

## **Innovation in rural areas and impact on job creation: evidence from EU and Portugal**

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### **Abstract**

The main purpose of this paper is to shed light over the effects of innovation on employment in particular for the case of the EU and Portuguese rural areas. There is a growing interest in literature about the effects of innovation on employment. Some evidence is already available, yet there is still a considerable way to go in this matter. This is particularly true for the case of rural areas, with poor evidence regarding innovation taking place and practically none about the effects of innovation on employment. This paper builds on statistical and case study data. Its conclusions suggest a positive impact of innovation on the rural job qualification and that a rural location might favour job creation by the innovative firms comparatively to an urban location.

**Keywords:** Innovation, Rural areas, Employment, Community Innovation Survey.

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## 1. Introduction

Innovation is widely considered to be a primary source of economic growth and job creation. However, the relation between innovation and employment is not linear, it depends on a number of interrelated factors such as the activity sector, type of innovation, economical and Institutional environment, the motivation and strategy of innovation, furthermore it varies according to the level and time perspective of the analysis. Therefore, if in aggregate terms and in the long-term a positive impact of innovation on employment is observed, the analysis at firm level is not so conclusive and the effect can be negative.

To know more about the relationship between innovation and employment is particularly relevant in the current times, because the strategies for economic growth rely strongly on innovation (e.g. the Lisbon Strategy). In the recent years, several authors have studied the effects of innovation employment using different models and scales of analysis (e.g. Edquist 1997, Vivarelli and Pianta 2000, Antonucci and Pianta 2002, Gonzáles and Álvarez 2005, Harrison et al. 2005, Tether et al. 2005, Lachenmaier and Rottmann 2006). Some conclusive evidence has been gathered regarding a positive effect of product innovation on employment, in particular for the industry. The evidence for process innovation is not conclusive so far and the effects of other types of innovation (e.g. organisational) are still quite unknown. In addition, a number of economic activities, namely agriculture, forestry and fisheries have been excluded from the analysis conducted so far.

The promotion of innovation within the rural areas is nowadays a concern of EU decision-makers, whom envisaged it as tool to aid the rural areas to keep in pace with urban counterparts in respect to the goals of the Lisbon Strategy and the European Employment Strategy. However, little evidence is available on innovation taking place in the EU rural areas and even less on the effects of innovation on employment in these areas.

This paper intends to shed some light about the effects of innovation on employment in the EU and Portuguese rural areas build on data from different sources, namely from the



RAPIDO<sup>1</sup> project. Within this project a number of case studies of innovative initiatives in EU rural areas were analysed with the aim of characterising innovation taking place in rural areas, namely regarding variables such as the type of innovation, sector and type of promoter, and effects on employment. The paper resorted also to the statistical data available from the European innovation survey (CIS III and CIS IV) for the Portuguese case.

Given the available data two main objectives were pursued by analysis developed along the paper: (1) to get insights on the features of innovation in the EU rural areas and its effects on employment, using case study based analysis; (2) to compare, using statistical data, the impact of innovation on job creation according to the firms location (urban vs. rural) for Portugal case.

The paper is organised as follows. The next section presents a literature review on the effects of innovation on employment. Section 3 explains the situation of rural employment both in EU and Portuguese rural areas. Next, Section 4 presents and discusses empirical evidence on the effects of innovation on employment in the EU and Portuguese rural areas. Finally, section 5 provides concluding remarks.

## **2. Innovation and employment: literature review**

Innovation is widely considered to be a primary source of economic growth (Howells 2005, Harmaakorpi and Tura 2006, OCDE 2007). A positive impact of innovation on employment is expected by policymakers, an example being the Lisbon Strategy (CEC 2005). The consequences of innovation on employment are of particular interest, yet empirical evidence available is not consensual regarding the direction of this relationship, if positive, negative or neutral (Vivarelli and Pianta 2000, Harrison et al. 2005). The problem is that the relation between innovation and employment is not linear, depending on a number of interrelated factors such as the activity sector, type of innovation, economical and Institutional environment, the motivation and strategy of innovation, and varies according to the level and time perspective of the analysis (Peters 2004).

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<sup>1</sup> RAPIDO – Rural Areas, People and Innovative Development. SSPE-CT-2006-44264. Detailed information can be found in [www.rapido-fp6.eu](http://www.rapido-fp6.eu).



Next, a literature review on the effects of innovation on employment is presented, accounting for three variables in particular: the type of innovation the activity sector and firm's dimension. The types of innovation analysed by the literature in respect to effects of innovation on employment are product and process innovation. The sectors that are object of analysis are the industry and the services. In addition, the firm dimension is also included in this review considering the importance of small firms in rural areas.

