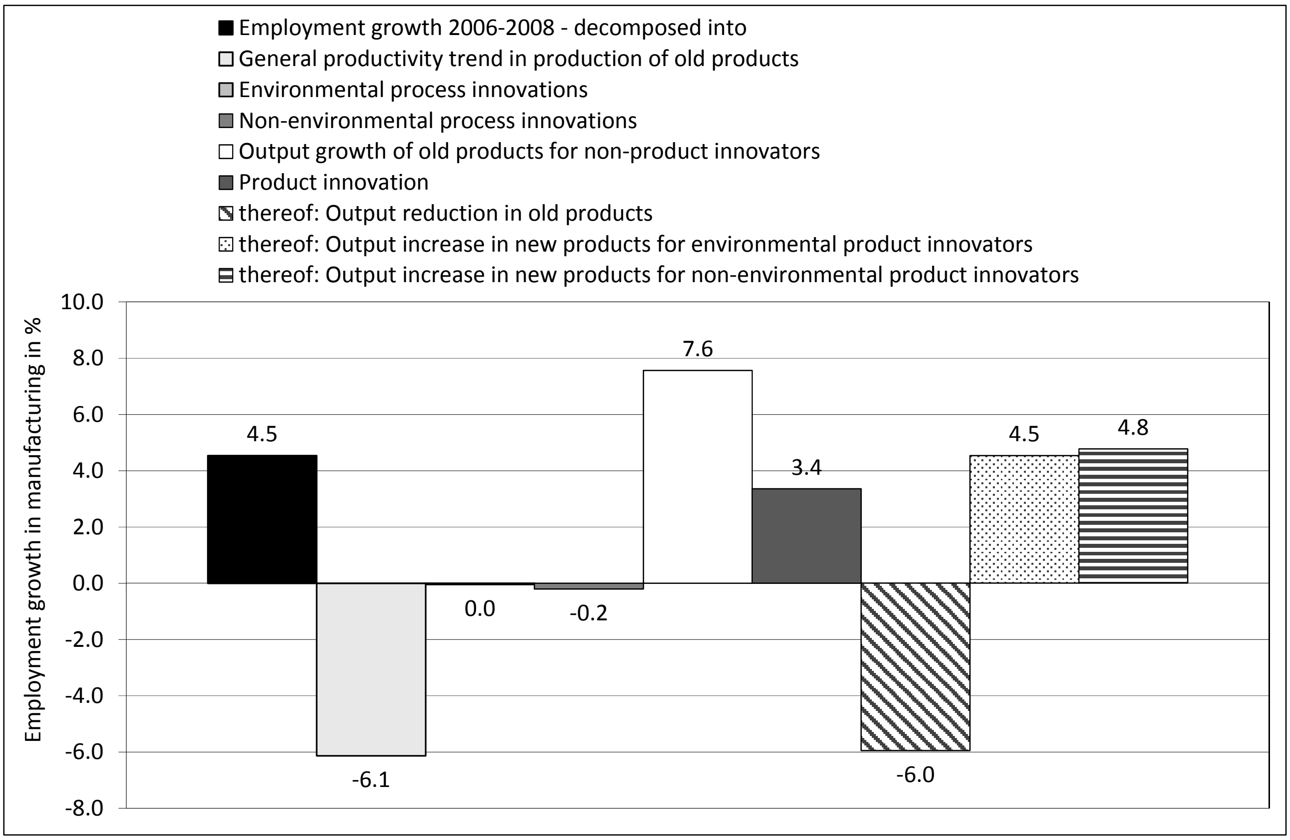
4. The fifth and sixth component summarizes the *net* contribution of *product innovation* to employment growth for environmental and non-environmental product innovators, respectively. The net effect of product innovation for environmental product innovators results from increases in the demand for the new products ($I\left(g_{2,ENV}>0\right)\hat{\beta}_{ENV}g_{2,ENV}$) and possible (positive or negative) shifts in demand for the old ones $\left(I\left(g_{2,ENV}>0\right)\left(g_1-\tilde{\pi}_1\right)\right)$. Analogue for non-environmental product innovators. In Figure 1 and 2 the overall impact of product innovation is shown (sum of term 5 and 6) as well as the output increases in new products for both types of product innovators and the output reduction in old products.

The residual is zero by definition. The decomposition thus allows us to separate the effects of environmental and non-environmental product and process innovation from effects originating from general demand and productivity trends. A dissection of the average employment growth can be obtained by inserting the estimated coefficients and the average shares of innovators and price and sales growth rates from the sample into the equation. Table 20 and Figures 1 and 2 show the decomposition results for manufacturing and services, respectively.

In manufacturing, average employment growth amounted to 4.5%. General improvements in productivity would have led to a decline in employment of about 6.1%. The contribution of both environmental and non-environmental process innovation to employment growth is negative but of secondary importance when observed quantitatively (-0.04% and -0.2%). These negative impacts on employment have been more than offset by the growth in output (demand) of old and new products. It turns out that the growth in old products was the main contributor to employment growth fostering it by about 7.6%. An additional 3.4% growth originates from the output growth in new products for product innovators. When we disentangle the sources of the latter effect, we find that environmental and non-environmental product innovators have contributed to a similar extent to employment growth via an increase in output for their new products (+4.5% vs. +4.8%). At the same time, product innovators have been faced with a decline in the output of their old products which weakened the positive employment effect by about 6%.

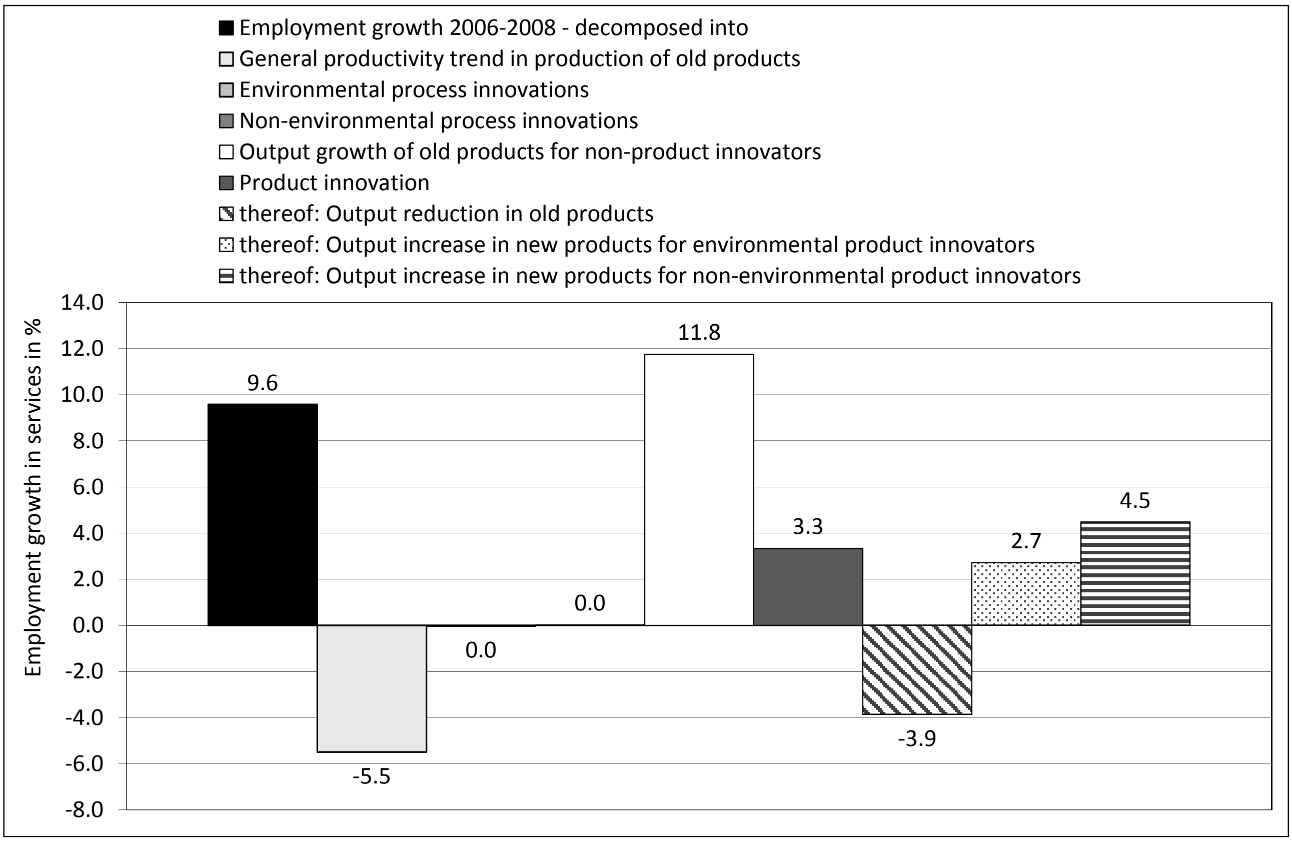
In services, the broad picture looks similar to manufacturing with some interesting distinctive features. As already mentioned in section 5, average employment growth was more than twice as large as in manufacturing (9.6%). However, the contribution of the general productivity trend, process innovation and product innovation was of similar magnitude in this period (-5.5%, 0% and +3.3%). The larger employment growth mainly stems from larger sales growth of old products for non-product innovators. The latter effect stimulated employment growth by nearly 12%. A second difference between manufacturing and services relates to the contribution of product innovations for environmental and non-environmental product innovators. In contrast to manufacturing, we record a much smaller contribution via an output increase in product innovations for environmental (+2.7%) than for non-environmental product innovators (+4.5%). Given the fact that the estimated coefficient is very similar for both groups, the lower contribution is the result of a lower engagement in environmental product innovations and a lower innovation success of environmental product innovators.

Figure 1 **Decomposition of Employment Growth in European Manufacturing, Pooled Sample, 2006-2008**



Source: CIS 2008, Eurostat, own calculation.

Figure 2 **Decomposition of Employment Growth in European Services, Pooled Sample, 2006-2008**



Source: CIS 2008, Eurostat, own calculation.

6.2 Employment Effects of Environmental Innovation at the Country Level

In this section, we relax the assumption that the way how environmental and non-environmental product and process innovation is the same in all European countries and allow for country differences by estimating separate regressions for each country. As in the previous section, we distinguish between manufacturing and service firms. For manufacturing, estimation results for West and East European countries are shown in Table 16 and Table 17, respectively. Results for services are displayed in Table 18 and Table 19. The decomposition of employment growth is summarized in Table 20 and illustrated for manufacturing in Figure 3 and for services in Figure 4.

Before discussing our findings, we briefly assess the quality of the IV estimates at the country level. There might be a trade-off between full comparability estimating the same model for all countries on the one hand and a better estimation fit by adjusting the model to country specificities on the other hand. We opted for the first approach and should therefore check to what extent our estimates are reliable at the country level. In manufacturing, we find in all countries, except for Lithuania, at least three different instruments that are highly correlated with the two endogenous variables in the first stage what we would need in order to test for overidentifying restrictions. The Hansen test confirms overall instrument validity except for Malta. Furthermore all single instruments pass C test on exogeneity test at the 5% level except for R&D in PT. Concerning the non-weakness, the instruments seem to be strong in most countries though the overall impression is that the quality of the instruments is worse in East European countries. Nevertheless, the F statistic turns out to be larger than ten in most of the first stage regressions except for Luxemburg, Latvia, and partly also for Malta, Lithuania and Slovakia. In a similar vein, the Kleibergen-Paap LM test would not reject underidentification for Malta, Latvia and Slovakia and the Cragg-Donald test on weak instruments would not reject the null hypothesis for Malta and Luxemburg. One problem might be that the sample size in all these countries is very small. We get very similar results for services. That is, we find at least three different instruments that are correlated with the two endogenous variables in the first stage in all countries except for Luxemburg and Lithuania. The F statistic on excluded instruments is likewise smaller than ten in both countries as it is the case for Malta, Latvia and Slovakia. On the other hand, all countries pass the test on underidentification except for Lithuania and all countries pass the Cragg-Donald test on weak instruments except for Latvia where it cannot be rejected that the relative bias of IV is larger than 30%. The bias can also be relatively large for Lithuania and Luxemburg. Overall instrument validity is confirmed in all countries except, surprisingly, for France where the two instruments related to the motives for environmental innovations do not pass the C test. To conclude, for 10 out of the 16 countries the IV estimation results provide fully reliable results for both sectors. For France the IV strategy seems to work only for manufacturing. For small sample size countries such as Malta, Luxemburg, Latvia, Lithuania and Slovakia there are various hints that the IV estimates might be biased in both sectors. This problem seems to be particularly severe in Malta and Luxemburg for manufacturing and in Latvia and Lithuania for services. We therefore recommend not interpreting the results for these countries, and we leave each of the two countries out of the discussion in manufacturing and services.

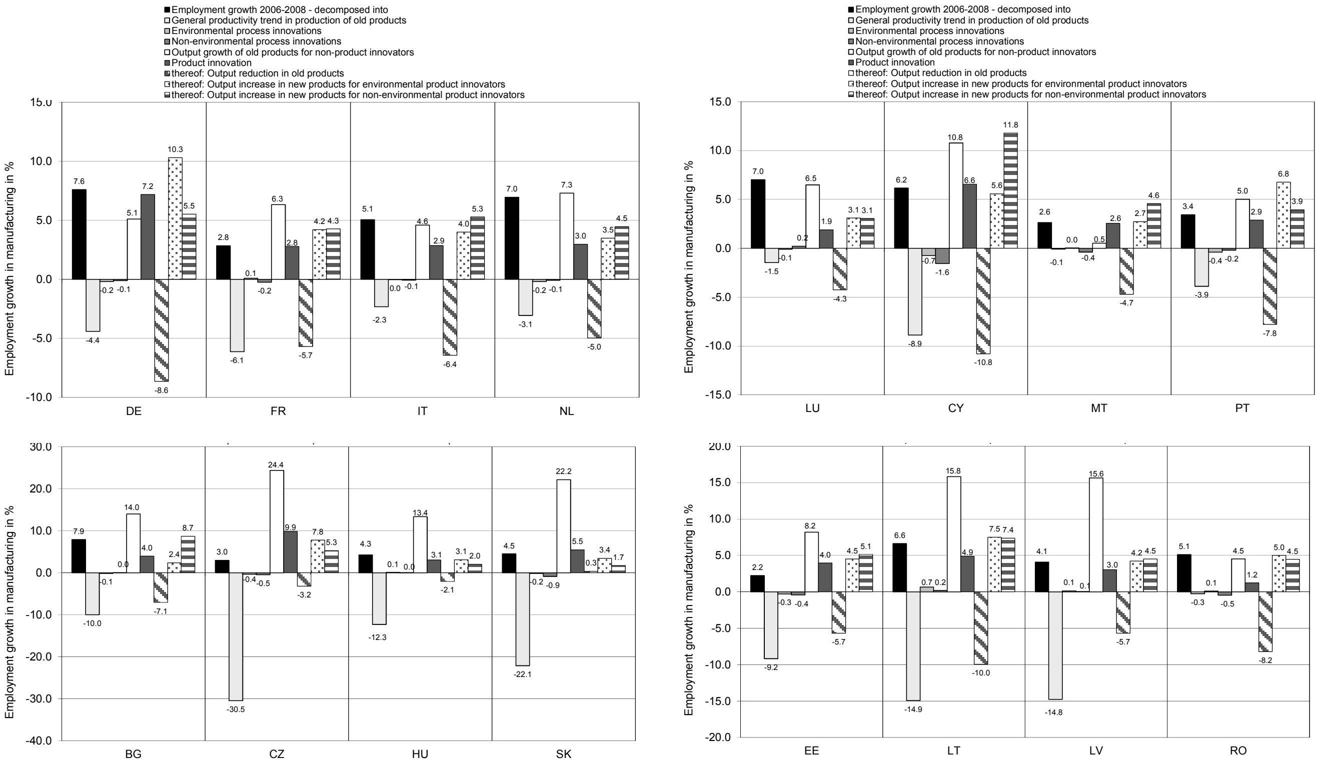
The most intriguing result is that environmental product innovators experience a significantly positive impact of product innovations on employment growth in *all* countries, except for Malta in services. On this matter, the employment results for product innovation in services are as strong as for manufacturing. Furthermore, for services we find this coefficient to be one in all countries (except Malta, see above). In manufacturing, we confirm this result for 11 out of the 14 countries. That is, a one-percent rise in the sales due to new products also increases *gross* employment of environmental product innovators by one percent for all these firms. Again this implies that in these countries old and new products of environmental product innovators are produced with the same efficiency and that there is no evidence of additional productivity effects of new products. Only in the Czech manufacturing sector we do observe a coefficient of less than one implying that new products of environmental product innovators are produced with higher efficiency and thus less labor input. On the contrary, there is evidence that new products of environmental product innovators are produced with lower efficiency in Estonian and Hungarian manufacturing.

