Innovation in 13 European economies

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We investigate the extent to which government support in 13 European countries might encourage self-assessed innovation and whether this innovation measure is associated with greater output. The principal approach is Propensity Score Matching and descriptive statistics of data from the Community Innovation Survey (CIS) 2008 for Belgium, Cyprus, Czech Republic, Estonia, Germany, Hungary, Latvia, Lithuania, Portugal, Romania, Slovakia, Slovenia and Spain.

A major component of the project has been ensuring the data are sufficiently consistent across countries for the analysis undertaken. Though the data supplied by Eurostat on the 16 countries are all based around the same variables in the harmonized questionnaire there are some basic differences between them. For instance Slovenia, Norway and Spain lack any environmental variable values, while Italy includes extra expenditure variables for training, innovation marketing and 'other preparation'. The first step was therefore to write an R program to merge the csv files and to identify variables which were named differently (Italy identifies a variable rrdinx which is named rrdinxm for most other countries for instance). Another type of anomaly arises for values; Italy uses a slightly different industrial classification. A third inconsistency arises with missing values, where examination showed that for example some variables in the Norway data zeroes were not distinguished from blanks (missing values). A fourth country-level discrepancy arises with primary weights and non-response adjusted weights; Ireland Germany and Slovenia have none. These problems require that Norway, Italy and Ireland be dropped from the sample.

Visualization methods are used to highlight key features of the data. The study variables have the merit of not being subject to the rather arbitrary aggregation of the indices in the European Innovation Survey and the Innovation Union Scoreboard which also use data from CIS to compare innovation across the EU (for example the sum of SMEs with in-house innovation activities[1]). The IU Scoreboard (2010) (using CIS 2008) shows that for instance Germany's innovation performance was well above that of the EU27 average whereas the performance of Bulgaria, Latvia, Lithuania and Romania was well below[2]. By contrast the CIS2008 data indicates that the percentage of firms with process innovating was highest in Estonia, while Belgium and Hungary had the lowest proportions, but Germany was close to the bottom of the ranking as well.

The specific research questions are;

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[1] Hollander H and Tarantola S (2011) Innovation Union Scoreboard 2010 – Methodology Report

[2] Innometrics (2010) Innovation Union Scoreboard:The Innovation Union's performance scoreboard for Research and Innovation.

1. Are firms supported by government more likely to innovate and if so by how much on average?
2. Do innovating companies increase their turnover and if so by how much on average?

Propensity Score Matching, employed to answer these questions, offers a solution to the identification problem inherent in cross-section data such as generated by the CIS. If enterprises were entirely randomly assigned to the two groups, state aided establishments and others, the difference in mean innovation outcome could be attributed to the state aid. Each firm getting state aid is therefore matched where possible with a business with an identical probability (propensity score) that did not receive aid[3]. All firms that can be matched are 'on support'. The difference in the mean innovation chances of these two groups is then attributed to the aid.

Public support for innovation from central government is associated with only about a two and a half percent average increase in process innovation chances, but this specification does not allow for national differences in policy effectiveness.[4] It does, however, indicate that firms in Cyprus, Spain and Hungary were significantly more likely than average to gain central government support, and those in Lithuania and Slovakia significantly less so[5]. Support also encouraged product innovation (a 5 percent increase in the probability). Measured by the proportion of turnover generated by new products or services, the induced increase in product innovation was statistically significant as well, but very small (1.2-1.8 percentage points).

Research question 2 is answered by matching enterprises on the chances of innovation. The average difference in 2006-8 turnover growth for the two groups of innovators and non-innovators is then the impact of innovation. We find that process innovation increases turnover by 3.4 - 4.1 percent on average (depending on the calliper). National innovation propensities in this model are low for Germany and Hungary but high for Romania, Spain, Estonia and Lithuania. The result for Germany (but not for Hungary) is surprising in view of the top ranking of Germany's descriptive innovation statistics among European economies[6]. A similar approach to product innovation estimates no significant impact on turnover growth.

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[3] Rosenbaum, P. and Rubin, D. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrica*, 70, 41–50

[4] It is less than one tenth of the effectiveness found for UK policy in Foreman-Peck J (2013) Effectiveness and efficiency of SME innovation policy, *Small Business Economics* 41, 1 55-70

[5] These results are consistent with the descriptive statistics of Eurostat (2011) *Eurostat Pocketbook: Science Technology and Innovation in Europe*, Table 5.10. Other country results are not, such as for Romania, markedly less likely to support innovative enterprise, but not significantly so when controls such as industry structure are employed, as they are in the present exercise.

[6] Eurostat (2011) fig. 5.1. Romania also reverses its position when controls are introduced.