The theoretical contributions analysing the effect of innovation on employment at the firm-level stress the importance of disentangling product and process innovation (Edquist 1997, Antonucci and Pianta 2002, Gonzáles and Álvarez 2005, Tether et al. 2005, Lachenmaier and Rottmann 2006).

At a first glance one might think that product innovation induces job creation and process innovation releases employees. Product innovation leads to new products which stimulate demand, leading the firm to need more employees to answer demand increase. Process innovations, on the contrary, are often developed and implemented to increase productivity, namely of labour, thus leading to job displacing.

However, as aforementioned, the relation between innovation and employment is not linear and the interaction between different variables must be accounted for. For instance, considering product innovations, if these are introduced only to replace old products (degree of innovation), it is likely that no effect or eventually a negative effect on employment can be observed (EU 2001, Pianta 2005). Mastrostefano and Pianta (2005) highlight that a positive impact of product innovation can only be observed if there is demand for it (market demand).

Improvement and increased data availability, namely from more recent CIS (Community Innovation Survey) datasets, have allowed several authors (e.g. Jaumaudreus 2003, Petters 2004, Harrison et al. 2005) to develop models that disentangle the impacts of product and process innovation, providing more accurate evidence regarding the impacts of innovation on employment at firm-level.

Harrison et al. (2005), using CIS data, analyzed a set of EU countries: France, Germany, Spain and UK, and find evidence that point to strong positive effects of product innovation on employment, which is in line with previous empirical evidence presented



by other authors (Freeman et al. 1982, Vivareli et al. 1996, Vivarelli e Pianta 2000, Edquist et al. 2001, Evangelista and Savona 2003, Jaumandreu 2003, Alvarez and Gonzáles 2004, Petters 2004, Mastrostefano and Pianta 2005).

As for process innovation, the empirical evidence is of non-robust effects of these innovations on employment. The problem is that the effect of process innovations on employment is even more complex to establish than the product innovation. While some studies point to jobs destruction (Vivareli et al. 1996, Rouschinski 1998, Caselli 1999, Alvarez and Gonzáles 2004); others authors find no effect of process innovation on employment (Entorf e Pohlmeier 1990, Machin and Van Reenen, 1997, Evangelista and Savona 2003, Lachenmaier and Rottmann 2006); yet some authors observe positive effect of process innovation on employment (Greenan and Guellec 2000, Smolny 2000, Lachenmaier and Rottmann 2006).

The activity sector of the firm is another variable that has been object of considerable attention by the researchers studying the effects of innovation on employment. In the case of industry the effects of innovation on employment tend to follow the impacts of innovation type: positive impacts of product innovation and ambivalent direction for process innovation (Pianta 2000, Antonucci and Pianta 2002, Peters 2003).

Empirical evidence for the impacts of innovation on employment in services is still poorly established due to limited data available. Yet, authors like Harrison et al. (2005) and Klomp and Leeuwen (2000) highlight the importance of innovation on job creation in the services. According to these authors the growing rates of employment on innovative firms are higher than the ones observed in the industry.

Findings relating innovation with firm size, for UK firms, suggest that the value of innovation tends to increase with the firm size and that larger firms are the major source of innovation related to R&D (Tehter et al. 1997, Tehter 2000). Nonetheless, Tehter (2000) shows that innovative small firms are more likely to create employment than similar non-innovative firms, although absolute number of jobs created being modest. North and Smallbone (2000), from analysis on innovation in UK small firms, found most innovative firms to present fast growth and best employment creation during the 1990s comparatively to non-innovative similar firms.



The positive impact of innovation on employment observed in small firms seems to be independent of the type of economic activity. In the services the smaller firms are the ones with better performance on employment when compared with medium and large firms (Blechinger et al. 1997, Evangelista and Savona 2003). Evangelista and Savona (2003) reported heavy job losses among low skilled workers in the largest firms of the services. For the industry the analysis for small firms evidences also positive impacts of innovation on employment, its relative dimension being similar to large firms and larger than medium firms (Blechinger *et al.*, 1997).

Summing up, the literature review states a positive effect of product innovation on employment, both in industry and services, but shows no convergence regarding the impact of process innovation. The latter impact seems to vary according to the country, depending on the differences in respective economic and institutional frameworks (Vivarelli et al. 1996, Pianta 2000, Antonucci and Pianta 2002, Peters 2004). Regarding the influence of firm's dimension on innovation and job creation, the literature shows that larger firms are the ones with higher innovation rates (Tehter et al. 1997, Tehter 2000) although better results regarding the impact of innovation on job creation are observed in small firms (North and Smallbone 2000, Tehter 2000).