A second striking result is that we also detect a considerably common pattern for the impact of product innovation success on employment growth for non-environmental product innovators across European countries. The employment effect is significantly positive in all countries except for Slovakian manufacturing. Similar to environmental product innovation, we obtain a coefficient that is close to one in 11 out of 14 countries in manufacturing and in 12 out of 14 countries in services. On the other hand, we find somewhat more evidence that product innovations of non-environmental product innovators are associated with additional productivity effects and hence less labor input. For manufacturing this has been ascertained for France, Cyprus, and Latvia. In addition, the coefficient in Hungary and Estonia slightly failed significance. In services we find such productivity effects of product innovations to take place in France and Estonia.

Turning to the impact of environmental process innovation, we observe more country heterogeneity. While we did not find any significant effects in the pooled estimates we are able to detect some in the country-level analysis. In the majority of countries, the effect is negative implying labor displacement though it turns out to be only significant in Cyprus, Portugal and Bulgaria for manufacturing and Malta and Slovakia in services. In a few countries, however, we also detect a positive impact of environmental process innovation on employment growth (IT and LU in services). A similar overall pattern is observed for non-environmental process innovation. For most of the countries the effect is negative though only significant in France, Cyprus, Romania for manufacturing and Malta and Netherlands for services. For Luxemburg and Hungary the results would indicate positive employment effects, which however seem to be unreasonably high. In a nutshell, we can ascertain that there is only weak evidence of employment effects of environmental and non-environmental process innovation among European countries.

The decomposition shows that the net contribution of production innovation, i.e. the effect of sales growth due to new products net of the substitution for old products, is positive and sizeable for product innovators in both industries and in all 14 countries. In manufacturing product innovation has stimulated growth in a range of about 2 to 4% in most of the countries, with a somewhat larger impact in DE, CY and CZ (between 6.5 and 10%). In services, the effect is even slightly larger, ranging mostly between 2 and 5%. How is this net contribution of product innovation made up? Both environmental and non-environmental product innovators have contributed to a considerable amount to employment growth by their increase in output for new products. Remember that we have estimated a gross employment effect of product innovation that is very similar for both types of product innovators. Observed differences in the contribution of environmental and non-environmental innovation to employment growth are thus a result of differences in the average innovation engagement and innovation success across countries or sectors, but not of differences in the transformation of a given level of innovation success to employment growth. In manufacturing the absolute contribution of environmental product innovation seems to be larger in West European countries. In terms of relative importance, however, the picture is less clear. The results show that the contribution of environmental product innovators was even larger than that of non-environmental product innovators in 7 out of 14 countries (DE, PT, CZ, HU, SK, RO, and LT). These country-specific differences might be for instance related to country-specific environmental policies, the distance of a country to the productivity frontier, or/and the industry structure, e.g. the relative importance of car or mechanical industry within manufacturing. In services, however, non-environmental product innovators matters more and in 11 out of 14 countries their growth contribution surpass the one of environmental product innovators (exceptions: PT, CZ, and SK). At same time we can observe cannibalization between sales for old and new products for both types of product innovators in almost all countries. That is, the positive contribution of an output increase in new products is partly offset by an output reduction in old products for product innovators.

Figure 3 **Decomposition of Employment Effects of Environmental and Non-Environmental Innovation by Country, Manufacturing, 2006-2008**

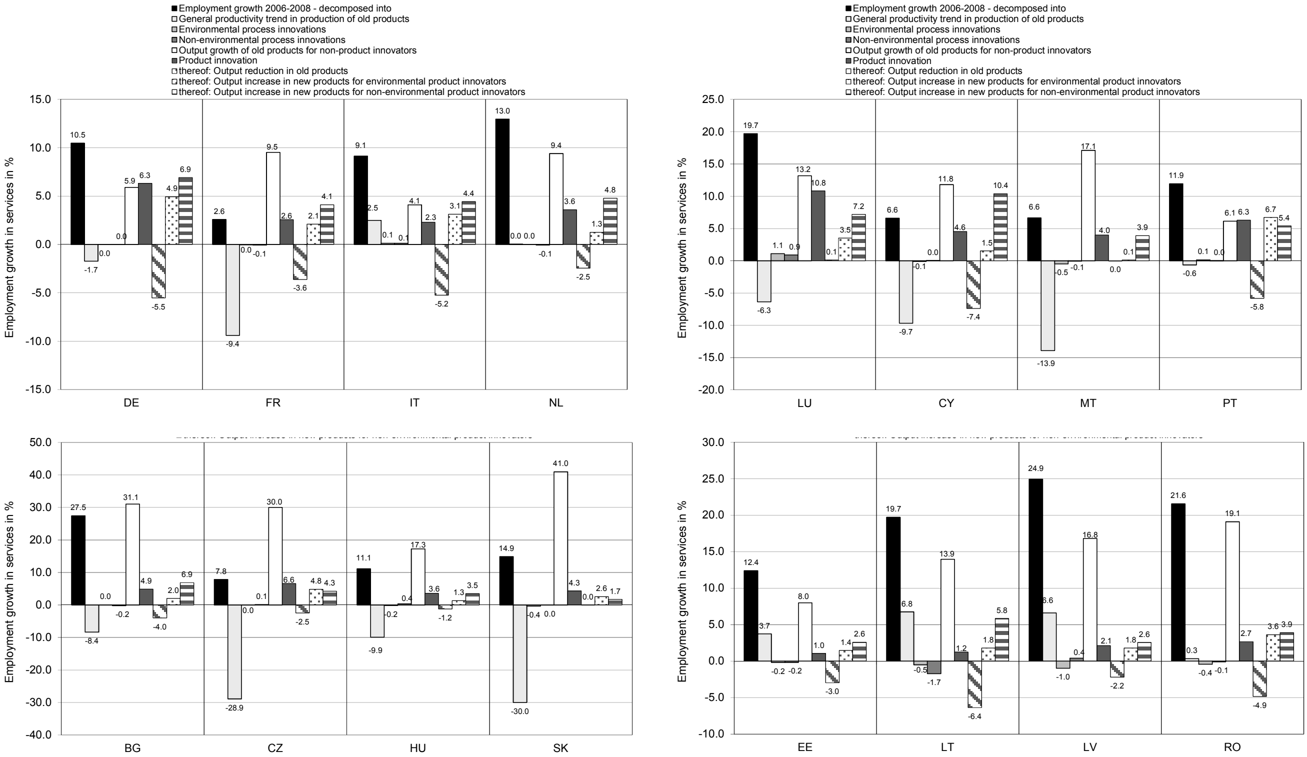


Source: CIS 2008, Eurostat, own calculation.

Despite its positive impact, product innovations have contributed less to employment growth than old products. The only exceptions are Germany and Portugal (services) where the employment contribution of product innovation exceeds the one of old products. The contribution of output for existing products to employment growth is particularly large in East European countries where we find at the same time large general productivity gains. In isolation these productivity gains would have led to a tremendous downsizing if it had not been compensated for by the growth in demand for existing products and to a lesser extent by the growth in demand for new products. Overall, the numbers reveals a quite large heterogeneity in the general productivity trend across European firms, particularly in East Europe and in services. But even for large Western European countries this effect ranges in manufacturing from -6% in France, -4.4% in Germany to -2.3% in Italy. In some countries, especially in the Baltic area, the effect is even positive indicating that these countries experienced a decline in labor productivity and hoard labor in this period.

Compared to product innovations, the demand for old products and the general productivity trend, it turns out that the contribution of both environmental and non-environmental process innovation is rather small in terms of magnitude.

Figure 4 **Decomposition of Employment Effects of Environmental and Non-Environmental Innovation by Country, Services, 2006-2008**



Source: CIS 2008, Eurostat, own calculation.

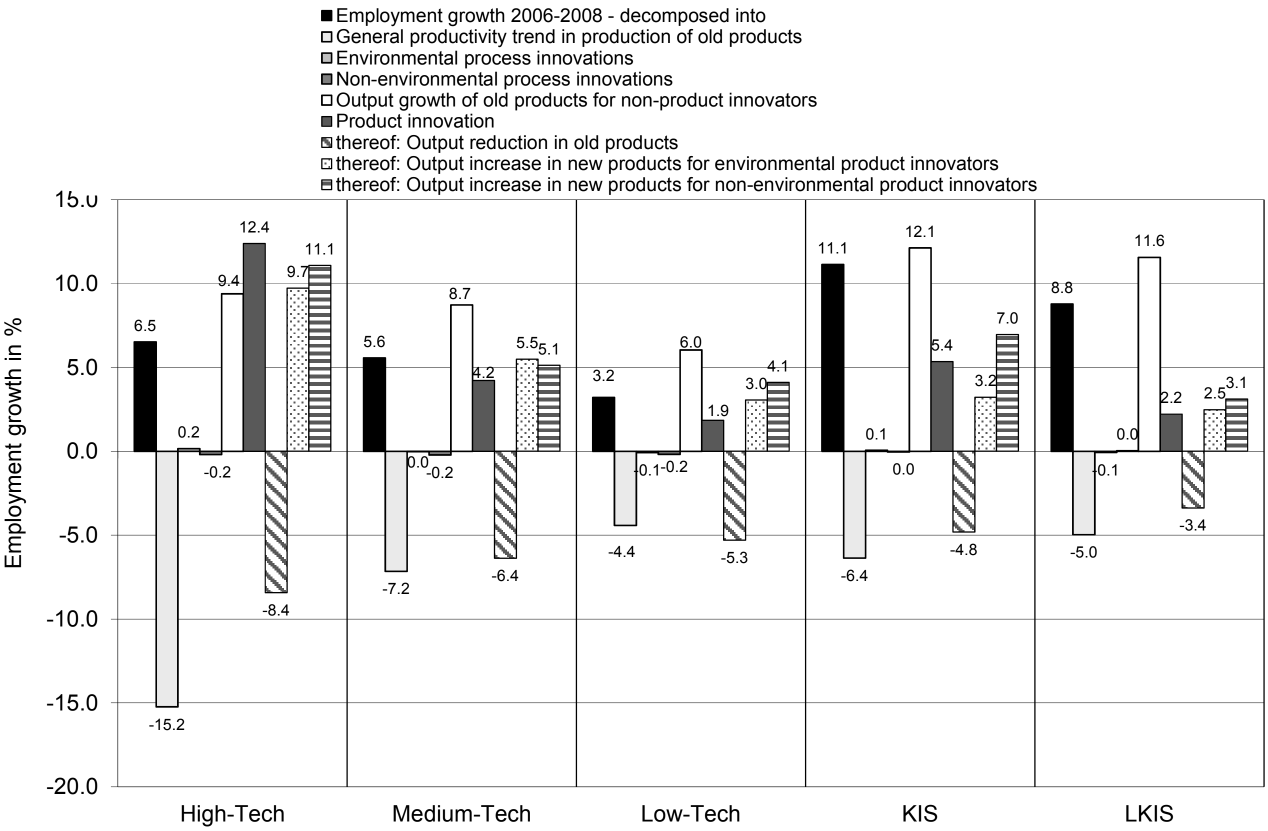
6.3 Employment Effects of Innovation at the Sector Level

In a final step, we investigate potential heterogeneity in the innovation-employment link across industries. Table 21, Table 22 and Figure 5 depict estimation and decomposition results when we split the manufacturing sample into high-, medium- and low-technology (HT, MT and LT, respectively) and the service sample into knowledge-intensive (KIS) and less knowledge-intensive services (LKIS).

The key finding from the two previous sections that product innovation stimulates employment for environmental and non-environmental product innovators is also confirmed at the sector level. In all sectors, we find a positive and significant impact. Furthermore, t-tests show that the null hypothesis that the elasticity is one cannot be rejected, except for non-environmental product innovators in knowledge-intensive services. In this sector we find new services of non-environmental product innovators to be produced with higher efficiency (less labor) than existing services. Taking into account that new products are likely to partially or totally replace existing products, the decomposition shows that product innovations have a positive net effect on employment growth in all sectors. In absolute terms the contribution of environmental product innovators is particularly large in high-tech manufacturing, followed by medium-tech industries. In the latter sector environmental product innovators contribute even more to employment growth than non-environmental innovators. Also at the disaggregated level we observe that product innovations contribute less to employment growth than existing products. The only exception is high-tech manufacturing where product innovations are the major source of employment growth.

By and large there are no sector differences with respect to the relationship between environmental process innovation and employment growth. That is, we find no significant effects of green process innovation in any of the sectors. On the contrary, non-environmental process innovations have reduced labor demand in medium- and low-technology sectors by about 4% in the period 2006-2008. In both sectors it is presumably more likely that process innovations are aimed at reducing costs instead of increasing the quality.

Figure 5 **Decomposition of Employment Growth in Europe by Sector, Pooled Sample, 2006-2008**



Source: CIS 2008, Eurostat, own calculation.

7. Conclusions

The aim of this paper was to further improve our understanding of new environmental products and processes and their impact on economic performance. In particular, we investigated how environmental innovations affect employment growth in European countries and whether differences exist to non-environmental innovation. In the following we will summarize the key findings and discuss potential lessons that can be drawn from a policy perspective.

The econometric analysis clearly demonstrates that both environmental and non-environmental product innovations are conducive to employment growth in European firms. We find impressive evidence for this growth stimulus in nearly all countries and across all sectors. In most cases, a one-percent increase in the sales due to new products for environmental product innovators also increases *gross* employment by one percent. This implies that there is no evidence that environmentally-friendly new products are produced with higher or lower efficiency than old products. We only observe deviations from this global pattern in a few cases: In Czech manufacturing results points towards the fact that new environmentally-friendly products are produced with higher productivity and thus less labor than old products. On the contrary, new products of environmental product innovators seemed to be produced with relatively more labor input in Estonian and Hungarian manufacturing. Furthermore, our results illustrate that there are no substantial differences between environmental and non-environmental product innovators how product innovation success translates into employment growth. That is, for the latter group we also find the elasticity to be one. Exception are France, manufacturing in Cyprus and Latvia, and services in Estonia (at the country level) and knowledge-intensive services (at the sector level). In the latter cases there is evidence that non-environmental product innovators produce new goods with higher efficiency and less labor input than existing products.

The decomposition of employment growth allows us to assess the net effect of product innovation. It turns out that product innovations have a positive net effect in all countries and sectors. In manufacturing product innovation has stimulated growth in a range of about 2 to 4% in most of the countries and in services the contribution ranges mainly between 2 and 5%. Regarding the question whether environmental or non-environmental product innovators have contributed more to this growth, we find mixed results. The results demonstrate that in manufacturing the contribution of environmental product innovators was larger than that of non-environmental product innovators in half of the countries (DE, PT, CZ, HU, SK, RO, and LT). In services, however, non-environmental product innovators matters more for growth in the vast majority of countries (exceptions: PT, CZ, and SK). Despite its positive impact, we have to ascertain that the contribution of product innovation to employment growth is still smaller than that of old products (except for DE, PT and High-tech manufacturing). However, the total employment effects of new products are presumably underestimated as we can only identify employment effects of product innovation within a three-year period. Data constraints do not allow us to trace long-term impacts of new products. Nevertheless, in view of problems of high unemployment in many European countries, policy is well advised to stimulate environmental product innovation. Direct government interventions, for instance direct innovation subsidies or tax credits, might be one solution to foster environmental product innovation in order to encounter market failure problems which arise because knowledge has the character of a public good and firms investing in innovation can often not fully reap the benefits of their investment.

