Forms of extramural research acquisition and product innovation: Data from econometric estimations

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\textbf{ABSTRACT}

This Data article provides a collection of Data and econometric estimates of the relationship between various forms of external research and Development (R&D) acquisition and product innovation. Specifically, the Data are elaborations on Eurostat (2015) and the EFIGE (2015) survey. Data relate to research acquired by external firms inside the group to which a company belongs, universities and research centres, and other companies. The Data presented here are additional information and analysis to the article of Carboni and Medda [1]. Data derive from econometric applications on the information contained in a survey of 13,621 European manufacturing firms. The econometric framework considers: (1) Potential non-linear effects of the age of firms on product innovation; (2) Geographical variation of innovative activity by the inclusion of 137 regional dummies (NUTS-2-level); (3) Intersectoral differences by the inclusion of 117 industrial dummies (3-digit NACE). We employ systems of equations regressions to take simultaneity end endogeneity into account. For this purpose, the model identification is accomplished through the use of a reduced form equation for

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R&D with two instrumental variables (IV) aimed at capturing regional technological environment. Specifically, we use an instrumental variable framework to compute the impact of external research on (1) the probability of implementing product innovations and (2) the market success of product innovations. The latter is measured by the share of total turnover of innovative products sales. Special focus is put on the potential role of the regional technological environment. For the computations we used the `cmp` command in STATA, which builds upon the maximum simulated likelihood analysis. The models are also estimated using the fractional response technique to check the 0-100% bounded nature of this variable. The Data presented here can be useful for companies to better design R&D strategies aimed at improving firms’ organization, synergies, and growth. This may help strategic decision making, and a more efficient coordination of the complex process of production. Data are also useful for policy makers for designing public R&D schemes, both at the national and at the European level. Finally, the Data represent a useful starting point for future research concerning the proprietary structure of the firm and the workforce, innovation and R&D, internationalization, finance, and market.

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**Specifications Table**

| Subject | Economics, Econometrics and Finance |
|---------|-------------------------------------|
| Specific subject area | Potential non-linear relationship between acquisition of external R&D and product innovation. Regional and industrial analysis of European companies. |
| Type of data | Tables |
| How data were acquired | Data derive from elaboration and econometric application on the information contained in a survey of 13,621 European manufacturing firms (European Firms in a Global Economy EFI/E/Brugel). Data also are built upon Eurostat (2015). For the computations we used the `cmp` command in STATA, which builds upon the maximum simulated likelihood analysis. Models are also estimated using the fractional response technique to check the 0-100% bounded nature of this variable. Data are contained in the DTA file as part of the work. |
| Data format | Analysed |
| Parameters for data collection | We provide a collection of Data and econometric estimates of the relationship between external R&D and product innovation, controlling for: |
| | (1) Potential non-linear effects of the age of the firms |
| | (2) Geographical variation of innovative activity by the inclusion of 137 NUTS-2-level regional binary controls |
| | (3) Intersectoral differences by the inclusion of 117 (three-digit NACE) industrial dummies |
| Description of data collection | Data derive from elaborations on the Efige Survey (2015) and from Econometric estimates include tests for non-linearities. Systems of equations regressions take simultaneity end endogeneity into account. Model identification is accomplished through the use of a reduced form for R&D with the instrumental variables aimed at capturing regional technological environment. Also, data derive from fractional response model analysis. |

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### Value of the Data

- Our raw data are constructed upon the EFIGE Survey (2015) [2] and Eurostat Europe in figures-Eurostat yearbook (2015) [4]. The EFIGE survey supplies information about the structure and the behaviour of firms complemented with their balance sheets. The database combines measures of a firm’s international activities with quantitative and qualitative information on about 150 items, ranging from R&D and innovation, labour organization, financing and organizational activities (Altomonte et al 2012) [3].

- Firms included in the survey were selected using a sampling design that stratified them by sector and firm size. Three elements were used for stratifying the sample: industries (11-NACE classification), regions (NUTS-1 level of aggregation), and size (10–19; 20–49; 50–250; more than 250 employees). All the questions mainly refer to 2008, with some questions asking information about 2009 and the balance sheet data of previous years.

- This information allowed us to construct the Data (contained in the DTA file) that were used in the empirical analysis. The final dataset contains 13,621 firms from Italy, France, Germany, Spain, and the UK. The variables and their construction are also reported in Table 3. To allow the reusability of the data for potential future research, the commands for the variable construction are contained in the STATA do file.

- The Data from econometric elaborations (Tables 1–12) supply interesting insights about Europeans companies’ innovative activity. More specifically, the data provide information about how the relation between external R&D and innovation performance is differentiated among industrial sectors and regions. The Data also supply information about the non-linear effect of age on product innovation.