Major limitations of available evidence are due to the lack of data on other types of innovation, such as organisational and marketing, and on other sectors, such as agriculture, forestry and fisheries, along with insufficient disaggregating of economic activities include on the services. Therefore, the literature review gives an overall picture on the relationship between innovation and employment, but give poor evidence regarding the innovation in rural areas, where: (a) primary sector is still important, whereas its importance varies across UE regions; (b) firms are small and encompass multiple activities; (c) innovation involves different types of innovators; and (d) innovators networking shows determinant for innovation success (RAPIDO 2008b and 2009).

### **3. Employment in EU rural areas**

This section presents, firstly, the general situation of EU rural employment, and next the Portuguese context in particular.



### **3.1 The gap between rural and urban areas**

Europe's rural areas are diverse in terms of population, demography, economic and social structures and labour markets. However, they face common problems, such as ageing society, unemployment and unbalanced labour markets. Although rural areas encompass 93% of the territory of the European Union (EU), its income per capita is little more than half of that observed in urban areas (CEC, 2006), what makes difficult to attract and retain skilled individuals in these areas. The unfavourable evolution of employment in EU rural areas confirms that, along the last decade, there is a growing gap between rural and urban employment situation, with the decline of employment rates and decrease of the productivity growth and skills of work in rural areas. In 2004 the employment rates in EU-27 were almost 5% higher in predominantly urban areas (64.7%) when compared to the predominantly rural areas (60.1%) (SERA, 2006).

The decision makers of EU are aware of the unfavourable situation of rural areas regarding the employment, as shown by a number of studies conducted to get a better understanding on this problem (e.g. SERA 2006, SCENAR-2010 2007). Their main concern is to increase effectiveness of public policies to enhance job creation in rural areas, allowing them to keep in pace with the goals of the European Employment Strategy (EES). The EES was launched in 2000, in the context of the Lisbon Strategy, and one of its major medium-term targets is to attain an employment rate of 70% in EU by 2010.

The actual EU situation on rural employment is quite diverse according to the country and types of rural areas. For instances, the primary sector importance for employment varies appreciably within the EU-27, from less than 5% to 25% of total employment. Services are already the most important sector, although their relative importance is still lower than in the urban areas. The industry weight on rural employment is also very dissimilar, and shows also a declining trend although not as accentuated as in agricultural work (European Communities 2006). Although the referred diversity among these areas, some of them, and in particular those which are most remote, depopulated or dependent on agriculture, will face particular challenges as regards growth, jobs and sustainability in the coming years.



The studies on the rural employment identify as promising activities for job creation in EU rural areas the following: (a) organic and quality products; (b) agro-tourism; (c) bioenergy; (d) environment-related activities; (e) culture; (f) social and health services; (g) ICT services (SERA, 2006 and SCENAR-2020, 2007). This list includes both the classical sectors, such as agriculture, forestry and tourism; and “new” sectors related to the societal demands for environment, nature and culture and to technological innovation, such as the ICT and renewable energy sectors (RAPIDO, 2008).

### 3.2 Rural employment in Portugal

Portugal follows the general trends of European rural areas. In 2001, as shown in Table 1, 92.1% of Portugal territorial area (only continental) could be framed in the OCDE definition of rural areas<sup>2</sup>. However, these areas encompass only 48.9% of the Portuguese active population<sup>3</sup>.

**Table 1.** Distribution of territorial area, active population and employment rate, in 2001, according to OECD definition of rural areas

	% of Portuguese Territory	% of Portuguese active population	Employment rate
Predominately Rural	72.1	20.1	44.2%
Significantly Rural	20.0	27.7	52.5%
Predominately Urban	7.9	52.2	58.1%

Source: INE, 2007a

While urban areas represent less than 10% of the Portuguese territory, they concentrate more than half of its active population. Data from 2001 confirm the gap on employed population between rural and urban areas for the Portuguese case. They show this gap to

<sup>2</sup> European Commission has adopted the OECD definition of rural areas in the context of Council Decision of 20 February 2006 on Community strategic guidelines for rural development (programming period 2007 to 2013) (2006/144/EC). The OECD defines areas as predominantly rural, significantly rural or predominantly urban according to population density and is based on the share of population living in rural communes. Local communities are classified as rural or urban, according to their population density (< > 150 inhabitants per sq km). Regions are then classified according to the proportion of population living in rural or urban communes: **Predominately Urbanised (PU)** if less than 15% of the population lives in rural communes; **Significantly Rural (SR)** if 15 or more and less than 49% of the population lives in rural communes; **Predominately Rural (PR)** if more than 50% of the population lives in rural communes.