Another result is worthy to note. We have estimated a gross employment effect of product innovation for both types of product innovators that is very similar in nearly all countries and sectors. Observed differences in the contribution of environmental and non-environmental innovation to employment growth across countries or sectors are thus a result of differences in the average innovation engagement and innovation success across countries or sectors, but not of differences in the transformation of a given level of innovation success to employment growth. Under the assumption that there will be no structural breaks in this relationship, this should open up similar employment potentials across countries or sectors for policy if they are successful in stimulating environmental innovation.

From a policy perspective, however, it is also important to take into account that our results show that the type of innovation matters for employment. When designing their innovation policies, governments should also take into account that process innovation plays only a little role for stimulating employment growth or releasing labor. This holds for both environmental and non-environmental process innovation and the result turns out to be quite robust across different countries and sectors.

The analyses provide some interesting policy insights: Overall, we do not corroborate a trade-off between employment growth and the introduction of environmentally-friendly processes (e.g. in terms of reductions of material or energy inputs, safer work environments, or negative environmental consequences of production). Hence, there seems to be some room for industrial and regulation policies to induce the increased use of environmentally-friendly production processes in manufacturing as well as in services. Even more, a stronger focus of environmental-friendly product innovation compared to non-environmental-friendly product innovation will most likely not have different employment impacts. An obvious implication is that an industrial or environmental policy which generated more favorable conditions for environmental product innovation will not induce a reduction of a country's ability to profit from product innovation in general with regard to employment growth. This is especially important if we take into account limits in the ability of firms and countries to generate innovation. Hence, the tradeoff between environmental regulation and employment growth seems to be small as long as the environmental policy provides a medium or long-term orientation so that firm can translate these incentives into process and product innovation with more favorable environmental characteristics. The results also show that in some countries such policies might even increase the employment impact from innovation.

Our findings have demonstrated that on average product innovation is conducive to employment growth and that there are only small differences between environmental and non-environmental product innovators. Future research should dig deeper whether the employment effects of environmental product innovations are heterogeneous across certain firm characteristics. For instance, it would be interesting to know whether the effects of eco product innovation are heterogeneous along the conditional distribution of employment growth. For instance whether fast growing firms benefit more from environmental product innovation that the least performing firms? This should also help policy to design innovation policies more effectively.

8. References

Baum, C.F., M.E. Schaffer and S. Stillman (2007), Enhanced Routines for Instrumental Variables/GMM Estimation and Testing, *STATA Journal* 7, 465-506.

Benavente, J.M. and R. Lauterbach (2007), *The Effect of Innovation on Employment, Evidence from Chilean Firms*, UNU-MERIT Working Paper, Maastricht.

Blechinger, D., A. Kleinknecht, G. Licht and F. Pfeiffer (1998), *The Impact of Innovation on Employment in Europe – An Analysis Using CIS Data*, ZEW Dokumentation 98-02, Mannheim.

Bogliacino, F. and M. Pianta (2010), Innovation and Employment: A Reinvestigation using Revised Pavitt Classes, *Research Policy* 39 (6), 699-842.

Buch, C.M. and A. Lipponer (2010), Volatile multinationals? Evidence from the Labor Demand of German Firms, *Labour Economics* 17, 345-353.

Chennells, L. and J. Van Reenen (2002), Technical change and the structure of employment and wages: A survey on the microeconometric evidence, in Greenan, N., Y. L'Horty and J. Mairesse (eds.), *Productivity, Inequality and the Digital Economy*, MIT Press, 175-224.

Cragg, J.G. and S.G. Donald (1993), Testing Identifiability and Specification in Instrumental Variable Models, *Econometric Theory* 9, 222-240.

Crespi, G. and E. Tacsin (2011), *Effects of innovation on employment in Latin America*, mimeo, IDB.

Crespi, G. and P. Zuniga (2012), Innovation strategies and employment in Latin American firms, *Structural Change and Economic Dynamics*, 24, 1-17.

Dachs, B. and B. Peters (2014), Innovation, Employment Growth and Foreign Ownership – A European Perspective, *Research Policy* 43 (1), 214-232.

Entorf, H. and W. Pohlmeier (1990), Employment, Innovation and Export Activity: Evidence from Firm-Level Data, in: Florens, J.-P., M. Ivaldi, J.-J. Laffont and F. Laisney (Eds.), *Microeconometrics: Surveys and Applications*, Oxford, 394–415.

Garcia, A., J. Jaumandreu and C. Rodriguez (2004), *Innovation and Jobs: Evidence From Manufacturing Firms*, Open Access Publication from Universidad Carlos III de Madrid hdl:10016/5263.

Greenan, N. and D. Guellec (2000), Technological Innovation and Employment Reallocation, *Labour* 14, 547-590.

Gibrat, R. (1934), *Les Inégalités Économiques; Applications: Aux Inégalités des Richesses, à la Concentration des Enterprises, aux Populations des Villes, aux Statistiques des Familles, etc., d'une Loi Nouvelle, la Loi des l'Effet Proportionnel*, Paris.

Hall, B.H., F. Lotti and J. Mairesse (2008), Employment, Innovation, and Productivity: Evidence from Italian Microdata, *Industrial Corporate Change* 17, 813-839.

Harrison, R., J. Jaumandreu, J. Mairesse and B. Peters (2008), *Does Innovation Stimulate Employment? A Firm-Level Analysis Using Comparable Micro-Data From Four European Countries*, NBER Working Paper 14216, Cambridge [Mass.].

Horbach, J. (2010), The Impact of Innovation Activities on Employment in the Environmental Sector – Empirical Results for Germany at the Firm Level, *Jahrbücher für Nationalökonomie und Statistik / Journal of Economics and Statistics* 230/4, 403-419.

Horbach, J. and C. Rennings (2013), Environmental Innovation and Employment Dynamics in Different Technology Fields – An Analysis Based on the German Community Innovation Survey 2009, *Journal of Cleaner Production* 57, 158-165.

Jovanovic, B. (1982), Selection and the Evolution of Industry, *Econometrica* 50(3), 649–670.

Kleibergen, F. and R. Paap (2006), Generalized Reduced Rank Tests Using the Singular Value Decomposition, *Journal of Econometrics* 133, 97-126.

König, H., G. Licht and H. Buscher (1995), Employment, Investment and Innovation at the Firm Level, in: OECD (Ed.), *The OECD Jobs Study – Investment, Productivity and Employment*, Paris, 67–81.

Lachenmaier, S. and H. Rottmann (2011), Effects of Innovation on Employment: A Dynamic Panel Analysis, *International Journal of Industrial Organization* 29, 210-220.

Mairesse, J., Y. Wu, Y. Zhao and F. Zhen (2011), *Employment growth, export, product innovation and distance to productivity frontier in China: A firm-level comparison across regions, industries, ownership types and size classes*, mimeo.

OECD/Eurostat (2005), *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*, Paris: OECD, 3rd edition.

Peters, B. (2008), *Innovation and Firm Performance - An Empirical Investigation for German Firms,* ZEW Economic Studies 38, Heidelberg, New York.

Peters, B., R. Riley und I. Siedschlag (2013), *The Influence of Technological and Non-Technological Innovation on Employment Growth in European Service Firms*, Servicegap Discussion Paper No. 40.

Pfeiffer, F. and K. Rennings (2001), Employment Impacts of Cleaner Production – Evidence from a German Study Using Case Studies and Surveys, *Business Strategy and the Environment* 10 (3), 161-175.

Rennings, K. and T. Zwick (2002), Employment Impact of Cleaner Production on the Firm Level: Empirical Evidence from a Survey in Five European Countries, *International Journal of Innovation Management*, 6(3), 319-342.

Rennings, K., A. Ziegler and T. Zwick (2004), The Effect of Environmental Innovations on Employment Changes: An Econometric Analysis, *Business Strategy and the Environment* 13, 374-387.

Scheve, K. and M.J. Slaughter (2004), Economic Insecurity and the Globalization of Production, *American Journal of Political Science* 48, 662-674.

Smolny, W. (1998), Innovations, Prices and Employment: A Theoretical Model and an Empirical Application for West German Manufacturing Firms, *The Journal of Industrial Economics* 46, 359-381.

Smolny, W. (2002), Employment Adjustment at the Firm Level. A Theoretical Model and an Empirical Investigation for West German Manufacturing Firms, *Labour* 16, 65-88.

Stock, J.H. and M. Yogo (2005), Testing for Weak Instruments in Linear IV Regression, in: Stock, J.H. and D.W.K. Andrews (Eds.), *Identification and Inference for Econometric Models: Essays in Honor of Thomas J. Rothenberg*, Cambridge University Press, New York.

Van Reenen, J. (1997), Employment and Technological Innovation: Evidence from U.K. Manufacturing Firms, *Journal of Labor Economics* 15, 255-284.

Zimmermann, K. F. (1991), The Employment Consequences of Technological Advance, Demand and Labour Costs in 16 German Industries, *Empirical Economics* 16(2), 253–266.

Annex

9. Tables

9.1 Descriptive Statistics

Table 3 **Distribution by Countries, 2006-2008**

Sample		Manufacturing			Services		
		N	%	Cum	N	%	Cum
BG	Bulgaria	5,094	14.42	14.42	3,811	12.86	12.86
CY	Cyprus	409	1.16	15.58	538	1.82	14.67
CZ	Czech Republik	2,373	6.72	22.29	1,870	6.31	20.98
DE	Germany	2,130	6.03	28.32	1,381	4.66	25.64
EE	Estonia	862	2.44	30.76	626	2.11	27.75
FR	France	6,239	17.66	48.42	5,868	19.80	47.55
HU	Hungary	2,116	5.99	54.41	1,174	3.96	51.51
IT	Italy	5,709	16.16	70.57	3,591	12.12	63.63
LT	Lithuania	414	1.17	71.74	369	1.24	64.87
LU	Luxembourg	149	0.42	72.16	332	1.12	65.99
LV	Latvia	255	0.72	72.88	348	1.17	67.17
MT	Malta	211	0.60	73.48	475	1.60	68.77
NL	Netherlands	2,382	6.74	80.22	3,782	12.76	81.53
PT	Portugal	3,180	9.00	89.22	2,056	6.94	88.47
RO	Romania	3,163	8.95	98.18	2,748	9.27	97.74
SK	Slovakia	644	1.82	100.00	670	2.26	100.00
Pooled		35,330	100.00		29,639	100.00	

Source: CIS2008, Eurostat, own calculation.

Table 4 **Size Distribution by Countries, 2006-2008**

Sample		Manufacturing			Services		
		10-49	50-249	250+	10-49	50-249	250+
BG	Bulgaria	60.6	28.2	5.7	71.1	12.3	1.9
CY	Cyprus	86.2	12.1	1.7	78.7	18.3	2.9
CZ	Czech Republic	66.8	24.6	7.0	80.7	14.6	2.6
DE	Germany	42.1	36.9	19.3	49.4	30.6	16.6
EE	Estonia	68.1	24.7	3.7	76.8	11.5	1.1
FR	France	70.3	18.8	5.1	75.3	13.8	3.5
HU	Hungary	69.6	23.2	5.8	80.7	15.1	2.7
IT	Italy	86.9	11.5	1.6	88.9	9.2	1.9
LT	Lithuania	34.8	50.9	12.1	71.8	20.3	2.3
LU	Luxembourg	58.4	26.9	11.6	64.8	18.7	4.8
LV	Latvia	42.6	43.2	4.2	64.1	15.9	3.0
MT	Malta	73.9	19.4	6.6	82.7	13.7	2.7
NL	Netherlands	70.5	22.9	4.7	76.4	17.5	3.7
PT	Portugal	77.4	17.2	2.2	79.6	11.7	2.3
RO	Romania	63.1	28.3	7.0	71.8	16.5	2.5
SK	Slovakia	59.7	26.1	8.2	72.2	11.9	2.7
Pooled		76.3	17.7	3.9	78.9	13.4	2.9

Notes: Weighted figures. Weights extrapolate to the number of firms in each stratum. Weighting factors are provided by Eurostat.

Source: CIS2008, Eurostat, own calculation.

Table 5 **Distribution by Industry, 2006-2008**

Manufacturing					Services				
Industry		N	%	Cum	Industry		N	%	Cum
FOOD	10-12	4,862	13.76	13.76	WHOLE	46	10,590	35.73	35.73
TEXT	13-15	4,393	12.43	26.20	TRANS	49-53, 79	6,103	20.59	56.32
WOOD	16-18	4,263	12.07	38.26	TELE	61-63	2,911	9.82	66.14
CHEM	20-21	1,732	4.90	43.16	BANK	64-66	2,681	9.05	75.19
PLAS	22	2,174	6.15	49.32	TEC	71-72	2,491	8.40	83.59
NONM	23	1,834	5.19	54.51	CONSULT	69-70, 73	1,874	6.32	89.92
BASM	24-25	5,290	14.97	69.48	OBRS	74, 78, 80-82	1,728	5.83	95.75
MACH	28,33	4,250	12.03	81.51	MEDIA	58-60	1,261	4.25	100.00
ELEC	26-27	2,403	6.80	88.31					
VEHI	29-30	1,483	4.20	92.51					
NEC	31-32	2,646	7.49	100.00					
Pooled		35,330	100.00		Pooled		29,639	100.00	

Source: CIS2008, Eurostat, own calculation.

Table 6 **Distribution of Sector Groups, 2006-2008**

	N	%
High-tech	1579	2.43
Medium-tech	17870	27.48
Low-tech	16030	24.65
KIS	12527	19.26
LKIS	17019	26.17

Source: CIS 2008, Eurostat, own calculation.

Table 7 **Share of Product, Process and Organizational Innovators, Pooled and by Country, 2006-2008**

	Manufacturing					Services				
	INNO	PD	PC	PCONLY	ORGA	INNO	PD	PC	PCONLY	ORGA
BG	31.2	20.7	21.1	10.6	20.7	16.5	11.9	10.6	4.5	14.2
CY	51.0	32.9	50.5	18.1	32.9	34.5	23.1	34.5	11.4	35.9
CZ	41.1	29.2	34.5	11.9	29.2	28.6	17.6	23.8	11.0	32.7
DE	62.7	50.4	43.9	12.3	50.4	46.6	35.4	33.8	11.2	51.5
EE	49.6	29.5	41.7	20.1	29.5	37.8	20.1	31.6	17.8	28.7
FR	39.0	27.8	29.8	11.2	27.8	27.8	18.5	21	9.3	33.4
HU	21.7	16.4	15.5	5.4	16.4	19.6	14.1	13.3	5.5	17.6
IT	40.5	30.1	33.3	10.4	30.1	28.6	20.6	21.8	8.0	31.5
LT	41.0	27.8	36.7	13.2	27.8	23.3	12.5	22.1	10.8	19.1
LU	45.3	35.4	35.8	9.9	35.4	43.4	35.1	33.2	8.3	46.1
LV	27.0	22.5	17.8	4.6	22.5	13.0	7.1	10.4	5.9	11.9
MT	34.1	23.7	28.9	10.4	23.7	20.8	14.1	18.9	6.7	18.9
NL	41.8	31.4	28.9	10.3	31.4	27.0	20.2	17.4	6.8	20.8
PT	47.2	32.6	40.7	14.6	32.6	52.5	37.5	44.7	15.0	45.1
RO	23.5	15.7	20.7	7.8	15.7	16.8	10.7	14.4	6.2	22.6
SK	25.5	18.5	19.7	7.1	18.5	16.1	10.8	13.2	5.4	21.2
Pooled	38.8	28.2	31.1	10.6	29.4	27.8	19.2	21.3	8.6	29.7

Notes: Weighted figures. Weights extrapolate to the number of firms in each stratum. Weighting factors are provided by Eurostat. INNO denotes the share of firms with technological innovation (product or process innovation), PD and PC denote the share of firms with product and process innovation, respectively. PCONLY measures the share of firms with process innovation only, i.e. PC=1 and PD=0. ORGA is the share of firms with organizational innovation.

Source: CIS 2008, Eurostat, own calculation.