- The Data can be useful for R&D managers and analysts to design strategies aimed at improving firms’ organization and growth. This may help strategic decision making, and a more efficient coordination of the complex process of production. The Data and the applied theoretical and analytical contributions may provide a guidance to policy makers for designing public R&D schemes, both at the national and at the European level.

- The Data represent a useful starting point for future research concerning the proprietary structure of the firm and the workforce, innovation and R&D, internationalization, finance, and market. The methodology employed may represent a base for building time-based econometric and behavioural models. This would allow evaluation of the medium- and long-term impacts of external R&D on innovation outcomes.
Description of Variables

Table 13 depicts and describes the variables employed in the empirical model. To facilitate the reader, it also contains the variable codification used in the STATA do_file program. All the variables and the original information from where they derive are contained in the DTA file as part of the paper.

| VARIABLES                          | STATA NAME | DESCRIPTION                                                                 |
|------------------------------------|------------|-----------------------------------------------------------------------------|
| **INTERNAL FACTORS:**              |            |                                                                             |
| Age of the firm                    | LOG_AGE    | Log of years from establishment                                            |
| Size of the firm                   | LOG_NUM_EMPL | Log of number of employees in 2008                                      |
| Dummy export                       | EXP_PAST   | Dummy = 1 if the firm has exported before 2008                             |
| Dummy group                        | D_GROUP    | Dummy = 1 if the firm belongs to a group                                  |
| Dummy head of group                | D_HEADGROUP | Dummy = 1 if the firm is head of the group                                 |
| **EXTERNAL FACTORS:**              |            |                                                                             |
| Country dummy variables            | D_FRA D_GER D_ITA D_SPA | Country dummies for France, Germany, Italy, and Spain                      |
| Sectoral dummy variables at NACE 2-digit level | MAN_SECTOR1 to 10 MAN_SECTOR1 | Manufacturing sector dummies                                             |
|                                    |            |                                                                             |
|                                    |            |                                                                             |
|                                    |            |                                                                             |
|                                    |            |                                                                             |
| **EXCLUDED VARIABLES:**            |            |                                                                             |
| Financial constraint variable      | APPR_FINANCE | Lack of appropriate financing as factor hampering innovation              |
| Business sector regional R&D intensity | RDPILBUS07 | Average business enterprise sector R&D expenditure over GDP by NUTS 2 regions (Eurostat) |
| Public sector regional R&D intensity | RDPILGVO07 | Average government sector R&D expenditure over GDP by NUTS 2 regions (Eurostat) |
| **EXTERNAL R&D VARIABLES:**        |            |                                                                             |
| Share of R&D acquired from external sources | SHARE_RD_EXTERNAL | Average % of R&D acquired from external sources                        |
| Square of Share of R&D acquired from external sources | SHARE_RD_EXTERNAL_SQ | Square of average % of R&D acquired from external sources              |
| R&D external partners homogeneity index | HERF_NEW2 | Sum of the respective squared shares over external R&D of three modes of R&D acquisition. The index was 0 in the case of no external acquisition, 1/3 if the external acquisition was equally distributed between the three partner types, and 1 if the total R&D was supplied by only one type of external partner. |

(continued on next page)
Table 13 (continued)

| VARIABLES                                      | STATA NAME         | DESCRIPTION                                                                 |
|------------------------------------------------|--------------------|-----------------------------------------------------------------------------|
| Square of R&D external partners homogeneity index | HERF_NEW2_SQ        | Square of sum of the respective squared shares over external R&D of three modes of R&D acquisition |
| Share of R&D acquired from firms in the same group | SHARE_RD_GROUP     | Average % of R&D supplied by another firm in the group                      |
| Square of Share of R&D acquired from firms in the same group | SHARE_RD_GROUP_SQ  | Square of average % of R&D supplied by another firm in the group            |
| Share of R&D acquired from firms not in the same group | SHARE_RD_OTH_FIRMS | Average % of R&D supplied by other firms / consultants                      |
| Square of Share of R&D acquired from firms not in the same group | SHARE_RD_OTH_FIRMS_SQ | Square of average % of R&D supplied by other firms / consultants  |
| Share of R&D acquired from universities / research centres | SHARE_RD_UNI      | Average % of R&D supplied by Universities and R&D centres                  |
| Square of Share of R&D acquired from universities / research centres | SHARE_RD_UNI_SQ | Square of average % of R&D supplied by Universities and R&D centres       |

**PRODUCT INNOVATIONS**

VARIABLES:
- Dummy has carried out product innovations: D_INN_PROD
- Average share of total turnover from innovative products sales: PROD_INN_OVER_SALES_0_1
- Dummy R&D: D_RD
- Dummy has undertaken R&D: D_RD

**DESCRIPTION**
- Did the firm carry out any product innovation? 
  (yes = 1 / no = 0)
- Average % of turnover from innovative products sales in the last three years
- Did the firm undertake R&D? dummy variable
  (yes = 1 / no = 0)