<sup>3</sup> INE includes in the active population the individuals with more than 15 potentially involved in economic activity.





be very significant and that SR areas are still considerably below the PU urban areas in respect to employment rates.

SR seems to be the areas performing better regarding employment, what might be explained by its better accessibility and infrastructure comparatively to PR areas, and the expansion/displacement of economic activities from PU to SR areas.

Table 2, presents the Portuguese population employment rates in 2001 and 2006 aggregate by NUT II. It shows an increase in the employment rates in Portugal, whereas the values are still far from the target of the EES (70% in 2010). The gap between PR and other areas seems to persist during this period. The Alentejo, which is the only NUT II totally classified as PR area exhibits the lowest employment rate comparatively to the regions including SR and PU areas.

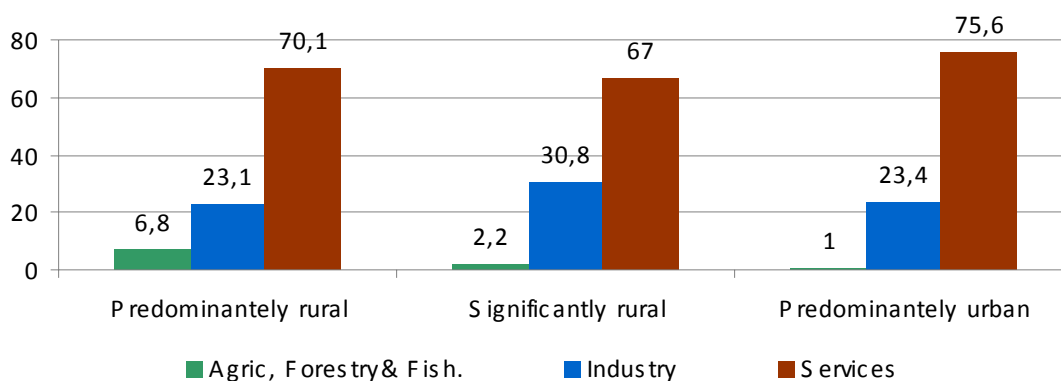
**Table 2. Employment rate by NUT II in 2001 and 2006**

Regions (NUT II)	2001	2006
Norte	54.4	57.6
Centre	50.4	63.0
Lisboa	56.7	55.1
Alentejo	48.2	52.2
Algarve	53.4	56.5
Portugal (continent)	53.5	57.7

Source: INE 2007a and 2007b

These data suggest a narrowing in the employment gap between rural and urban areas in the later years, whereas disaggregate data (by NUT III) are needed for a conclusive statement. The relatively good performance in terms of employment rate of Alentejo, which includes coastal areas, was not probably followed by PR of inland areas of North and Centre regions.

Figure 1 shows the distribution of the employed population in 2006 according to economic activity, evidencing a relatively small weight of agriculture, forestry and fisheries for the overall employment and the concentration of this sector in the PR areas. The services are at large the most important sector for employment, in spite of its weight being smaller in the SR where the industry shows more relevance in terms of employment.



**Figure 1.** Number of employed persons according activity economic and type of rural area in Portugal for the year 2006

Source: MTSS (Ministério do Trabalho e da Segurança Social), 2008

This figures evidence the strong decline in the employment on the agriculture, forestry and fisheries sector within the later years, as shown by Table 3.

**Table 3.** Distribution of the active population by activity sector for 2001 and 2006, by NUT II (%)

Regions (NUT II)	Primary01	Primary06	Industry01	Industry06	Services01	Services06
Norte	11,0	4,4	36,2	42,7	43,9	65,2
Centro	21,2	6,4	28,5	35,9	44,9	75,4
Lisboa	1,1	1,1	20,1	22,2	70,4	97,3
Alentejo	10,5	11,0	22,7	25,6	56,3	82,7
Algarve	6,5	5,7	19,3	21,1	69,1	90,0
Continente	10,8	4,4	28,3	33,1	53,0	79,1

Source: INE 2007a and 2007b

Table 3 show a significant decline of employment in the agriculture sector in the North and Centre regions what is result of an expressive urbanisation of these areas.

#### 4. Innovation and employment in EU rural areas

Although the study on innovation and its impacts, namely on employment has grew significantly within the later years, little research has been focused on the innovation in rural areas and its impacts on employment and rural development.



Rural areas were somewhat deleted with regard to innovation being implicitly define as “an urban affair” according to Farrel and Lukesch (1998). In spite of the acknowledgement of the principal specificities of the EU rural areas, like its territorial dimension and its impact on rural enterprises, these aspects are not fitted to the current approach to innovation.