Table 8 **Share of Firms with Environmental Innovation, Pooled and by Country, 2006-2008**

	Manufacturing							Services						
	PC_ ENV	PD_ ENV	PD_ ENV only	PC_ ENV only	PD_ENV and PC_ENV	PCONLY _ENV	PCONLY _NE	PC_ ENV	PD_ ENV	PD_ ENV only	PC_ ENV only	PD_ENV and PC_ENV	PCONLY _ENV	PCONLY _NE
BG	6.7	3.9	1.2	4.0	2.7	2.1	8.4	2.9	2.7	1.4	1.6	1.3	0.6	4.0
CY	22.6	9.8	0.5	13.4	9.3	5.3	12.8	5.5	2.2	0.1	3.4	2.1	1.0	10.4
CZ	25.4	17.1	3.7	11.9	13.5	6.9	5.0	11.3	8.7	3.5	6.1	5.2	4.8	6.2
DE	37.7	31.2	10.2	16.8	20.9	9.9	2.4	18.2	14.3	5.6	9.5	8.7	4.9	6.3
EE	25.3	10.4	2.4	17.3	8.0	10.2	9.9	11.0	3.6	1.2	8.6	2.4	4.9	12.9
FR	20.9	12.7	3.9	12.0	8.9	6.9	4.4	12.2	6.3	2.3	8.2	3.9	5.4	3.9
HU	11.7	6.1	1.6	7.2	4.5	3.5	1.9	7.5	4.8	2.1	4.8	2.7	2.4	3.1
IT	17.3	13.9	2.9	6.4	11.0	4.7	5.7	8.9	8.3	3.0	3.7	5.2	2.5	5.6
LT	25.6	13.4	1.6	13.8	11.8	6.9	6.3	8.9	2.4	0.6	7.1	1.8	3.5	7.3
LU	29.6	19.5	5.1	15.2	14.4	7.5	2.4	20.4	16.2	5.3	9.4	11.0	3.7	4.6
LV	12.8	11.5	5.3	6.6	6.2	3.5	1.0	5.0	2.7	1.0	3.3	1.7	2.3	3.6
MT	20.9	7.6	2.4	15.6	5.2	6.6	3.8	7.2	3.4	0.4	4.2	2.9	1.7	5.1
NL	19.5	13.7	5.9	11.7	7.8	5.9	4.4	7.8	6.2	3.2	4.8	3.0	2.9	3.9
PT	33.1	21.0	3.6	15.7	17.4	10.9	3.7	30.7	21.0	3.7	13.5	17.2	8.5	6.5
RO	14.5	8.1	0.8	7.3	7.2	4.4	3.3	7.3	5.1	0.9	3.1	4.2	2.4	3.7
SK	12.9	10.5	2.2	4.6	8.3	2.7	4.4	6.1	3.8	0.9	3.1	2.9	1.5	3.8
Pooled	19.2	13.5	3.2	8.9	10.3	5.7	5.0	10.7	7.4	2.6	5.9	4.8	3.8	4.8

Notes: Weighted figures. Weights extrapolate to the number of firms in each stratum. Weighting factors are provided by Eurostat. For a definition of PC_ENV, PD_ENV, PCONLY_ENV and PCONLY_NE see Table 2. PD_ENV only denotes firms having environmental product innovation but no environmental process innovation. An analogue definition applies for PC_ENV only. PD_ENV and PC_ENV measure the share of firms reporting both types of environmental innovations.

Source: CIS 2008, Eurostat, own calculation.

Table 9 **Types of Environmental Process Innovation, Pooled and by Country, 2006-2008**

	Manufacturing						Services					
	MAT	ENER	CO2	SUB	POLL	RECYC	MAT	ENER	CO2	SUB	POLL	RECYC
BG	4.0	4.7	2.2	3.3	3.5	3.1	1.5	1.7	0.7	1.4	1.2	1.1
CY	9.9	13.0	8.3	7.8	13.4	11.7	2.2	2.4	1.5	1.7	2.0	3.1
CZ	15.4	16.5	8.1	10.2	12.6	16.4	5.4	5.9	4.2	4.4	5.7	9.2
DE	28.0	29.3	22.3	19.6	26.1	26.7	11.9	12.8	10.4	6.4	10.1	10.6
EE	13.1	14.5	4.4	9.4	13.4	13.1	5.3	5.2	3.7	3.9	3.5	4.0
FR	11.4	10.2	6.6	12.3	10.8	15.1	6.7	6.7	5.3	4.2	4.1	7.5
HU	7.9	9.1	3.3	6.6	6.3	5.9	4.3	4.6	2.0	3.5	2.9	3.7
IT	6.7	8.3	6.4	6.9	11.9	11.0	2.1	3.4	2.8	4.0	4.0	5.6
LT	15.6	18.4	10.6	15.5	13.6	10.9	6.7	3.9	3.3	3.9	4.1	3.2
LU	19.0	17.3	16.3	18.4	20.2	25.1	7.3	9.7	11	10.3	7.3	15.3
LV	4.0	4.0	3.6	4.8	8.3	3.0	2.7	2.5	1.9	1.6	1.9	1.8
MT	10.0	11.8	4.7	10.0	7.6	10.9	3.2	3.8	2.7	2.7	0.8	4.6
NL	10.0	11.2	6.5	10.2	10.0	11.1	2.7	3.6	3.8	4.4	3.7	4.1
PT	18.9	20.9	14.9	20.4	23.5	28.5	17.5	18.4	15.3	18.2	17.3	24.5
RO	10.3	10.2	6.5	6.5	8.4	8.4	3.6	3.9	3.9	2.6	4.5	4.5
SK	7.7	8.1	2.7	7.0	7.1	7.7	2.8	2.0	1.4	2.8	2.5	3.3
Pooled	9.7	10.5	7.0	9.3	11.8	12.8	4.9	5.5	4.5	4.6	4.7	6.9

Notes: Weighted figures. Weights extrapolate to the number of firms in each stratum. Weighting factors are provided by Eurostat. MAT, ENER and CO2 denote the share of firms with process innovations that have reduced material, energy and CO2 consumption, respectively. SUB measures share of firms with process innovations which have replaced dangerous materials with less polluting or hazardous substitutes. POLL measures the share of firms with process innovations that have reduced air, water, soil or noise pollution. RECYC stands for the share of firms with process innovations that have improved recycling.

Source: CIS 2008, Eurostat, own calculation.

Table 10 **Types of Environmental Product Innovation, Pooled and by Country, 2006-2008**

	Manufacturing			Services		
	ENER_CLIENT	POLL_CLIENT	RECYC_CLIENT	ENER_CLIENT	POLL_CLIENT	RECYC_CLIENT
BG	2.9	2.5	2.3	2.0	1.5	1.3
CY	4.9	5.3	5.2	1.2	1.5	1.4
CZ	11.3	11.0	10.4	6.4	4.8	6.2
DE	27.1	19.8	19.2	12.8	10.6	8.0
EE	7.3	4.9	4.9	2.4	1.9	1.7
FR	8.2	6.2	7.1	4.8	3.1	2.4
HU	3.8	3.7	2.5	3.5	2.9	1.9
IT	9.4	9.5	8.2	5.8	4.4	5.5
LT	9.1	7.6	8.0	1.8	1.6	1.7
LU	12.9	11.4	14.5	12.3	6.2	10.4
LV	5.9	10.2	1.4	2.5	2.3	1.7
MT	5.2	1.9	3.8	2.5	1.1	2.5
NL	9.5	7.8	7.2	4.8	3.6	3.3
PT	14.8	15.6	16.5	16.7	14.4	16.3
RO	5.9	5.6	4.4	3.7	3.7	1.9
SK	7.1	5.5	6.6	2.6	2.1	2.0
Pooled	9.1	8.6	8.0	5.5	4.2	4.3

Notes: Weighted figures. Weights extrapolate to the number of firms in each stratum. Weighting factors are provided by Eurostat. ENER_CLIENT, POLL_CLIENT, RECYC_CLIENT denote the share of firms with product innovations that have led to a reduced energy use for clients, reduced (air, water, soil or noise) pollution on clients side, and to improved recycling possibilities of products after use for clients, respectively.

Source: CIS 2008, Eurostat, own calculation.

Table 11 **Growth Rates of Employment, Sales, Productivity and Prices, Pooled and by Country, 2006-2008 Manufacturing**

	Employment growth (l)	Labour prod. growth	Sales growth (g)	Sales growth – old products (g_1)	Sales growth – new products (g_2)	Sales growth – new products – PD_ENV (g_{2m})	Sales growth – new products – PD_NE (g_{2f})	Price growth ($\tilde{\pi}_1$)
BG	7.922	25.859	33.728	22.784	10.944	2.560	8.383	15.827
	3.125	21.824	27.037	19.698	0.000	0.000	0.000	13.582
	25.363	33.075	40.862	48.526	32.240	16.745	28.319	10.628
CY	6.166	20.507	27.566	7.968	19.597	5.529	14.068	7.985
	2.326	16.560	20.000	10.054	0.000	0.000	0.000	7.532
	17.010	22.801	30.903	41.331	39.036	21.414	34.946	3.812
CZ	2.983	33.269	36.237	22.746	13.491	9.032	4.459	1.560
	0.000	20.573	27.684	17.634	0.000	0.000	0.000	-0.649
	16.439	32.235	35.017	43.433	31.795	28.031	17.487	6.405
DE	7.593	8.691	16.464	-0.045	16.508	10.577	5.931	3.504
	4.762	6.004	12.500	1.549	0.440	0.000	0.000	4.421
	16.316	19.542	25.472	32.199	27.519	23.034	18.768	6.426
EE	2.232	16.821	18.484	8.834	9.650	3.024	6.627	6.334
	0.000	12.695	12.962	6.384	0.000	0.000	0.000	7.390
	20.497	26.221	32.905	37.615	23.914	12.419	21.396	4.184
FR	2.842	12.727	14.676	5.605	9.071	4.155	4.916	4.963
	0.000	9.273	10.279	5.510	0.000	0.000	0.000	5.587
	16.847	23.491	25.451	32.273	23.473	16.419	18.195	4.817
HU	4.263	18.235	21.931	16.918	5.013	2.240	2.773	5.607
	0.000	13.028	16.483	12.716	0.000	0.000	0.000	3.616
	20.173	27.893	32.471	35.706	17.307	11.801	13.142	8.106
IT	5.071	8.133	12.757	3.429	9.328	4.288	5.040	5.686
	0.000	5.133	7.725	2.120	0.000	0.000	0.000	5.222
	16.601	22.615	26.357	31.897	22.120	15.161	17.397	3.954
LT	6.629	28.099	35.828	21.099	14.729	6.246	8.483	15.237
	2.273	24.651	28.630	17.816	0.000	0.000	0.000	13.291
	22.153	29.339	38.762	49.556	34.840	21.299	29.435	14.392
LU	7.011	10.390	17.319	8.768	8.552	4.203	4.349	6.552
	4.000	8.587	12.911	6.947	0.000	0.000	0.000	7.390
	17.066	19.984	24.612	29.436	17.736	10.797	15.323	4.244
LV	4.085	26.331	26.706	16.997	9.709	3.397	6.311	7.059
	0.000	24.483	22.598	18.179	0.000	0.000	0.000	7.390
	27.892	32.055	30.336	37.805	30.472	14.090	27.804	5.036
MT	2.639	6.234	8.030	1.289	6.742	2.863	3.879	5.483
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.787
	16.769	20.284	22.222	25.327	18.677	14.252	12.963	6.010
NL	6.957	11.983	18.974	11.127	7.847	3.578	4.269	8.788
	5.263	8.650	15.144	9.864	0.000	0.000	0.000	10.775
	16.536	22.319	26.823	31.879	21.946	14.130	17.679	5.061
PT	3.437	11.047	13.970	3.082	10.888	7.649	3.238	6.079
	0.000	7.111	8.704	2.378	0.000	0.000	0.000	5.787
	17.848	24.330	28.580	34.590	24.708	21.688	13.772	3.674
RO	5.113	26.606	31.309	21.592	9.717	5.448	4.268	25.303
	0.000	22.472	24.452	17.559	0.000	0.000	0.000	29.117
	24.981	32.552	40.911	47.420	30.805	24.149	20.305	8.131
SK	4.505	30.804	35.427	27.990	7.437	4.220	3.218	5.474
	0.000	27.090	29.657	22.609	0.000	0.000	0.000	5.787
	20.174	31.298	37.364	39.739	24.805	17.864	17.983	4.322
Total	4.546	13.796	17.870	8.259	9.610	4.766	4.845	6.901
	0.000	9.212	11.655	5.807	0.000	0.000	0.000	5.570
	18.049	26.356	30.251	35.973	24.455	17.705	18.187	7.337

Notes: Weighted figures. Weights extrapolate to the number of firms in each stratum. Weighting factors are provided by Eurostat. For each country, the figures reported are the mean (1), median (2) and the standard deviation (3) of the corresponding variable.
Source: CIS 2008, Eurostat, own calculation.

Table 12 **Growth Rates of Employment, Sales, Productivity and Prices, Pooled and by Country, 2006-2008 Services**

	Employment growth	Labour prod. growth	Sales growth	Sales growth – old products	Sales growth – new products	Sales growth – new products	Sales growth – new products	Price growth

	(l)		(g)	(g_1)	(g_2)	– PD_ENV (g_{2m})	– PD_NE (g_{2f})	$(\tilde{\pi}_1)$
BG	27.470	22.835	52.036	43.333	8.703	2.066	6.637	16.253
	18.750	17.671	41.618	36.291	0.000	0.000	0.000	16.880
	38.057	37.949	53.548	59.552	32.299	15.847	28.627	5.130
CY	6.619	20.529	27.430	15.345	12.085	1.557	10.528	10.927
	4.762	13.813	21.951	15.627	0.000	0.000	0.000	11.785
	15.312	26.485	28.773	37.053	28.327	11.447	26.537	6.069
CZ	7.843	33.535	41.621	32.652	8.968	4.999	3.970	5.119
	0.000	26.988	46.109	36.360	0.000	0.000	0.000	1.056
	22.43	31.715	34.970	42.744	27.989	21.381	19.130	5.217
DE	10.469	5.455	15.859	4.094	11.764	5.040	6.724	3.755
	4.545	3.082	8.380	3.724	0.000	0.000	0.000	4.297
	23.612	19.667	32.435	33.604	27.603	19.206	21.468	2.192
EE	12.385	13.114	25.771	18.816	6.954	0.953	6.001	13.822
	5.263	8.421	15.795	11.788	0.000	0.000	0.000	14.724
	26.105	31.862	42.251	44.002	25.307	6.858	24.594	4.570
FR	2.584	18.549	19.390	12.200	7.189	2.444	4.745	6.309
	-1.587	15.546	11.920	9.127	0.000	0.000	0.000	6.907
	24.188	27.749	32.512	36.228	24.001	14.521	19.707	1.227
HU	11.120	14.482	24.482	20.072	4.410	1.925	2.484	4.044
	4.412	10.247	18.468	15.526	0.000	0.000	0.000	0.892
	27.512	29.674	35.180	37.430	17.335	11.776	13.091	5.481
IT	9.165	4.980	12.863	5.335	7.528	3.160	4.368	6.714
	5.000	1.538	7.642	4.063	0.000	0.000	0.000	7.580
	21.768	23.118	26.946	30.600	21.920	14.532	17.231	1.523
LT	19.709	17.762	40.479	31.217	9.262	1.650	7.612	23.646
	12.500	14.951	29.548	25.794	0.000	0.000	0.000	24.414
	25.595	29.684	46.183	53.065	31.117	12.343	29.002	12.194
LU	19.701	12.061	31.572	22.568	9.004	4.003	5.001	9.262
	11.111	8.022	18.435	12.642	0.000	0.000	0.000	12.394
	30.209	31.614	42.990	43.825	22.873	17.341	16.205	4.051
LV	24.930	14.123	39.802	36.579	3.223	1.339	1.884	21.989
	15.385	12.863	25.899	24.405	0.000	0.000	0.000	24.861
	37.916	36.107	57.924	60.057	17.734	11.099	14.013	7.589
MT	6.648	9.242	14.637	10.637	4.000	0.842	3.158	-6.471
	0.000	0.000	4.455	2.595	0.000	0.000	0.000	-10.870
	20.095	26.508	28.515	31.161	16.283	5.669	15.438	7.173
NL	12.973	8.741	21.548	15.992	5.557	1.504	4.052	9.046
	8.333	5.525	15.086	11.903	0.000	0.000	0.000	11.939
	23.036	23.770	31.502	33.776	19.212	9.141	17.255	3.723
PT	11.869	8.619	19.491	6.641	12.850	7.224	5.626	6.397
	1.852	3.941	11.536	3.121	0.000	0.000	0.000	6.904
	27.526	27.160	35.238	38.718	29.437	22.389	21.133	1.291
RO	21.557	21.128	44.016	35.621	8.394	4.201	4.193	21.394
	12.500	14.852	31.296	25.796	0.000	0.000	0.000	26.161
	36.223	36.967	53.566	57.468	31.067	22.683	22.043	7.969
SK	14.924	28.834	45.011	40.694	4.317	1.796	2.520	-0.311
	10.000	27.434	38.558	36.248	0.000	0.000	0.000	-2.259
	26.419	35.077	42.886	46.728	18.331	12.953	13.316	3.519
Total	9.580	14.488	23.337	15.854	7.484	2.983	4.501	8.056
	2.222	10.044	14.314	10.681	0.000	0.000	0.000	6.907
	26.013	29.085	36.645	40.287	24.152	15.576	19.172	6.148

Notes: Weighted figures. Weights extrapolate to the number of firms in each stratum. Weighting factors are provided by Eurostat. For each country, the figures reported are the mean (1), median (2) and the standard deviation (3) of the corresponding variable.
Source: CIS 2008, Eurostat, own calculation.

