



# IMPACT OF INTRODUCING ECO-INNOVATION MEASURES ON PRODUCTIVITY IN TRANSPORT SECTOR COMPANIES

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## 1. PURPOSE

The transport and storage sector, like other sectors of the Spanish economy, is experiencing the effects of the current economic crisis. The Annual Services Survey prepared by the Spanish National Institute of Statistics (INE) shows that between 2008 and 2013 there was an 11.9% reduction in turnover and an 18.3% reduction in paid workers in companies in sector. However, in the same period, there was a 7.8% increase in labour productivity.

The main aim of this study was to determine the impact of factors related to innovation and the environment, among others, on labour productivity in the Spanish transport and storage sector. Few studies are available on this topic, which is most likely due to the scant statistical information available for the sector analysed. The structural analysis model used in this study was an extended version of the well-known Cobb-Douglas production function applied to data obtained from the Technological Innovation Panel (PITEC). PITEC is a panel type database (for 2003-2013), which was developed jointly by the Spanish National Institute of Statistics (INE) and the Spanish Foundation for Science and Technology.

## 3. RESULTS & FINDINGS

As indicated, the data used in this study was obtained from the PITEC. The sample comprised 1920 observations of 225 transport and storage sector companies (group H of the National Classification of Economic Activities, 2009) for the period 2005 to 2013. Equation (2) was estimated by Ordinary Least Squares, with labour productivity as the dependent variable. Table 1 shows the results.

Table 1. Labour productivity equation.

Variables	Coefficient	SD
Capital stock (log) <sup>1</sup>	0.2094*	0.0413
Number of workers (log) <sup>1</sup>	- 0.2253*	0.0171
Inn. Products	0.2271*	0.0555
Inn. processes	0.0904***	0.0475
Inn. organisation	0.2147*	0.0610
Eco-innovation aim	0.0341**	0.0141
Belongs to a business group	0.1665*	0.0421
Government funding	0.2349**	0.0944
Company based in Madrid	0.0992***	0.0516
Company based in Catalonia	0.1437**	0.0598
Company based in Andalusia	- 0.2034**	0.0801
Cons.	10.8188*	0.1321

Obs. 1920 (225 firms)

Adjusted R<sup>2</sup>: 0.2247

F test: F(19, 1950), 31.03\*

RSS: 1471.23

<sup>1</sup>Wald test H<sub>0</sub>: α+β=1: 0.86 (0.3541)

Notes: Significant at: \* 1%, \*\* 5%, \*\*\* 10%.

White-corrected standard errors.

The coefficients of the variables corresponding to the year of observation have been estimated.

Source: PITEC

## 2. DATA & METHODOLOGY

We expanded the classic Cobb-Douglas production function by incorporating the following variables: firstly, three variables that indicate whether the company has implemented innovation in products (I<sub>1</sub>), processes (I<sub>2</sub>), or the organization (I<sub>3</sub>) in the 2 years preceding the reference year; and, secondly, a variable that indicates whether these innovations are relevant to the company's aim of reducing the environmental impact -EI- of its activity (i.e., the company's aim is eco-innovation). We also incorporated other control variables related to other characteristics of the company and to the year the observations were conducted. The proposed production function is:

$$Y = AK^{\alpha}L^{\beta}e^{\gamma_n I_n}e^{\theta EI} \quad \text{for } n = 1, 2, 3 \quad (1)$$

where  $Y$  represents production estimated by the company's number of sales,  $K$  the stock of deflated physical capital,  $L$  the number of employees,  $\alpha$  the elasticity of production in terms of physical capital,  $\beta$  the elasticity of production in terms of labour,  $\gamma_n$  the semi-elasticity of production according to each type of innovation, and  $\theta$  the semi-elasticity of production taking into account the relevance of eco-innovation to the company.

The equation to estimate was obtained by taking logarithms in (1) and subtracting in both members the work factor  $L$ :

$$\ln\left(\frac{Y}{L}\right)_i = \ln A + \alpha \ln K_i + (\beta - 1) \ln L_i + \gamma_n I_n + \theta EI \quad (2)$$

## 4. CONCLUSIONS

1. Firstly, the values of elasticities of productivity in terms of capital stock ( $\alpha=0.2094$ ) and of the number of workers ( $\beta=0.7747$ ) suggest the existence of constant returns to scale of the production factors, which was confirmed by the Wald test.

2. The introduction of innovation measures in this sector is positively associated with productivity, as shown in the estimated semielasticities. Product innovation (22.71%) and organizational innovation (21.47%) have a greater impact than process innovations (9.04%).

3. Companies in this sector that value the reduction of the environmental impact of its activities by implementing innovations obtain improvements in labour productivity (3.41%) compared to companies that do not value this aim.

4. Other factors, such as belonging to a business group or obtaining aid from the Spanish government to implement innovation activities, also have a positive impact on labour productivity in companies in this sector.

5. Finally, the region in which the headquarters of the transport and storage company is located has a marked impact on productivity. Compared to other Spanish reference regions, the impact on productivity is positive in Madrid and Catalonia (9.92% and 14.37%, respectively), but negative in Andalusia (-20.34%).