Positive effects on employment are often linked to innovative initiatives reported in EU rural areas. However, there are no estimates for the actual impact of innovation on rural employment. In fact, current statistical data for innovation collected by the CIS (Community Innovation Survey) ignore important activities in the rural areas, like agriculture and agri-tourism.

However, despite the scarce evidence addressing innovation and employment effects in EU rural areas, the findings presented by North and Smallbone (2000), pointed to no relevant differences for SMEs located in remote areas as opposed to accessible rural areas in the UK, during the 1990s. Surprisingly, in relation to new market developments, a remote location appears to have stimulated innovation (North and Smallbone 2000). This finding shows that the need to overcome local constraints can induce firms to become more innovative than they would be otherwise. In particular, North and Smallbone (2000) findings suggest that remote locations can be beneficial for innovation in sectors such as food and tourism, which take advantage of local resources and skills.

The RAPIDO project was one of the first attempts to shed light on the effects of innovation on employment in the EU rural areas. Next, the evidence gathered by this project is presented with the aim to give a first overview on the issue and to discuss how to improve current innovation framework to allow a better understanding on the innovation in rural areas and its impacts, namely on the employment.

#### **4.1 Findings of RAPIDO project**

This section presents some evidence on the relationship between innovation and employment in the EU rural areas build on the results of the project RAPIDO. The main objective of this project was to analyse current best practices concerning the development of innovation in agriculture, forestry, the food sector and the wider rural areas as well as to analyse methods to transfer knowledge to different target groups. A



specific objective of the project was to identify the sectors where innovation enhances the creation of employment in rural areas.

The RAPIDO project built on case study analysis of a best practice innovation database (67 case studies<sup>4</sup>) complemented by a survey to innovation-takers (102 observations) and in-depth analysis of around 20 case studies (RAPIDO 2007, 2008a and 2008b).

The evidence obtained by the RAPIDO project shows that innovation occurs in both the classical sectors such agriculture, food industry and tourism, and in the so called “new sectors” which include environment related activities and R&D and ICT sectors (RAPIDO, 2008b).

Another relevant result is the overwhelming presence of multiple-activity innovative rural organisations. There are a significant number of organisations that integrate within their value chain activities of the three major economic sectors (agriculture, industry and services) (RAPIDO, 2008b).

Regarding innovation nature (see Table 3), product innovation comes out as the most important source of innovation for the majority of sectors often related with other types of innovations like marketing/supply chain innovations in the case classical sectors, such as agriculture, food industry and tourism. The activities classified as service-related show, as expected, a higher importance of organisational innovation, namely networking innovation. Environment-related activities and other services/advanced technology related activities seem to rely on every type of innovation, product (new services), process, marketing and organisational innovation.

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<sup>4</sup> These 67 case studies are distributed across 17 of the 25 Members States of EU.



**Table 3.** Type of innovation by activity sector according to the innovation-takers surveyed

Type of innovation	Agriculture, Renewable energy	Food industry	Tourism	Environment- related activities	Social services	ICT and Education & Training	R&D and Techno. activities
	%	%	%	%	%	%	%
Introduction of new good/new product	47.1	63.6	47.1	35.6	43.6	40.5	40.6
Improved quality of good	68.6	72.7	47.1	42.2	35.9	40.5	40.6
Introduction of new method of production	60.8	50.0	35.3	51.1	53.8	32.4	43.8
Opening new market	35.3	40.9	47.1	33.3	41.0	32.4	21.9
Acquiring of new source of raw material	15.7	18.2	17.6	17.8	7.7	13.5	18.8
Altering existing industry structure	29.4	31.8	29.4	22.2	30.8	24.3	15.6
Altering existing social/institutional structure	17.6	18.2	41.2	35.6	51.3	48.6	31.3

Source: RAPIDO 2008b

The effect of innovation on employment appears to be positive, especially in terms of labour force qualification.

Positive effects of innovation on employment are observed both in the classical and new rural sectors, whereas the food industry, R&D and advanced technology and environment-related activities appear as the sectors performing better in terms of job creation. Tourism appears to present a reasonable ability to secure existing jobs (see Table 4).