9.2 Employment Effects of Environmental Innovation in Europe (Pooled Sample)

Table 13 **Employment Effects of Innovation in European Manufacturing, Pooled Sample, 2006-2008 (Reduced Form Regressions)**

Dep Var: *l*	**Unweighted OLS**						**Weighted OLS**					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Constant	5.698***	5.699***	5.715***	5.697***	-5.939***	-5.939***	5.450***	5.492***	5.495***	5.431***	-5.211***	-5.200***
	(1.393)	(1.397)	(1.393)	(1.391)	(1.024)	(1.024)	(1.512)	(1.516)	(1.514)	(1.516)	(1.343)	(1.348)
PD	0.795***	1.866***	1.520***	-	-	-	1.034**	1.736***	1.659**	-	-	-
	(0.261)	(0.270)	(0.293)				(0.521)	(0.529)	(0.693)			
PC	1.672***	-	-	-	-	-	1.285**	-	-	-	-	-
	(0.250)						(0.585)					
PCONLY	-	1.503***	1.184***	-	-	-	-	0.475	0.406	-	-	-
		(0.316)	(0.327)					(0.613)	(0.687)			
ORGA	1.981***	2.196***	2.113***	1.964***	1.171***	1.171***	2.983***	3.262***	3.247***	3.024***	1.955***	1.971***
	(0.242)	(0.241)	(0.245)	(0.243)	(0.199)	(0.200)	(0.598)	(0.564)	(0.541)	(0.574)	(0.567)	(0.566)
ENV	-	-	0.624**	-	-	-	-	-	0.143	-	-	-
			(0.289)						(0.592)			
PD_ENV	-	-	-	0.590*	-	-	-	-	-	0.239	-	-
				(0.340)						(0.685)		
PD_NE	-	-	-	0.905***	-	-	-	-	-	1.571***	-	-
				(0.303)						(0.590)		
PC_ENV	-	-	-	1.870***	1.064***	1.063***	-	-	-	1.551**	1.090*	1.343**
				(0.291)	(0.230)	(0.229)				(0.679)	(0.586)	(0.588)
PC_NE	-	-	-	1.403***	0.638**	0.639**	-	-	-	1.099	0.670	0.443
				(0.327)	(0.271)	(0.281)				(0.742)	(0.721)	(0.700)
SGR OLDPD	-	-	-	-	0.307***	0.307***	-	-	-	-	0.287***	0.287***
					(0.005)	(0.005)					(0.009)	(0.009)
SGR NEWPD	-	-	-	-	0.323***	-	-	-	-	-	0.301***	-
					(0.006)						(0.009)	
SGR NEWPD_ENV	-	-	-	-	-	0.323***	-	-	-	-	-	0.284***
						(0.007)						(0.012)
SGR NEWPD_NE	-	-	-	-	-	0.323***	-	-	-	-	-	0.315***
						(0.007)						(0.012)
R2_adj	0.045	0.045	0.045	0.045	0.284	0.284	0.032	0.031	0.031	0.032	0.242	0.243
Log L	-153830	-153840	-153838	-153829	-148755	-148755	-153830	-151763	-151763	-151746	-147424	-147414
BIC	-61988	-61968	-61961	-61969	-72117	-72107	-66144	-66122	-66111	-66134	-74779	-74789
AIC	8.710	8.711	8.711	8.710	8.423	8.423	8.592	8.593	8.593	8.592	8.348	8.347
Joint sign. (p-value)												
Industry dummies	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.001***	0.001***
Country dummies	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Size dummies	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Ownership dummies	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.763	0.760	0.762	0.753	0.603	0.578

Table 13 **Employment Effects of Innovation in European Manufacturing, Pooled Sample, 2006-2008 (Reduced Form Regressions) (cont.)**

Dep Var: *l*	**Unweighted OLS**									**Weighted OLS**								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**		**(6)**		**(7)**	**(8)**	**(9)**	**(10)**		**(11)**		**(12)**	
PD_ENV=PD_NE	-	-	-	0.403	-		-		-	-	-	0.057	*	-		-	
PC_ENV=PC_NE	-	-	-	0.193	0.141		0.169		-	-	-	0.560		0545		0.165	
OLDPD=NEWPD	-	-	-	-	0.000	***	-		-	-	-	-		0.013	**	-	
OLDPD=NEWPD_ENV	-	-	-	-	-		0.006	***	-	-	-	-		-		0.723	
OLDPD=NEWPD_NE	-	-	-	-	-		0.003	***	-	-	-	-		-		0.012	**
NEWPD_E=NEWPD_NE	-	-	-	-	-		0.992		-	-	-	-		-		0.043	**
Number of obs	35330	35330	35330	35330	35330		35330		35330	35330	35330	35330		35330		35330	

Notes: ***, ** and * indicates significance at the 1%, 5% and 10% level. Clustered standard errors are reported (clustered by country and industry).
Source: CIS 2008, Eurostat, own calculation.

Table 14 **Employment Effects of Innovation in European Services, Pooled Sample, 2006-2008 (Reduced Form Regressions)**

Dep Var: *l*	Unweighted OLS						Weighted OLS					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	21.130 ***	21.123 ***	21.118 ***	21.158 ***	5.713 ***	5.751 ***	19.986 ***	19.973 ***	19.965 ***	20.004 ***	5.388 ***	-5.420 ***
	(1.636)	(1.639)	(1.638)	(1.625)	(1.279)	(1.270)	(0.845)	(0.850)	(0.849)	(0.838)	(0.820)	(0.825)
PD	1.139 **	2.072 ***	2.417 ***	-	-	-	1.691 **	2.688 ***	3.397 ***	-	-	-
	(0.479)	(0.507)	(0.565)				(0.860)	(0.752)	(1.160)			
PC	1.451 ***	-	-	-	-	-	1.629 ***	-	-	-	-	-
	(0.480)						(0.624)					
PCONLY	-	1.427 **	1.715 ***	-	-	-	-	1.565 *	2.184 **	-	-	-
		(0.560)	(0.560)					(0.845)	(0.935)			
ORGA	2.384 ***	2.511 ***	2.580 ***	2.425 ***	1.389 ***	1.393 ***	2.997 ***	3.138 ***	3.237 ***	3.055 ***	1.897 ***	1.902 ***
	(0.340)	(0.359)	(0.367)	(0.349)	(0.300)	(0.300)	(0.585)	(0.623)	(0.648)	(0.603)	(0.607)	(0.606)
ENV	-	-	-0.756	-	-	-	-	-	-1.525	-	-	-
			(0.707)						(1.243)			
PD_ENV	-	-	-	-0.011	-	-	-	-	-	0.335	-	-
				(0.667)						(0.964)		
PD_NE	-	-	-	1.747 ***	-	-	-	-	-	2.503 **	-	-
				(0.550)						(1.094)		
PC_ENV	-	-	-	1.554 **	0.968 **	1.178 ***	-	-	-	1.355	1.103 *	1.321 **
				(0.671)	(0.445)	(0.428)				(0.929)	(0.643)	(0.604)
PC_NE	-	-	-	1.499 ***	1.292 ***	1.174 ***	-	-	-	2.013 **	2.076 ***	1.943 ***
				(0.515)	(0.428)	(0.444)				(0.835)	(0.723)	(0.686)
SGR OLDPD	-	-	-	-	0.367 ***	0.367 ***	-	-	-	-	0.358 ***	0.358 ***
					(0.009)	(0.009)					(0.011)	(0.011)
SGR NEWPD	-	-	-	-	0.355 ***	-	-	-	-	-	0.346 ***	-
					(0.011)						(0.017)	
SGR NEWPD_ENV	-	-	-	-	-	0.341 ***	-	-	-	-	-	0.330 ***
						(0.015)						(0.018)
SGR NEWPD_NE	-	-	-	-	-	0.361 ***	-	-	-	-	-	0.354 ***
						(0.012)						(0.020)
R2_adj	0.096	0.096	0.096	0.096	0.340	0.340	0.079	0.079	0.079	0.080	0.303	0.303
Log L	-139823	-139825	-139824	-139820	-135157	-135155	-137397	-137399	-137396	-137390	-133264	-133262
BIC	-25233	-25230	-25221	-25219	-34546	-34539	-30086	-30081	-30078	-30079	-38330	-38325
AIC	9.437	9.437	9.437	9.437	9.122	9.122	9.273	9.274	9.273	9.273	8.995	8.995
Joint sign. (p-value)												
Industry dummies	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.001 ***	0.001 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.001 ***	0.001 ***
Country dummies	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***
Size dummies	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***
Ownership dummies	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.031 **	0.031 **	0.030 **	0.027 **	0.081 *	0.080 *
PD_ENV=PD_NE	-	-	-	0.015 **	-	-	-	-	-	0.059 *	-	-
PC_ENV=PC_NE	-	-	-	0.937	0.573	0.995	-	-	-	0.586	0.282	0.423
OLDPD=NEWPD	-	-	-	-	0.121	-	-	-	-	-	0.425	-
OLDPD=NEWPD_ENV	-	-	-	-	-	0.074 *	-	-	-	-	-	0.099 *
OLDPD=NEWPD_NE	-	-	-	-	-	0.473	-	-	-	-	-	0.864
NEWPD_E=NEWPD_NE	-	-	-	-	-	0.173	-	-	-	-	-	0.229
Number of obs	29639	29639	29639	29639	29639	29639	29639	29639	29639	29639	29639	29639

Notes: ***, ** and * indicates significance at the 1%, 5% and 10% level. Clustered standard errors are reported (clustered by country and industry). Source: CIS 2008, Eurostat, own calculation.

Table 15 **Employment Effects of Environmental Innovation in Europe, Pooled Sample, 2006-2008**

	Manufacturing				Services			
	Unweighted (1)	Weighted (2)	Weighted (3)	Weighted (4)	Unweighted (5)	Weighted (6)	Weighted (7)	Weighted (8)
Constant	2.417	2.142	2.154	2.232	1.985	1.152	1.147	1.238
	(2.581)	(2.585)	(2.583)	(2.626)	(3.094)	(3.626)	(3.627)	(3.644)
SGR_NEWPD	0.980 ***	0.991 ***	0.991 ***	-	0.961 ***	0.970 ***	0.970 ***	-
	(0.012)	(0.029)	(0.029)		(0.020)	(0.028)	(0.028)	
SGR_NEWPD_ENV	-	-	-	1.011 ***	-	-	-	0.931 ***
				(0.028)				(0.042)
SGR_NEWPD_NE	-	-	-	0.973 ***	-	-	-	0.993 ***
				(0.049)				(0.044)
PCONLY	-1.623 ***	-2.553 ***	-	-	-0.642 ***	-0.218	-	-
	(0.478)	(0.881)			(0.242)	(0.940)		
PCONLY_ENV	-	-	-1.215	-0.847	-	-	-0.875	-0.894
			(1.034)	(1.049)			(1.254)	(1.323)
PCONLY_NE	-	-	-4.065 ***	-4.056 ***	-	-	0.300	0.303
			(1.313)	(1.049)			(1.198)	(1.197)
Joint sign. (p-value)								
Industry dummies	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***
Country dummies	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***
Size dummies	0.925	0.901	0.902	0.896	0.036 **	0.169	0.178	0.207
Ownership dummies	0.626	0.581	0.592	0.613	0.030 **	0.168	0.169	0.177
R2_adj	0.468	0.439	0.439	0.434	0.353	0.342	0.342	0.339
Wald-Test: β=1	0.085 *	0.752	0.750	-	0.043 **	0.288	0.289	-
Wald-Test: $β_{ENV}$=1	-	-	-	0.677	-	-	-	0.106
Wald-Test: $β_{NE}$=1	-	-	-	0.585	-	-	-	0.880
PCONLY: ENV=NE	-	-	0.063 *	0.036 **	-	-	0.465	0.483
SGR_NEWPD: ENV=NE	-	-	-	0.501	-	-	-	0.360
Tests on Exogeneity								
SGR_NEWPD/_ENV&_NE	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***
Tests on instr. validity								
Sargan/Hansen J-Test	0.428	0.783	0.779	0.988	0.330	0.905	0.904	0.868
Diff-in-Sargan test								
C: RANGE	0.201	0.520	0.518	0.822	0.566	0.951	0.956	0.910
C: R&D	0.395	0.526	0.522	0.806	0.151	0.658	0.655	0.597
C: CLIENT	0.335	0.649	0.647	0.879	0.989	0.896	0.890	0.736
C: ENV_REG	-	-	-	0.804	-	-	-	0.426
C: ENV_AGREE	-	-	-	0.850	-	-	-	0.415
First stage results 1 (SGR_NEWPD / _ENV):								
RANGE	9.117 ***	8.980 ***	8.981 ***	2.631 ***	9.729 ***	9.482 ***	9.482 ***	2.615 ***
	(0.373)	(0.368)	(0.368)	(0.222)	(0.585)	(0.589)	(0.590)	(0.345)
R&D	2.775 ***	4.390 ***	4.386 ***	2.661 **	8.037 ***	8.253 ***	8.253 ***	2.026 **
	(0.882)	(1.616)	(1.616)	(1.155)	(1.675)	(1.829)	(1.829)	(1.000)
CLIENT	6.347 ***	4.833 ***	4.834 ***	1.288 *	9.035 ***	8.512 ***	8.512 ***	2.119 ***
	(0.620)	(0.840)	(0.842)	(0.766)	(1.111)	(1.274)	(1.275)	(0.773)
ENV_REG	-	-	-	13.660 ***	-	-	-	16.772 ***
				(1.276)				(2.645)
ENV_AGREE	-	-	-	11.813 ***	-	-	-	12.178 ***
				(1.262)				(2.095)
F-stat of excl. instr.	375.41 ***	334.05 ***	334.87 ***	142.53 ***	163.25 ***	195.29 ***	194.80 ***	56.73 ***
First stage results 2 (SGR_NEWPD_NE)								
RANGE	-	-	-	5.760 ***	-	-	-	6.409 ***
				(0.370)				(0.361)
R&D	-	-	-	0.827	-	-	-	5.743 ***
				(1.026)				(1.439)
CLIENT	-	-	-	2.971 ***	-	-	-	5.667 ***
				(0.877)				(0.920)
ENV_REG	-	-	-	-7.534 ***	-	-	-	-8.894 ***
				(1.137)				(1.565)
ENV_AGREE	-	-	-	-6.077 ***	-	-	-	-8.854 ***
				(0.861)				(1.094)
F-stat of excl. instr.	-	-	-	73.05 ***	-	-	-	87.43 ***
Tests on underident.								
Kleibergen-Paap LM test	125.14 ***	51.68 ***	51.65 ***	58.94 ***	60.14 ***	38.94 ***	38.92 ***	32.14 ***
Test on weak inst.								
Cragg-Donald F test	3742.61 ***	4412.63 ***	4413.11 ***	723.89 ***	3469.18 ***	4056.40 ***	4056.02 ***	623.92 ***
Kleibergen-Paap F test	375.41 ***	334.05 ***	334.87 ***	58.00 ***	163.25 ***	195.29 ***	194.80 ***	26.71 ***

