



# Regional between-firm spillovers of R&D spendings Sales of newly invented products in Spanish firms <sup>\*</sup>

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Project outline

## Abstract

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## 1 INTRODUCTION

In a global competition a firm's ability to innovate and come up with new and successful products is crucial for regional growth and jobs.

Innovations is not just the result of isolated research and development (R&D) processes within firms but will also be driven up by R&D spending in other firms, especially within the same region, through formal and informal interactions between firms and employees of different firms.

## 2 BACKGROUND

### 2.1 Theory of firm-level innovations

I modify the "modified regional knowledge production function" proposed by Ó hUallacháin and Leslie (2007) by no longer assuming other influences to be random and uncorrelated, but also letting R&D spending in other firms within the region affect firm-level innovations.

As analyzed by Harrison et al. (2014), though primarily positive, the effect of R&D spendings and introduction of new products in other firms can be expected to capture effects in two directions: while there can be positive spill-overs through development, interaction and exchange of human capital and technology there is also the risk that sales in other firms might take over market shares.

### 2.2 Results in other studies

Barrios Cobos et al. (2001) measure the effects of R&D spendings and regional spillovers on firms' export from Spain. Harrison et al. (2014) estimate the effects of innovations on employment growth in Spanish firms using the PITEC database. Vogel (2015) find effects of R&D spendings and evidence of local technology spillovers through her estimation of a long run model for convergence in Total Factor Productivity (TFP) between all European regions. However, Sternberg and Arndt (2001) found regional characteristics and regional between-firm spillovers to be of less importance than the characteristics of the individual firm itself.

## 3 EMPIRICAL STRATEGY

The aim is to model the firm level inventions, measured as sales due to new products, as a function of within-firm R&D spendings as well as R&D spendings in other firms within the region. That is, for firms within the same sector and in other sectors respectively. I use a panel regression with a Spatial Lag of X (SLX) model (Gibbons and Overman, 2012) controlling for firm-level fixed effects (FE)

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As a specification test I also try applying the Spatial Lag Model (SAR) were (time lagged) sales due to new products in other firms would directly be an explanatory term for sales due to new products for the firm. Furthermore I test a combination of the SLX and SAR specification. Even more so than R&D spendings this could be expected to capture effects in two directions: human capital spill-overs (positive) while sales in other firms might take over market shares (negative).

The spacial weight matrix  $W$  is constructed such that the cells are 1 if the two firms are within the same region and 0 otherwise.

To control for spatial-dependence in spillover effects a weight between  $]0;1[$  is assigned to surrounding regions or even continuous weights based on inverse squared distance between regions. If continuous weights based on distance is not easily done this control could alternatively be performed by assigning equal weight to R&D expenditures for all firms across Spain.

## 4 DATA

The Spanish region of the firm is identified using the firm's location based on information on the region in which they have their R&D department.<sup>1</sup> This implies that the modified dataset will be limited to single-unit firms.

### Dependent variables

- Sales of new products (share of total sales constituted by products, invented within the past two years).
- Robustness check: Absolute number of patent applications.

### Main explanatory variables

- Innovations in products within the past two years (possibly interacted with one of the follownig).
- Variables on R&D's share of total personnel and total payments.
  - Possibly disaggregated into researchers, technicians and clerks.
- Spacially weighted R&D expenditures (as share of total sales) for all firms within the same sector.
- Spacially weighted R&D expenditures (as share of total sales) for all firms.

### Controls

- Statistical Classification of Economic Activities (NACE2/CNAE2009 & CNAE93).

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<sup>1</sup>This novel identification strategy for regions is developed by Enrique López-Bazo.

## 6 Conclusion

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- E.g. dummies of one digit sector number (possibly with a few corrections)
- More irrelevant sectors should probably be dropped from the dataset.
- Sectoral reliance on innovation, inspired by Barrios Cobos et al. (2001):

$$\frac{\text{New products as share of total sales in sector } j}{\text{New products as share of total sales in all sectors}}$$

- Sectoral level of R&D spendings:

$$\frac{\text{R\&D spendings in sector } j}{\text{R\&D spendings in all sectors}}$$

- Innovations in process within the past two years.
- Investments in physical stock.
- Exports.
- Belonging to a business group.
- Type of business (1=Pública; 2=Privada nacional; 3=Privada multinacional; 4=Asociación de investigación y otras instituciones de investigación).
- Firm size (number of employees).

## 5 RESULTS

## 6 CONCLUSION

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