**Table 4.** Innovation effects on employment measured by the answers of innovation-takers (sectors where they report job creation and maintenance)

Innovation effect	Agriculture, Renewable energy		Forestry		Food industry		Tourism	
	yes	no	yes	no	yes	no	yes	no
Jobs secured	<b>49.0</b>	9.8	<b>45.5</b>	9.1	<b>72.7</b>	9.1	<b>58.8</b>	0.0
Jobs created	<b>52.9</b>	9.8	<b>54.5</b>	0.0	<b>72.7</b>	4.5	<b>47.1</b>	5.9
Innovation effect	Environment-related activities		Social services		ICT and Education & Training		R&D and Techno. activities	
	yes	no	yes	no	yes	no	yes	no
Jobs secured	<b>66.7</b>	12.8	<b>51.1</b>	11.1	<b>56.3</b>	15.6	<b>64.9</b>	18.9
Jobs created	<b>64.1</b>	15.4	<b>51.1</b>	4.4	<b>50.0</b>	9.4	<b>64.9</b>	18.9

Source: RAPIDO 2008b

A survey addressing the employment effects of innovation was undertaken to 10 of the 21 case studies that were object of in-depth analysis by the RAPIDO team.

The results of this in-depth survey show positive effect of innovation on employment, especially through the creation of skilled jobs (see Table 5).

**Table 5.** Jobs created by employee occupation

Jobs created by employee occupation	No
High skilled non manual	5
Skilled non manual	18
Low skilled manual	0
Elementary occupations	1
Total	24

Source: RAPIDO 2008b

Regarding the dimension of the organisations, the survey (see Table 6) appears to confirm the findings of the literature that small firms tend to present a good performance respecting job creation when innovation is introduced.



**Table 6.** Jobs created according to the organisation's size

Size of organisation	No organisations	No jobs created
Micro (up to 9 workers)	5	9
Small (10 to 49 workers)	2	14
Medium (50 to 249 workers)	2	1
Total	10	24

Source: RAPIDO, 2008b

Therefore, these results suggest that jobs created by innovation are mostly qualified. This highlights that innovation might prove an effective tool to attain the EES goals and in particular to implement Lisbon strategy in the EU rural areas.

#### **4.2 Impact of urban vs. rural location**

This section presents the results of modelling the impacts of location and innovation on the employment using data from the Community Innovation Survey databases (CIS III and CIS IV) for Portuguese case. These data were used, in spite of its limitations to capture innovation in rural areas<sup>5</sup>, in order to understand if location is a determinant factor for employment, especially for the innovative firms.

The database used build over the total data from the Portuguese CIS III (1998-2000) and IV (2002-2004), considering only the firms that answered the two surveys<sup>6</sup>. In the database used rural areas correspond to the PR and the SR areas, while the urban areas include only PU areas. Table 7 gives a general overview of profile of the 508 firms comprised by the database.

<sup>5</sup> The Community Innovation Survey (CIS) is the main database on innovation in the EU, because it is uses a common survey in all EU Member States based on the methodology developed by the Oslo Manual (OECD 1997 and 2005), it is applied to large samples of innovative and non-innovative firms and its administration is continued along the time. However, this survey presents important shortcomings, in particular to the study of innovation in rural areas. These shortcomings are mainly related to a narrow definition of innovation, based on a technological perspective, and to the unit of analysis, the firm, thus excluding other types of organisations. Other limitations refer to the economic activity specifications: (a) it considers only the main activity of the firm, thus neglecting multi-activity strategies; (b) includes only firms from the industry and services sectors, this latest very incomplete regarding several activities, excluding the agriculture, forestry and fishery sector.

<sup>6</sup> These data were provided by the GPEARI (Office of Planning, strategy, evaluation and international relations), the official entity responsible for managing Portuguese CIS database. The database is collected by the INE (National Institute of Statistics).



**Table 7.** Main characteristics of firms included on the database

	<b>Rural</b>	<b>Urban</b>	<b>CIS III</b>	<b>Rural</b>	<b>Urban</b>	<b>CIS IV</b>
	<b>(%)</b>	<b>(%)</b>	<b>(total)</b>	<b>(%)</b>	<b>(%)</b>	<b>(total)</b>
			<b>(nº)</b>			<b>(nº)</b>
Micro	0	0	0	0	100	3
Small	37.3	63.4	154	37.8	62.2	156
Medium	36.6	63.3	161	30.0	70.0	140
Large	31.8	68.2	192	36.8	63.2	209
Innovative firms: yes	33.5	66.5	397	33.8	66.2	373
Product Innovation	31.5	68.5	216	32.2	67.8	199
Process Innovation	33.5	66.5	254	35.7	64.3	224
Others	29.8	70.2	282	32.4	67.6	346
All types	28.4	71.6	141	32.3	67.7	127
Innovation Strategy: Market Innovations	30.6	69.4	160	29.2	70.8	130
Job creation: yes	39.9	32.9	179	39.9	35.2	179

As table 7 shows that most of the surveyed firms are located in urban areas (65%) and present as main activities those related to industry (71.8%). The services represent only 28.2% of the total firms, which are mainly locate in urban areas.