Table 15 **Employment Effects of Environmental Innovation in Europe, Pooled Sample, 2006-2008 (cont.)**

	Manufacturing								Services							
	Unweighted (1)		Weighted (2)		Weighted (3)		Weighted (4)		Unweighted (5)		Weighted (6)		Weighted (7)		Weighted (8)	
Weak instr. rob. inf.																
Anderson-R. Wald test	897.85	***	814.79	***	814.23	***	834.28	***	460.28	***	600.21	***	599.84	***	695.46	***
Stock-Wright LM test	120.12	***	49.19	***	49.22	***	58.75	***	62.14	***	40.22	***	40.20	***	42.27	***

Notes: Method: Unweighted (1, 5) and weighted (2-4, 6-8) instrumental variables estimation. Estimates are based on pooled data. Number of observations: 35330 (manufacturing) and 29639 (services). In regressions (4) and (8) the number of observation reduces to 35097 and 29546. ***, ** and * indicate significance at the 1%, 5% and 10% level. Clustered standard errors are reported (clustered by country and Nace 2-digit industry). Industry, country, size and ownership dummies are included in each regression. For each set of dummies the p-value of a test on joint significance is reported. Instruments for sales growth due to new products (SGR_NEWPD): RANGE (product innovation was aimed to increasing product range: measured on a 4-point Likert scale (3: high importance; 0 not important), R&D (dummy for continuous R&D activity) and CLIENT (dummy equals 1 if clients have been a high-to-medium-sized information source of innovation). In regressions (4) and (8), two additional instruments have been employed: ENV_REG and ENV_AGREE which are two dummy variables that equal 1 if the enterprise introduces an environmental innovation in response to existing environmental regulations or taxes on pollution (ENV_REG) and to voluntary codes or agreements for environmental good practice within its sector (ENV_AGREE). 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 X2(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/Hansen test on the validity of a single instrument. A difference-in-Sargan/Hansen test statistic is likewise used for the *test on the exogeneity* of SGR_NEWPD in (1-3) and (5-7), and on the joint exogeneity of SGR_NEWPD_ENV and SGR_NEWPD_NE in (4) and (8), respectively. The test statistic is robust to violations of conditional homoskedasticity. If conditional homoskedasticity holds, it is numerically equal to a Hausman-Durbin-Wu test statistic. First 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 reports the test statistic of an F-Test on the joint significance of the instruments in the first stage. The test on *underidentification* tests whether the instrument matrix has full rank in the first stage. Rejection of null hypothesis implies that 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 rk LM statistic (Kleibergen and Paap, 2006) which follows a X2(m+1)-distribution. *Weak instruments* can lead to a large relative bias of IV compared to the bias of OLS. The Cragg-Donald F statistic and Kleibergen-Paap Wald F statistic both test the null hypothesis that the instruments are weak, more precisely that the maximal relative bias of IV is larger than p%. Here p is chosen to be 5% , 10%, 20%, and 30%. Cragg-Donald F statistic is for i.i.d. errors whereas Kleibergen and Paap statistic is heteroskedasticity-robust. For one endogenous regressor (K=1), the test statistic is identical to the first stage F-statistic on excluded instruments. For K=1 endogenous regressor and L=3 instruments the critical values are 13.91 (p=5%,***), 9.08 (p=10%, **), 6.46 (p=20%, *) and 5.39 (p=30%, #). For K=2 endogenous regressors and L=5 instruments the corresponding critical values are 13.97, 8.78, 5.91 and 4.79. Note that these critical values are for i.i.d. errors; see Baum et al., 2007; Cragg and Donald, 1993; Stock and Yogo, 2005)
Source: CIS 2008, Eurostat, own calculation.

9.3 Country-Level Employment Effects of Environmental Innovation

Table 16 **Employment Effects of Environmental Innovation in West European Countries, Manufacturing, 2006-2008**

	CY		DE		FR		IT		LU		MT		NL		PT	
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Constant	-4.932		4.170	***	1.152		4.614	***	6.117		-33.330	***	1.987		2.529	
	(3.026)		(1.448)		(3.626)		(1.533)		(4.311)		(4.428)		(2.052)		(2.383)	
SGR_NEWPD_ENV	1.007	***	0.976	***	1.010	***	1.093	***	0.736	**	0.948	***	0.976	***	0.906	***
	(0.089)		(0.050)		(0.058)		(0.085)		(0.316)		(0.325)		(0.102)		(0.066)	
SGR_NEWPD_NE	0.838	***	0.928	***	0.869	***	1.020	***	0.703	***	1.176	***	1.044	***	1.213	***
	(0.080)		(0.097)		(0.059)		(0.075)		(0.234)		(0.239)		(0.111)		(0.193)	
PCONLY_ENV	-14.120	**	-1.993		1.384		-0.527		-1.325		0.448		-3.193		-3.674	*
	(6.202)		(1.711)		(1.345)		(1.877)		(5.727)		(6.244)		(2.263)		(2.147)	
PCONLY_NE	-12.159	***	-4.221		-5.494	***	1.013		8.323		-10.155		-1.861		-5.222	
	(4.666)		(3.763)		(1.790)		(1.994)		(7.366)		(9.737)		(4.152)		(4.701)	
Joint sign. (p-value)																
Industry dummies	0.033	**	0.000	***	0.000	***	0.000	***	0.191		0.055	*	0.000	***	0.001	***
Size dummies	0.073	*	0.961		0.054	*	0.154		0.626		0.588		0.301		0.044	**
Ownership dummies	0.785		0.346		0.312		0.516		0.075	*	0.440		0.365		0.739	
R2_adj	0.690		0.551		0.449		0.404		0.306		0.410		0.360		0.422	
Wald-Test: β_{ENV}=1	0.941		0.628		0.860		0.274		0.403		0.872		0.810		0.153	
Wald-Test: β_{NE}=1	0.042	*	0.455		0.026	**	0.793		0.204		0.462		0.694		0.271	
PCONLY: ENV=NE	0.785		0.573		0.001	***	0.848		0.277		0.358		0.764		0.747	
SGR_NEWPD: ENV=NE	0.214		0.682		0.155		0.555		0.929		0.578		0.700		0.188	
Tests on Exogeneity																
SGR_NEWPD/_ENV&_NE	0.666		0.036	**	0.113		0.002	***	0.792		0.262		0.002	***	0.004	***
Tests on instr. validity																
Sargan/Hansen J-Test	0.544		0.141		0.796		0.973		0.699		n.a.		0.878		0.160	
Diff-in-Sargan test																
C: RANGE	0.240		0.586		0.760		0.928		0.731		n.a.		0.558		0.350	
C: R&D	0.576		0.080	*	0.657		0.689		0.299		n.a.		0.612		0.029	**
C: CLIENT	0.199		0.494		0.517		0.754		0.415		n.a.		0.759		0.744	
C: ENV_REG	0.709		0.166		0.449		0.944		0.730		n.a.		0.753		0.662	
C: ENV_AGREE	0.712		0.130		0.430		0.952		0.417		n.a.		0.515		0.860	
First stage results 1 (SGR_NEWPD_ENV):																
RANGE	1.625		1.528	***	1.511	***	2.372	***	1.896		0.953		1.184	*	3.318	***
	(1.126)		(0.535)		(0.321)		(0.320)		(1.381)		(2.336)		(0.685)		(0.812)	
R&D	1.879		5.247	***	4.198	***	0.914		-2.660	**	4.626		3.768	***	1.042	
	(6.626)		(1.449)		(1.155)		(1.426)		(3.997)		(6.138)		(1.429)		(2.386)	
CLIENT	2.837		6.043	***	2.883	***	1.299		0.529		3.867		2.759	*	3.791	**
	(3.320)		(1.388)		(0.999)		(0.915)		(4.833)		(5.997)		(1.483)		(1.847)	
ENV_REG	17.538	***	8.786	***	10.416	***	15.137	***	7.030	**	-1.098		9.773	***	6.678	**
	(6.556)		(1.621)		(1.452)		(2.516)		(3.579)		(6.447)		(3.155)		(2.639)	
ENV_AGREE	24.798	***	11.486	***	8.905	***	9.673	***	8.489		14.951	**	6.933	***	13.232	***
	(6.591)		(1.762)		(1.513)		(2.755)		(3.882)		(6.916)		(1.751)		(2.347)	
F-stat of excl. instr.	8.68	***	84.93	***	77.72	***	33.73	***	6.62	***	1.20	***	31.29	***	54.97	***
First stage results 2 (SGR_NEWPD_NE)																
RANGE	12.891	***	2.046	***	5.242	***	5.716	***	3.056	***	7.375	***	4.294	***	2.381	***
	(2.188)		(0.458)		(0.445)		(0.581)		(1.139)		(1.837)		(1.284)		(0.469)	
R&D	12.676		4.862	***	2.193	*	2.436		14.358	***	3.637		-1.677		-0.005	
	(14.104)		(1.274)		(1.309)		(2.324)		(4.908)		(5.017)		(2.035)		(1.441)	
CLIENT	3.988		2.200		1.388		2.800	*	2.699		-9.781	**	4.604		4.078	***
	(6.247)		(1.365)		(1.270)		(1.581)		(3.704)		(4.228)		(2.877)		(1.489)	
ENV_REG	-0.595		-6.041	***	-4.398	***	-12.268	***	-6.882		-6.532	*	-5.481	***	-0.777	
	(15.645)		(0.987)		(1.233)		(1.590)		(6.055)		(3.985)		(0.992)		(1.046)	
ENV_AGREE	-25.455	***	-5.587	***	-5.021	***	-6.479	***	-6.315		-0.720		-7.089	***	-4.739	***
	(7.945)		(1.041)		(1.190)		(1.618)		(4.171)		(5.516)		(1.528)		(0.971)	
F-stat of excl. instr.	12.54	***	22.91	***	62.87	***	33.10	***	5.86	***	13.35	***	23.71	***	17.93	***
Tests on underident.																
Kleibergen-Paap LM test	25.21	*	104.13	***	136.92	***	112.33	***	10.98	**	4.71		54.69	***	43.13	***
Test on weak inst.																
Cragg-Donald F test	15.80	***	26.22	***	94.80	***	152.06	***	4.70		3.69		30.58	***	33.80	***
Kleibergen-Paap F test	6.78	*	22.92	***	32.58	***	29.29	***	2.23		0.96		12.32	**	9.55	**
Weak instr. rob. inf.																
Anderson-R. Wald test	103.83	***	324.31	***	508.60	***	321.44	***	10.40	*	33.26	***	176.41	***	276.11	***
Stock-Wright LM test	70.58	***	253.41	***	402.86	***	232.50	***	9.34	*	21.07	***	140.75	***	182.68	***
Number of obs	409		2111		6239		5504		149		211		2382		3171	

Notes: See Table 15. Source: CIS 2008, Eurostat, own calculation.

Table 17 **Employment Effects of Environmental Innovation in East European Countries, Manufacturing, 2006-2008**

	BG		CZ		EE		HU		LT		LV		RO		SK	
	(9)		(10)		(11)		(12)		(13)		(14)		(15)		(16)	
Constant	2.212	*	-33.330	***	-3.820		-2.596		-39.873	***	5.033		-2.314		-26.327	***
	(1.271)		(4.428)		(2.934)		(2.471)		(6.312)		(11.767)		(2.649)		(5.661)	
SGR_NEWPD_ENV	0.924	***	0.862	***	1.492	***	1.384	***	1.200	***	1.245	***	0.917	***	0.810	***
	(0.069)		(0.064)		(0.286)		(0.156)		(0.133)		(0.228)		(0.062)		(0.221)	
SGR_NEWPD_NE	1.038	***	1.187	***	0.775	***	0.735	***	0.868	***	0.713	***	1.044	***	0.536	
	(0.041)		(0.188)		(0.176)		(0.116)		(0.145)		(0.160)		(0.099)		(0.372)	
PCONLY_ENV	-6.857	**	-5.196		-2.946		2.719		9.390		3.859		2.216		-5.963	
	(3.397)		(4.613)		(3.295)		(3.769)		(6.816)		(8.501)		(4.175)		(7.922)	
PCONLY_NE	0.338		-9.133		-4.383		1.327		3.002		4.988		-14.096	**	-19.721	
	(1.789)		(6.830)		(5.193)		(3.818)		(11.927)		(7.208)		(6.332)		(18.250)	
Joint sign. (p-value)																
Industry dummies	0.000	***	0.000	***	0.001	***	0.000	***	0.000	***	0.213		0.000	***	0.295	
Size dummies	0.005	***	0.000	***	0.051	**	0.182		0.082	*	0.040	**	0.256		0.598	
Ownership dummies	0.689		0.763		0.001	***	0.413		0.315		0.047	*	0.719		0.100	*
R2_adj	0.414		0.492		0.348		0.226		0.580		0.433		0.397		0.264	
Wald-Test: β_{ENV}=1	0.269		0.030	**	0.085	*	0.014	**	0.132		0.284		0.185		0.389	
Wald-Test: β_{NE}=1	0.358		0.320		0.199		0.112		0.362		0.073	*	0.659		0.213	
PCONLY: ENV=NE	0.216		0.611		0.087	*	0.786		0.617		0.898		0.026	**	0.479	
SGR_NEWPD: ENV=NE	0.053	*	0.140		0.792		0.021	**	0.149		0.028	**	0.353		0.607	
Tests on Exogeneity																
SGR_NEWPD/_ENV&_NE	0.000	***	0.262		0.003	***	0.003	***	0.089	*	0.198		0.017	**	0.749	
Tests on instr. validity																
Sargan/Hansen J-Test	0.786		0.798		0.336		0.535		0.746		0.375		0.214		0.203	
Diff-in-Sargan test																
C: RANGE	0.884		0.560		0.654		0.274		0.467		0.246		0.556		0.518	
C: R&D	0.339		0.554		0.608		0.421		0.437		0.943		0.143		0.079	*
C: CLIENT	0.855		0.467		0.764		0.263		0.662		0.262		0.604		0.761	
C: ENV_REG	0.907		0.552		0.096	*	0.356		0.399		0.365		0.168		0.058	*
C: ENV_AGREE	0.671		0.899		0.119		0.260		0.676		0.085	*	0.329		0.253	
First stage results 1 (SGR_NEWPD_ENV):																
RANGE	2.691	***	7.133	***	2.458	***	0.729		2.101		0.983		4.927	***	4.162	**
	(0.538)		(1.439)		(0.638)		(0.614)		(1.463)		(1.155)		(1.684)		(2.049)	
R&D	2.109		12.996	**	1.897		6.356		3.994		39.713		5.529		5.298	
	(4.597)		(5.873)		(2.312)		(4.010)		(5.535)		(19.552)		(8.169)		(5.802)	
CLIENT	0.640		-9.692	**	-1.936		4.711	**	6.036		2.133		2.387		8.083	*
	(1.270)		(4.502)		(1.376)		(1.920)		(3.856)		(3.315)		(3.629)		(4.516)	
ENV_REG	21.904	***	15.373	***	3.264	*	8.738	***	23.360	***	18.960	***	21.060	***	3.701	
	(5.179)		(4.631)		(1.853)		(2.499)		(5.109)		(8.481)		(4.153)		(7.028)	
ENV_AGREE	29.257	***	20.660	***	9.153	***	6.374	**	5.394		8.012	***	28.426	***	11.961	*
	(7.017)		(5.636)		(2.149)		(2.895)		(6.465)		(6.245)		(6.228)		(7.113)	
F-stat of excl. instr.	30.07	***	23.32	***	12.14	***	16.73	***	14.91	***	8.59	***	29.73	***	17.33	***
First stage results 2 (SGR_NEWPD_NE)																
RANGE	11.168	***	5.948	***	6.338	***	5.619	***	14.395	***	14.807	*	11.125	***	5.759	**
	(0.829)		(1.607)		(1.489)		(1.003)		(4.710)		(7.627)		(1.519)		(2.921)	
R&D	-9.648	***	-3.147		0.506		-3.001		-2.087		-25.601		-3.388		-3.352	
	(3.756)		(2.658)		(3.943)		(2.541)		(8.220)		(20.058)		(3.313)		(6.380)	
CLIENT	8.890	***	1.454		4.122		2.126		-7.755		13.411		6.510	**	5.733	
	(2.174)		(3.316)		(3.400)		(2.496)		(9.292)		(23.679)		(2.920)		(6.575)	
ENV_REG	-13.976	***	-3.934		-2.885		-7.166	***	-11.296	**	-1.833		-14.609	***	-7.900	
	(3.771)		(2.419)		(3.672)		(2.504)		(5.537)		(9.227)		(3.863)		(6.025)	
ENV_AGREE	-6.214		-4.905		-1.577		0.305		-11.082		-39.600	*	-14.737	***	-9.463	**
	(4.853)		(3.082)		(4.147)		(2.486)		(7.721)		(20.867)		(3.237)		(4.509)	
F-stat of excl. instr.	95.26	***	13.35	***	13.71	***	15.45	***	3.85	***	1.52		18.31	***	3.22	***
Tests on underident.																
Kleibergen-Paap LM test	96.81	***	19.87	***	19.66	***	28.66	***	14.27	***	5.24		41.28	***	7.55	
Test on weak inst.																
Cragg-Donald F test	145.25	***	48.16	***	10.00	**	37.58	***	14.31	***	18.40	***	129.91	***	6.52	*
Kleibergen-Paap F test	25.06	***	5.17		3.54		6.52	*	3.28		1.16		10.72	**	1.76	
Weak instr. rob. inf.																
Anderson-R. Wald test	614.57	***	172.16	***	107.67	***	134.06	***	695.46	***	83.04	***	333.57	***	30.68	***
Stock-Wright LM test	430.86	***	97.28	***	75.28	***	76.96	***	42.27	***	17.45	***	147.79	***	22.64	***
Number of obs	5094		2373		862		2116		414		255		3163		644	

Notes: See **Fehler! Verweisquelle konnte nicht gefunden werden.** Table 15.
Source: CIS 2008, Eurostat, own calculation.