The sample an increase in the proportion of large firms in the period 2002-2004 comparatively to the previous one (19998-2000), what indicates the growth of some of the firms included in the sample. Yet, the number of SME in the sample is larger than the number of large firms, while the proportion is quite distant of Portuguese reality where more than 90% of the firms are SME.

Innovative firms are present both in urban and rural locations representing more than 70% of total surveyed firms, with the process innovation and other innovations being the most expressive types of innovation.

Regarding the employment, only 179 firms (around 35% of total firms) present job creation between 1998 and 2004. Yet, as shown by Table 8, innovative firms appear to perform better in this respect, especially in rural locations.





**Table 8.** Variation in employment between 1998 and 2004 according to firm's location and innovative behaviour

Employment variation		Total	Rural Areas	Urban Areas
<b>Total</b>	Obs.	508	178	330
	Mean	-2	3	-5
	St. Dev.	38	41	36
<b>Innovative firms</b>	Obs.	373	126	247
	Mean	0	7	-5
	St. Dev.	39	45	34
<b>Non innovative firms</b>	Obs.	135	52	83
	Mean	-5	-6	-5
	St. Dev.	36	28	41

To identify the determinants of job creation a regression equation was estimated, where the employment variation between 1998 and 2004 is the dependent variable and a diversified set of explanatory variables were included, such as the type of innovation, sector of activity, and firm's location and dimension. These variables are described in Table 9.



**Table 9.** Description of the variables

Variable	Variable description	Mean	St deviation
vemp	Variation in the number of employed persons between 1998 and 2004 (%)	-2	38
loc	Firm's location (0 = rural; 1 =urban)	0.65	0.478
CAEE	Firms with industry as main activity (0 = no; 1 = yes)	0.27	0.457
CAES	Firms with services as main activity (0 = no; 1 = yes)	0.40	0.525
dmed	Medium dimension firms (0 = no; 1 = yes)	0.69	0.463
dgrand	Large dimension firm (0 = no; 1 = yes)	0.28	0.454
turnracio	Racio of the average turnover in period 2 (2002-2004) by the average turnover in period 2 (2002-2004)*	1.16	0.828
inov2	Firms that introduced some kind of innovation in 2002-2004 (CIS IV) (0= no; 1= yes)	0.73	0.442
Invt2	Firms that had introduced product innovation in 2002-2004 (CIS IV) (0= no; 1= yes)	0.43	0.495
invpc2	Firms that had introduced process innovation in 2002-2004 (CIS IV) (0= no; 1 = yes)	0.44	0.497
outinov2	Firms that had introduced other innovations in 2002-2004 (CIS IV) (0 =no; 1= yes)	0.68	0.467
inovtotal2	Firms that had introduced all types of innovation in 2002-2004 (CIS IV) (0 = no; 1 = yes)	0.28	0.448
inovnova2	Firms that had introduced innovations in the market (radical innovation) in 2002-2004 (CIS IV) (0 = no; 1 = yes)	0.27	0.446

\* The turnover value was corrected for inflation using the GDP deflator (source: Banco de Portugal, [www.bportugal.pt](http://www.bportugal.pt))

The estimates for the OLS model corrected for heteroskedasticity are present in Tables 10 and 11, showing respectively, the results considering the whole set of variables listed in Table 9 and next only for the significant determinants set.



**Table 10.** WLS model – total firms

Dependant variable: vemp

Variable	Coef.	t-ratio	Variable	Coef.	t-ratio
const	-52.8809	-8.8779 ***	invpt2	5.6534	1.0235
loc	-6.14418	-2.1445 **	invpc2	10.86	2.5443 **
CAEE	17.5856	4.1657 ***	outinov2	-2.31173	-0.4531
CAES	26.1628	5.8286 ***	inovtotal2	-8.80395	-1.3686
dmed	1.43083	0.4489	inovnova2	-8.1229	-1.9793 **
dgrand	3.66847	1.2815			
TurnRACIO	30.2045	10.1503 ***			
inov2	-2.59262	-0.4234			
No Obs.	508				
R-Square	0.263412				
Adj. R-Square	0.214135				
F(6, 501)	29.86051				

- Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

**Table 11.** WLS model – total firms (only sig. variables)

Dependant variable: vemp

	Coef.	t-ratio
const	-50.8067	-11.3141 ***
loc	-7.42941	-2.7040 ***
CAEE	17.5574	7.1051 ***
CAES	22.8029	9.6954 ***
TurnRACIO	30.3618	9.9041 ***
invpc2	5.9653	2.1895 **
inovnova2	-6.73755	-2.2801 **
No Obs.	508	
R-Square	0.263412	
Adj.R-Square	0.254590	
F (6, 501)	29.86051	

The variables showing to influence the employment variation are the firm's location, the variation in its turnover, undertaking process innovation and radical innovation. An



urban location appears to influence negatively the variation in the employment. Radical innovation (introduction of novelty into the market) presents an impact in the same direction. Both, industry and services influence positively the employment variation. Regarding innovation types, only process innovation shows significant and impacts positively the employment variation.