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Table 18 **Employment Effects of Environmental Innovation in West European Countries, Services, 2006-2008**

	CY	DE	FR	IT	LU	MT	NL	PT
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-7.861 ***	-5.925 ***	-9.393 ***	6.907 ***	0.087	-16.410 ***	3.577 **	1.558
	(2.402)	(2.195)	(0.820)	(1.268)	(5.630)	(1.920)	(1.414)	(1.706)
SGR_NEWPD_ENV	0.990 ***	0.985 ***	0.861 ***	1.074 ***	0.880 **	0.138	0.837 ***	0.940 ***
	(0.137)	(0.084)	(0.090)	(0.090)	(0.360)	(0.455)	(0.257)	(0.081)
SGR_NEWPD_NE	0.988 ***	1.025 ***	0.864 ***	1.005 ***	1.439 ***	1.233 ***	1.181 ***	0.956 ***
	(0.072)	(0.109)	(0.067)	(0.110)	(0.338)	(0.260)	(0.121)	(0.144)
PCONLY_ENV	-8.587	-0.157	-0.778	5.781 *	30.253 ***	-29.074 ***	0.458	1.738
	(7.578)	(2.551)	(1.561)	(3.270)	(8.818)	(7.497)	(3.207)	(2.981)
PCONLY_NE	0.291	0.158	-1.552	2.093	19.719 **	-1.318	-1.548	0.263
	(3.251)	(2.552)	(2.384)	(3.924)	(8.812)	(6.431)	(3.601)	(3.059)
Joint sign. (p-value)								
Industry dummies	0.000 **	0.253	0.000 ***	0.000 ***	0.039 **	0.001 ***	0.000 ***	0.097 *
Size dummies	0.396	0.088 *	0.100 *	0.020 **	0.538	0.815	0.383	0.562
Ownership dummies	0.115	0.303	0.024 **	0.153	0.639	0.657	0.275	0.120
R2_adj	0.474	0.476	0.336	0.339	0.180	0.236	0.213	0.411
Wald-Test: β_{ENV}=1	0.939	0.860	0.120	0.414	0.738	0.058 *	0.527	0.460
Wald-Test: β_{NE}=1	0.868	0.819	0.042 **	0.964	0.195	0.369	0.135	0.760
PCONLY: ENV=NE	0.262	0.927	0.778	0.451	0.375	0.004 ***	0.669	0.699
SGR_NEWPD: ENV=NE	0.992	0.793	0.979	0.655	0.289	0.028 **	0.321	0.928
Tests on Exogeneity								
SGR_NEWPD/_ENV&_NE	0.112	0.002 ***	0.290	0.003 ***	0.209	0.133	0.000 ***	0.285
Tests on instr. validity								
Sargan/Hansen J-Test	0.890	0.603	0.017 **	0.505	0.549	0.564	0.853	0.259
Diff-in-Sargan test								
C: RANGE	0.671	0.563	0.877	0.558	0.268	0.637	0.921	0.346
C: R&D	0.600	0.287	0.131	0.169	0.885	0.186	0.455	0.369
C: CLIENT	0.613	0.911	0.223	0.967	0.292	0.855	0.595	0.267
C: ENV_REG	0.813	0.377	0.007 ***	0.753	0.472	0.925	0.655	0.151
C: ENV_AGREE	0.816	0.354	0.008 ***	0.691	0.246	0.331	0.775	0.107
First stage results 1 (SGR_NEWPD_ENV):								
RANGE	1.096	1.148 ***	2.309 ***	2.855 ***	0.535	-0.010	0.958 **	2.403 ***
	(0.773)	(0.414)	(0.480)	(0.801)	(0.961)	(0.440)	(0.450)	(0.806)
R&D	-3.822	5.018 **	4.230 ***	1.071	7.636	-5.540 **	1.542	3.138
	(2.483)	(2.167)	(1.636)	(2.592)	(6.441)	(2.558)	(1.291)	(3.685)
CLIENT	-0.003	4.138 ***	1.252	2.556	4.698	4.914 ***	2.344 **	3.898 *
	(2.278)	(1.072)	(1.627)	(2.148)	(2.965)	(1.901)	(1.183)	(2.308)
ENV_REG	31.517 *	5.912	8.502 ***	19.494 ***	-0.904	7.497	7.207 ***	11.299 ***
	(17.887)	(3.690)	(2.048)	(4.628)	(9.014)	(7.584)	(2.666)	(3.545)
ENV_AGREE	23.230 **	18.371 ***	10.566 ***	10.422 **	9.822	11.797 *	11.986 ***	15.270 ***
	(10.633)	(4.755)	(1.855)	(4.429)	(6.414)	(6.350)	(2.674)	(2.719)
F-stat of excl. instr.	3.93 ***	20.06 ***	38.41 ***	23.52 ***	4.45 ***	4.52 ***	23.87 ***	22.63 ***
First stage results 2 (SGR_NEWPD_NE)								
RANGE	9.234 ***	3.232 ***	6.192 ***	6.816 ***	5.618 ***	6.436 **	4.946 ***	5.148 ***
	(1.137)	(0.563)	(0.585)	(1.149)	(1.773)	(2.623)	(0.836)	(0.729)
R&D	12.000	6.554 ***	9.407 ***	-0.509	1.616	18.846	5.281 **	2.157
	(8.997)	(2.333)	(1.946)	(2.843)	(4.209)	(11.751)	(2.397)	(2.510)
CLIENT	19.915 ***	4.020 ***	3.451 **	6.722 ***	6.001	2.116	4.290 **	1.804
	(3.529)	(1.555)	(1.601)	(2.539)	(4.074)	(5.888)	(2.140)	(1.710)
ENV_REG	-23.000	-6.251 ***	-4.451 **	-15.119 ***	-6.219 *	-9.710 **	-9.925 **	-4.438 ***
	(16.720)	(2.044)	(1.945)	(1.925)	(3.845)	(4.247)	(4.083)	(1.655)
ENV_AGREE	-1.544	-9.192 ***	-8.018 ***	-12.318 ***	-16.677 ***	-11.859 **	-2.461	-8.660 ***
	(10.027)	(1.938)	(1.645)	(1.969)	(3.923)	(4.683)	(8.959)	(1.793)
F-stat of excl. instr.	26.00 ***	25.56 ***	63.31 ***	23.33 ***	4.70 ***	5.06 ***	29.15 ***	14.65 ***
Tests on underident.								
Kleibergen-Paap LM test	8.92 *	68.44 ***	72.88 ***	65.09 ***	10.13 **	21.71 ***	31.47 ***	58.90 ***
Test on weak inst.								
Cragg-Donald F test	28.43 ***	20.83 ***	70.33 ***	91.18 ***	7.44 *	22.92 ***	53.89 ***	34.73 ***
Kleibergen-Paap F test	3.25	15.48 ***	15.85 ***	16.37 ***	2.27	5.00 #	9.84 **	13.18 **
Weak instr. rob. inf.								
Anderson-R. Wald test	135.58 ***	183.78 ***	356.48 ***	221.62 ***	32.31 *	22.68 ***	169.03 ***	124.55 ***
Stock-Wright LM test	55.68 ***	139.13 ***	269.77 ***	150.07 ***	22.78 *	17.73 ***	127.38 ***	95.29 ***
Number of obs	538	1377	5868	3510	332	475	3782	2048

Notes: See Table 15.
Source: CIS 2008, Eurostat, own calculation.

Table 19 **Employment Effects of Environmental Innovation in East European Countries, Services, 2006-2008**

	BG		CZ		EE		HU		LT		LV		RO		SK	
	(9)		(10)		(11)		(12)		(13)		(14)		(15)		(16)	
Constant	-5.744	***	-35.059	***	10.793	***	-10.034	***	10.438		13.263	***	7.546	***	-27.029	***
	(1.058)		(2.262)		(4.168)		(2.100)		(7.018)		(3.896)		(1.358)		(3.201)	
SGR_NEWPD_ENV	0.977	***	0.967	***	1.514	*	0.693	*	1.074	***	1.332	***	0.861	***	1.435	***
	(0.098)		(0.081)		(0.832)		(0.411)		(0.343)		(0.231)		(0.103)		(0.294)	
SGR_NEWPD_NE	1.034	***	1.073	***	0.430	**	1.400	***	0.768	***	1.354	*	0.932	***	0.676	***
	(0.057)		(0.155)		(0.204)		(0.310)		(0.186)		(0.767)		(0.133)		(0.264)	
PCONLY_ENV	8.511		-0.186		-3.739		-6.569		-14.586		-41.921	*	-17.660		-24.004	**
	(9.066)		(4.793)		(10.961)		(8.788)		(14.414)		(25.620)		(11.066)		(9.932)	
PCONLY_NE	-4.512		2.017		-1.386		11.330	**	-23.454	***	10.915		-2.453		-0.013	
	(3.706)		(4.889)		(6.350)		(4.697)		(7.912)		(9.158)		(5.451)		(11.579)	
Joint sign. (p-value)																
Industry dummies	0.000	***	0.002	***	0.003	***	0.000	***	0.011	**	0.010	**	0.000	***	0.389	
Size dummies	0.069	*	0.024	**	0.076	*	0.246		0.845		0.182		0.462		0.208	
Ownership dummies	0.202		0.140		0.386		0.067	*	0.586		0.315		0.941		0.043	**
R2_adj	0.260		0.386		0.165		0.171		0.382		0.197		0.261		0.160	
Wald-Test: β_{ENV}=1	0.814		0.682		0.536		0.456		0.830		0.151		0.179		0.140	
Wald-Test: β_{NE}=1	0.549		0.639		0.005	***	0.197		0.211		0.644		0.607		0.218	
PCONLY: ENV=NE	0.180		0.729		0.844		0.064	*	0.569		0.042	**	0.201		0.103	
SGR_NEWPD: ENV=NE	0.662		0.564		0.228		0.288		0.530		0.979		0.726		0.108	
Tests on Exogeneity																
SGR_NEWPD/_ENV&_NE	0.000	***	0.177		0.061	*	0.123		0.844		0.012	**	0.030	**	0.064	*
Tests on instr. validity																
Sargan/Hansen J-Test	0.163		0.290		0.563		0.100	*	0.348		0.929		0.488		0.581	
Diff-in-Sargan test																
C: RANGE	0.558		0.085	*	0.211		0.191		0.088		0.589		0.466		0.496	
C: R&D	0.156		0.107		0.318		0.282		0.946		0.757		0.317		0.535	
C: CLIENT	0.403		0.421		0.623		0.238		0.145		0.552		0.264		0.255	
C: ENV_REG	0.124		0.583		0.878		0.061	*	0.253		0.939		0.663		0.293	
C: ENV_AGREE	0.127		0.966		0.912		0.031	**	0.276		0.686		0.726		0.264	
First stage results 1 (SGR_NEWPD_ENV):																
RANGE	4.194	***	3.554	***	0.497		3.594	**	2.537		1.152		8.107	***	1.486	
	(0.939)		(0.980)		(0.555)		(1.439)		(1.747)		(1.573)		(1.786)		(1.667)	
R&D	0.679		-2.580		-0.080		5.189		-2.692		26.072		-5.618		11.016	
	(6.040)		(4.309)		(2.208)		(5.028)		(5.345)		(18.173)		(5.399)		(7.247)	
CLIENT	0.261		1.915		0.796		-2.338		7.006		-2.659		-3.235		-2.908	
	(2.455)		(3.569)		(1.298)		(3.471)		(5.673)		(4.190)		(4.674)		(4.765)	
ENV_REG	23.000	***	31.758	***	12.840	***	1.494		12.137		43.280	***	47.642	***	34.606	**
	(8.232)		(9.357)		(4.556)		(5.028)		(15.903)		(13.436)		(7.413)		(14.120)	
ENV_AGREE	36.885	***	29.644	***	-0.063		11.291	*	9.248		19.975	**	5.058		-6.772	
	(11.659)		(8.508)		(3.838)		(6.285)		(14.376)		(9.363)		(9.861)		(16.991)	
F-stat of excl. instr.	19.44	***	20.86	***	2.49	**	6.74	***	1.88	*	4.18	***	42.51	***	2.84	**
First stage results 2 (SGR_NEWPD_NE)																
RANGE	12.734	***	5.983	***	7.283	***	2.287	***	14.276	***	4.065	*	11.215	***	8.782	***
	(1.789)		(1.239)		(1.470)		(0.699)		(4.515)		(2.481)		(1.723)		(1.738)	
R&D	23.338	**	10.160	***	10.179	*	4.616		13.482		0.190		12.699	**	15.845	*
	(11.106)		(3.942)		(6.102)		(4.988)		(10.293)		(6.166)		(5.458)		(8.276)	
CLIENT	19.764	***	6.797		3.346		9.972	**	6.196		1.650		17.582	***	1.473	
	(4.528)		(4.267)		(3.439)		(4.028)		(13.712)		(6.143)		(5.127)		(3.938)	
ENV_REG	-33.295	***	-13.276	***	-3.717		-0.855		0.908		-6.620		-31.853	***	-18.424	***
	(8.888)		(3.220)		(3.893)		(3.042)		(18.838)		(7.774)		(5.398)		(5.107)	
ENV_AGREE	1.720		-10.981	***	-7.631		-6.475	*	-1.029		-0.535		-12.605	***	8.765	
	(11.719)		(3.283)		(4.812)		(3.630)		(15.517)		(9.806)		(4.279)		(9.431)	
F-stat of excl. instr.	50.60	***	14.97	***	10.08	***	10.28	***	6.91	***	3.09	***	24.42	***	8.35	***
Tests on underident.																
Kleibergen-Paap LM test	39.42	***	55.72	***	37.81	***	9.72	**	6.22		9.96	**	71.26	***	13.64	***
Test on weak inst.																
Cragg-Donald F test	124.03	***	77.80	***	15.73	***	12.66	**	5.13	#	2.80		162.28	***	31.65	***
Kleibergen-Paap F test	13.18	**	13.51	**	6.80	*	1.98		0.99		1.74		20.63	***	3.74	
Weak instr. rob. inf.																
Anderson-R. Wald test	410.09	***	120.88	***	18.21	***	58.60	***	47.95	***	48.80	***	223.75	***	58.72	***
Stock-Wright LM test	229.25	***	54.97	***	15.52	***	42.51	***	21.79	***	18.64	***	129.15	***	23.05	***
Number of obs	3811		1870		626		1174		369		348		2748		670	

Notes: See Table 15.