Table 12 presents estimates for the model considering only the innovative firms.

**Table 12.**WLS model – innovative firms

Dependant variable: vemp

Variable	Coef.	t-ratio	Variable	Coef.	t-ratio
const	-45.903	-4.4565 ***	invpt2	8.37573	1.4469
loc	-10.3264	-2.8297 ***	invpc2	12.0841	2.6803 ***
CAEE	13.0869	1.6233	outinov2	0.253618	0.0451
CAES	19.4982	2.3049 **	inovtotal2	-11.5766	-1.7191 *
dmed	0.47468	0.1163	inovnova2	-8.39364	-1.9829 **
dgrand	3.42213	0.9070			
TurnRACIO	25.2761	7.6529 ***			
No Obs.			373		
R-Square			0.208176		
Adj. R-Square			0.184049		
F(6, 501)			8.628152		

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

When the model is estimated only with the innovative firms the variables, location, variation in turnover, undertaking process innovation and radical innovation, show a significant and similar influence on the variation of employment as observed for the whole sample. However, in this case only services keep a significant determinant, whereas industry shows no significant. The undertaking of all types of innovation simultaneously enter now in the equation as a significant explanatory variable, impacting negatively the variation on the employment.

Given the interest of the firm's location to this analysis a simplest equation was estimate to check if being an innovative firm shows to impact positively the employment



variation when firm locates in a rural area<sup>7</sup>. Tables 13 and 14 shows that the innovative firms located in rural areas appear to present a positive effect on the employment variation.

**Table 13.** WLS model – total firms

Dependant variable: vemp

	Coef.	t-ratio
const	-42.8729	-11.6747 ***
TurnRACIO	36.0637	10.9396 ***
inov2	1.79108	0.6386
No Obs.		508
R-Square		0.194797
Adj R-Square		0.191608
F(6, 501)		61.08545

**Table 14.** WLS model – rural firms

Dependant variable: vemp

	Coef.	t-ratio
const	-53.2095	-7.4597 ***
TurnRACIO	46.0364	6.6514 ***
inov2	7.35152	1.6864 *
No Obs.		178
R-Square		0.224262
Adj. R-Square		0.215397
F (6, 501)		25.29588

The results presented suggest that a rural location favours the job creation related to innovation. Product innovation does not present a significant effect on employment variation, while process innovation shows a positive impact on job creation. Note that though the literature shows some ambivalence regarding the impacts of process innovation on employment, a positive effect as been notice by some authors (e.g. Greenand and Guellec 2000, Smolny 2000, Lachenmaier and Rottmann 2006). Radical innovation, by its turn, affects the employment in a negative way, what might suggest minimal innovation to be more conservative in this respect. In spite of the importance that other types of innovations (besides product and process) appear to have to the firms in the database, its impact on employment does not show to be significant.

## 5. Concluding remarks

The promotion of employment is an important concern in EU as shown by the EES. The gap between employment rates in the EU rural areas and their urban counterpart indicates that targets of EES are more difficult to accomplish in the former areas. On the other hand, innovation became in the later years, in particularly with the launching of Lisbon Strategy in 2000, a major tool to enhance economic growth and firm's competitiveness. Therefore, to identify and measure the impacts of innovation on

<sup>7</sup> The Chow test shows a significant change in the model structure according to the firm's location, when model is not correct for heteroskedasticity.



employment became an important task for researchers. Nonetheless, these variables are not related in a linear way, being influenced by a number of other variables related to the firms and to the economic and institutional environment.

The relationship between innovation and employment is complex and therefore its modelling is data demanding. The limitations on the available data, namely from the CIS, are an important constraint to more comprehensive modelling of the effects of innovation on employment as shown by the results presented by the literature. The available data allow only for disentangling product and process innovation and covers only industry and some sectors of the services. They restrict conclusive analysis for other types of innovation and for the interactions between the firm and its environment.

The results of this paper suggest that a rural location appears to favour job creation by innovative firms. However, in the case of rural areas the CIS data are very restrictive because they do not consider the agriculture and forestry sector and include only the main activity of the firm, hindering the capture of multi-activity effects. Therefore, in spite of the statistical data suggest a positive effect of a rural location on employment and the case study analysis highlights that innovation appears to enhance the creation of skilled jobs, better data are needed to dig deeper in this respect.

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