Source: CIS 2008, Eurostat, own calculation.

Table 20 **Employment Growth Decomposition, 2006-2008**

	Pooled	By Country: West Europe								By Country: East Europe							
		CY	DE	FR	IT	LU	MT	NL	PT	BG	CZ	EE	HU	LT	LV	RO	SK
Manufacturing																	
Employment growth	**4.5**	**6.2**	**7.6**	**2.8**	**5.1**	**7.0**	**2.6**	**7.0**	**3.4**	**7.9**	**3.0**	**2.2**	**4.3**	**6.6**	**4.1**	**5.1**	**4.5**
Decomposed into contribution of																	
General productivity trend in production of old products	**-6.1**	**-8.9**	**-4.4**	**-6.1**	**-2.3**	**-1.5**	**-0.1**	**-3.1**	**-3.9**	**-10.0**	**-30.5**	**-9.2**	**-12.3**	**-14.9**	**-14.8**	**-0.3**	**-22.1**
Environmental process innovations	**0.0**	**-0.7**	**-0.2**	**0.1**	**0.0**	**-0.1**	**0.0**	**-0.2**	**-0.4**	**-0.1**	**-0.4**	**-0.3**	**0.1**	**0.7**	**0.1**	**0.1**	**-0.2**
Non-environmental process innovations	**-0.2**	**-1.6**	**-0.1**	**-0.2**	**-0.1**	**0.2**	**-0.4**	**-0.1**	**-0.2**	**0.0**	**-0.5**	**-0.4**	**0.0**	**0.2**	**0.1**	**-0.5**	**-0.9**
Output growth of old products for non-product innovators	**7.6**	**10.8**	**5.1**	**6.3**	**4.6**	**6.5**	**0.5**	**7.3**	**5.0**	**14.0**	**24.4**	**8.2**	**13.4**	**15.8**	**15.6**	**4.5**	**22.2**
Thereof for																	
Non-innovators	6.1	5.8	3.4	5.2	3.8	5.3	-0.1	5.7	3.4	11.8	19.3	4.8	12.2	14.0	14.7	3.6	19.3
Environmental process innovators only	0.7	1.9	1.3	0.6	0.4	0.9	0.1	0.8	1.1	0.5	2.8	1.9	0.9	0.1	0.8	0.2	0.8
Non-environmental process innovators only	0.7	3.0	0.5	0.6	0.5	0.2	0.5	0.8	0.5	1.7	2.3	1.5	0.2	1.7	0.1	0.6	2.1
Product innovation	**3.4**	**6.6**	**7.2**	**2.8**	**2.9**	**1.9**	**2.6**	**3.0**	**2.9**	**4.0**	**9.9**	**4.0**	**3.1**	**4.9**	**3.0**	**1.2**	**5.5**
Thereof																	
Output reduction in old products	-6.0	-10.8	-8.6	-5.7	-6.4	-4.3	-4.7	-5.0	-7.8	-7.1	-3.2	-5.7	-2.1	-10.0	-5.7	-8.2	0.3
Output increase in new products for environmental product innovators	4.5	5.6	10.3	4.2	4.0	3.1	2.7	3.5	6.8	2.4	7.8	4.5	3.1	7.5	4.2	5.0	3.4
Output increase in new products for non-environ. product innovators	4.8	11.8	5.5	4.3	5.3	3.1	4.6	4.5	3.9	8.7	5.3	5.1	2.0	7.4	4.5	4.5	1.7
Services																	
Employment growth	**9.6**	**6.6**	**10.5**	**2.6**	**9.1**	**19.7**	**6.6**	**13.0**	**11.9**	**27.5**	**7.8**	**12.4**	**11.1**	**19.7**	**24.9**	**21.6**	**14.9**
Decomposed into contribution of																	
General productivity trend in production of old products	**-5.5**	**-9.7**	**-1.7**	**-9.4**	**2.5**	**-6.3**	**-13.9**	**0.0**	**-0.6**	**-8.4**	**-28.9**	**3.7**	**-9.9**	**6.8**	**6.6**	**0.3**	**-30.0**
Environmental process innovations	**0.0**	**-0.1**	**0.0**	**0.0**	**0.1**	**1.1**	**-0.5**	**0.0**	**0.1**	**0.0**	**0.0**	**-0.2**	**-0.2**	**-0.5**	**-1.0**	**-0.4**	**-0.4**
Non-environmental process innovations	**0.0**	**0.0**	**0.0**	**-0.1**	**0.1**	**0.9**	**-0.1**	**-0.1**	**0.0**	**-0.2**	**0.1**	**-0.2**	**0.4**	**-1.7**	**0.4**	**-0.1**	**0.0**
Output growth of old products for non-product innovators	**11.8**	**11.8**	**5.9**	**9.5**	**4.1**	**13.2**	**17.1**	**9.4**	**6.1**	**31.1**	**30.0**	**8.0**	**17.3**	**13.9**	**16.8**	**19.1**	**41.0**
Thereof for																	
Non-innovators	10.4	9.8	4.6	8.3	3.7	13.1	14.9	8.3	4.3	29.1	26.1	6.2	16.2	10.4	15.8	16.8	38.0
Environmental process innovators only	0.6	0.2	0.4	0.7	0.1	-0.2	0.8	0.4	0.9	0.2	1.7	0.8	0.7	0.5	1.1	1.5	0.9
Non-environmental process innovators only	0.8	1.8	0.9	0.5	0.4	0.3	1.3	0.7	0.9	1.8	2.2	1.0	0.4	3.0	-0.1	0.8	2.0
Product innovations	**3.3**	**4.6**	**6.3**	**2.6**	**2.3**	**10.8**	**4.0**	**3.6**	**6.3**	**4.9**	**6.6**	**1.0**	**3.6**	**1.2**	**2.1**	**2.7**	**4.3**
Thereof																	
Output reduction in old products	-3.9	-7.4	-5.5	-3.6	-5.2	0.1	0.0	-2.5	-5.8	-4.0	-2.5	-3.0	-1.2	-6.4	-2.2	-4.9	0.0
Output increase in new products for environmental product innovators	2.7	1.5	4.9	2.1	3.1	3.5	0.1	1.3	6.7	2.0	4.8	1.4	1.3	1.8	1.8	3.6	2.6
Output increase in new products for non-environ. product innovators	4.5	10.4	6.9	4.1	4.4	7.2	3.9	4.8	5.4	6.9	4.3	2.6	3.5	5.8	2.6	3.9	1.7

Source: CIS 2008, Eurostat, own calculation.

9.4 Sector-Level Employment Effects of Environmental Innovation

Table 21 **Employment Effects of Environmental Innovation by Sector, 2006-2008**

	High-tech		Medium-tech		Low-tech		KIS		LKIS	
	(1)		(2)		(3)		(4)		(5)	
Constant	1.504		0.592		2.334		-4.811		1.891	
	(4.137)		(1.886)		(1.564)		(4.736)		(1.338)	
SGR_NEWPD_ENV	0.984	***	1.033	***	0.977	***	0.959	***	0.919	***
	(0.092)		(0.048)		(0.051)		(0.060)		(0.050)	
SGR_NEWPD_NE	1.060	***	0.973	***	0.984	***	0.902	***	1.078	***
	(0.103)		(0.059)		(0.062)		(0.042)		(0.083)	
PCONLY_ENV	4.049		-0.248		-1.584		2.118		-1.587	
	(3.773)		(1.335)		(1.287)		(1.963)		(1.567)	
PCONLY_NE	-6.536		-4.084	**	-3.746	**	-0.6988		0.825	
	(5.047)		(1.930)		(1.781)		(2.024)		(2.092)	
Joint sign. (p-value)										
Industry dummies	0.001	***	0.000	***	0.000	***	0.000	***	0.000	***
Country dummies	0.000	***	0.000	***	0.000	***	0.000	***	0.000	***
Size dummies	0.248		0.690		0.984		0.006	***	0.379	
Ownership dummies	0.109		0.924		0.174		0.024	**	0.750	
R2_adj	0.557		0.451		0.407		0.358		0.331	
Wald-Test: β_{ENV}=1	0.858		0.500		0.651		0.489		0.104	
Wald-Test: β_{NE}=1	0.563		0.642		0.795		0.021	**	0.346	
PCONLY: ENV=NE	0.076	*	0.080	*	0.294		0.295		0.330	
SGR_NEWPD: ENV=NE	0.604		0.480		0.941		0.508		0.154	
Tests on Exogeneity										
SGR_NEWPD/_ENV&_NE	0.014	**	0.000	***	0.014	**	0.000	***	0.000	***
Tests on instr. validity										
Sargan/Hansen J-Test	0.877		0.521		0.393		0.522		0.880	
Diff-in-Sargan test										
C: RANGE	0.913		0.972		0.578		0.376		0.990	
C: R&D	0.538		0.156		0.206		0.507		0.417	
C: CLIENT	0.493		0.471		0.250		0.623		0.798	
C: ENV_REG	0.812		0.642		0.776		0.186		0.952	
C: ENV_AGREE	0.804		0.953		0.792		0.190		0.983	
First stage results 1 (SGR_NEWPD_ENV):										
RANGE	2.153	**	2.859	***	2.425	***	1.999	***	3.078	***
	(1.005)		(0.293)		(0.304)		(0.312)		(0.481)	
R&D	5.002	*	3.146	**	1.000		3.309	***	1.213	
	(2.836)		(1.317)		(1.124)		(1.167)		(1.775)	
CLIENT	0.910		1.291		1.136		1.652	*	2.423	*
	(2.814)		(0.933)		(0.858)		(0.979)		(1.383)	
ENV_REG	17.027	***	14.200	***	12.143	***	17.523	***	16.311	***
	(3.245)		(1.726)		(1.576)		(3.478)		(2.267)	
ENV_AGREE	13.176	***	11.745	***	12.287	***	13.614	***	11.161	***
	(3.405)		(1.765)		(1.682)		(2.238)		(2.170)	
F-stat of excl. instr.	25.53	***	83.65	***	82.80	***	74.03	***	61.99	***
First stage results 2 (SGR_NEWPD_NE)										
RANGE	6.530	***	5.599	***	5.958	***	7.040	***	5.928	***
	(0.811)		(0.476)		(0.451)		(0.467)		(0.646)	
R&D	3.939	*	0.516		0.425		7.639	***	1.377	
	(2.373)		(1.797)		(1.169)		(1.403)		(1.773)	
CLIENT	1.982		3.671	***	1.703		7.328	***	4.284	***
	(2.349)		(1.226)		(1.155)		(1.308)		(1.467)	
ENV_REG	-9.386	***	-8.656	***	-5.341	***	-11.341	***	-7.301	***
	(2.347)		(1.203)		(0.985)		(2.200)		(1.163)	
ENV_AGREE	-11.271	***	-6.332	***	-4.908	***	-9.814	***	-7.531	***
	(2.041)		(1.056)		(1.033)		(2.534)		(1.148)	
F-stat of excl. instr.	21.75	***	50.86	***	92.52	***	165.36	***	45.59	***

Table 21 **Employment Effects of Environmental Innovation by Sector, 2006-2008 (cont.)**

	High-tech		Medium-tech		Low-tech		KIS		LKIS	
	(1)		(2)		(3)		(4)		(5)	
Tests on underident.										
Kleibergen-Paap LM test	46.53	***	178.50	***	172.40	***	174.71	***	128.77	***
Test on weak inst.										
Cragg-Donald F test	51.29	***	375.42	***	302.03	***	240.57	***	344.39	***
Kleibergen-Paap F test	22.37	***	44.20	***	39.26	***	38.08	***	27.27	***
Weak instr. rob. inf.										
Anderson-R. Wald test	187.86	***	650.94	***	641.92	***	22.68	***	511.10	***
Stock-Wright LM test	132.61	***	460.71	***	488.44	***	17.73	***	327.97	***
Number of obs	1579		17870		16030		12527		17019	

Notes: See Table 15.

Source: CIS 2008, Eurostat, own calculation.

Table 22 **Employment Growth Decomposition by Sector, 2006-2008**

	High-tech	Medium-tech	Low-tech	KIS	LKIS
Manufacturing					
Employment growth	**6.5**	**5.6**	**3.2**	**11.1**	**8.8**
Decomposed into contribution of					
General productivity trend in production of old products	**-15.2**	**-7.2**	**-4.4**	**-6.4**	**-5.0**
Environmental process innovations	**0.2**	**0.0**	**-0.1**	**0.1**	**-0.1**
Non-environmental process innovations	**-0.2**	**-0.2**	**-0.2**	**0.0**	**0.0**
Output growth of old products for non-product innovators	**9.4**	**8.7**	**6.0**	**12.1**	**11.6**
Thereof for					
Non-innovators	8.0	7.0	5.0	11.0	10.0
Environmental process innovators only	0.7	0.9	0.5	0.3	0.8
Non-environmental process innovators only	0.7	0.8	0.6	0.8	0.8
Product innovations	**12.4**	**4.2**	**1.9**	**5.4**	**2.2**
Thereof					
Output reduction in old products	-8.4	-6.4	-5.3	-4.8	-3.4
Output increase in new products for environmental product innovators	9.7	5.5	3.0	3.2	2.5
Output increase in new products for non-environmental product innovators	11.1	5.1	4.1	7.0	3.1

Source: CIS 2008, Eurostat, own calculation.

9.5 Definition of Sectors

Table 23 **Definition of Sectors**

Sector	Industry NACE rev. 2
High-tech	Pharmaceuticals (21), Computer, electronic and optical products (26), Air and spacecraft and related machinery (30.3)
Medium-tech	Chemicals and chemical products (20); Electrical equipment (27); Machinery and equipment n.e.c. (28); Motor vehicles, trailers and semi-trailers (29); Other transport equipment (30) excluding (30.3); Medical and dental instruments and supplies (32.5); Reproduction of recorded media (18.2); Coke and refined petroleum products (19); Rubber and plastic products (22); Other non-metallic mineral products (23); Basic metals (24); Fabricated metal products (25); Repair and installation of machinery and equipment (33).
Low-tech	Food products (10); Beverages (11); Tobacco (12); Textiles (13); Wearing apparel (14); Leather (15); Wood and of products of wood (16); Paper and paper products (17); Printing and reproduction of recorded media (18) excluding (18.2); Furniture (31); Other manufacturing (32) excluding (32.5).
KIS	Water transport (50); Air transport (51); Publishing activities (58); Motion picture, video and television program production, sound recording and music publishing activities (59); Programming and broadcasting activities (60); Telecommunications (61); Computer programming, consultancy and related activities (62); Information service activities (63); Financial and insurance activities (64-66); Legal and accounting activities (69); Activities of head offices, management consultancy activities (70); Architectural and engineering activities, technical testing and analysis (71); Scientific research and development (72); Advertising and market research (73); Other professional, scientific and technical activities (74); Employment activities (78); Security and investigation activities (80).
LKIS	Wholesale (46) ; Land transport and transport via pipelines (49); Warehousing and support activities for transportation (52); Postal and courier activities (53); Travel agency, tour operator reservation service and related activities (79); Services to buildings and landscape activities (81); Office administrative, office support and other business support activities (82).

Source: Eurostat, own calculation.

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Project Information

Welfare, Wealth and Work for Europe

A European research consortium is working on the analytical foundations for a socio-ecological transition

Abstract

Europe needs change. The financial crisis has exposed long-neglected deficiencies in the present growth path, most visibly in the areas of unemployment and public debt. At the same time, Europe has to cope with new challenges, ranging from globalisation and demographic shifts to new technologies and ecological challenges. Under the title of Welfare, Wealth and Work for Europe – WWWforEurope – a European research consortium is laying the analytical foundation for a new development strategy that will enable a socio-ecological transition to higher levels of employment, social inclusion, gender equity and environmental sustainability. The four-year research project within the 7th Framework Programme funded by the European Commission was launched in April 2012. The consortium brings together researchers from 33 scientific institutions in 12 European countries and is coordinated by the Austrian Institute of Economic Research (WIFO). The project coordinator is Karl Aiginger, director of WIFO.

For details on WWWforEurope see: www.foreurope.eu

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