1. Data description

1.1. The age of firm analysis

Tables Age a,b,c,d depict the results of the age of firms analysis. Specifically, they relate to the non-linear effect of age on product innovation considering the log transformation of age, expressed as the number of years from establishment. Since this does not allow us to check for a possible inversion of the relationship beyond a certain point, we have run all our model estimates employing the variable AGE and its squared term. However, it is worth noting that the sample used for the EFIGE survey cuts off firms with under 10 employees (which for many countries means the exclusion of a consistent number of firms). This implies an under-representation of very young companies (8.1% of firms are up to seven years of age and 5.4% are above 100 years, with the age variable ranging from 1 to 189 years and a median age of 25). In all the estimations, the squared term of AGE is added both in the first and in the second stage. The first stage refers to the binary yes/no decision about firms’ R&D engagement.

Table 1 Age.a depicts the results of the enquiry about external R&D and innovation performance. In columns 1 and 2 the structural equation refers to the dependent dummy variable product innovation yes/no. In columns 3 and 4 the dependent variable is the product innovation sales. In columns 1 and 3 the independent variables are the share of external R&D and its squared term. In columns 2 and 4 the independent variables are the homogeneity index and its squared term.

Table 2 Age.b depicts the results of the enquiry about external R&D partners and the propensity to carry out product innovations. The dependent variable of the structural equation is the dummy product innovation. The independent variables are the share of external R&D differentiated for: (a) research supplied by external firms inside the group to which a company belongs; (b) universities and research centres; (c) other companies. Their respective squared terms are also considered among the regressors.
Table 3 Age.c depicts the results of the enquiry about external R&D partners and the intensity of product innovation performance. The dependent variable in the structural equation is represented by the share of product innovation over total sales. The independent variables are the share of external R&D differentiated for: (a) research supplied by external firms inside the group to which a company belongs; (b) universities and research centres and (c) other companies. Their respective squared terms are also considered among the regressors.

Table 4 Age.d depicts the results of the enquiry about fractional probit model - structural equation for the intensity of product innovation performance. The dependent variable in the structural equation is the share of total turnover from innovative product sales. The independent variables are the share of external R&D, their respective squared terms and the homogeneity index. Among the independent variables are also included the share of external R&D differentiated for: (a) research supplied by external firms inside the group to which a company belongs; (b) universities and research centres; (c) other companies. Their respective squared terms are also considered among the regressors.

1.2. The industrial sectors

Tables NACE.a,b,c,d depict the results of the industry analysis. The models employ binary controls for industrial sectors, to consider the significant intersectoral heterogeneity in firms’ innovative activity. We provide Data about estimates including 117 NACE-3 level industrial dummy variables both in the first and second stage.

Table 5 Nace.a depicts the results of the enquiry about external R&D and innovation performance. In columns 1 and 2 the structural equation refers to the dependent dummy variable product innovation yes/no. In columns 3 and 4 the dependent variable is the product innovation sales. In columns 1 and 3 the independent variables are the share of external R&D and its squared term. In columns 2 and 4, the independent variables are the homogeneity index and its squared term.

Table 6 Nace.b depicts the results of the enquiry about external R&D partners and the propensity to carry out product innovations. The dependent variable of the structural equation is the dummy product innovation. The independent variables are the share of external R&D differentiated for: (a) research supplied by external firms inside the group to which a company belongs; (b) universities and research centres; (c) other companies. Their respective squared terms are also considered among the regressors.

Table 7 Nace.c - depicts the results of the enquiry about External R&D partners and the intensity of product innovation performance. The dependent variable in the structural equation is represented by the share of product innovation over total sales. The independent variables are the share of external R&D differentiated for: (a) research supplied by external firms inside the group a company belongs; (b) universities and research centres; (c) other companies. Their respective squared terms are also considered among the regressors.

Table 8 Nace.d depicts the results of the fractional probit model - structural equation for the intensity of product innovation performance. The dependent variable in the structural equation is the share of total turnover from innovative product sales. The independent variables are the share of external R&D, their respective squared term and the homogeneity index. Among the independent variables are also included the share of external R&D differentiated for: (a) research supplied by external firms inside the group to which a company belongs; (b) universities and research centres; (c) other companies. Their respective squared terms are also considered among the regressors.
1.3. The regional technological context

The models in Tables Nuts a,b,c,d show the results for the geographical variation of innovative activity. The models employ 137 binary controls for regions within countries at the NUTS-2 level, to consider the significant national internal technological heterogeneity.

Table 9 Nuts.a depicts the results of the enquiry about external R&D and innovation performance. In columns 1 and 2 the structural equation refers to the dependent dummy variable product innovation yes/no. In columns 3 and 4 the dependent variable is the product innovation sales. In columns 1 and 3 the independent variables are the share of External R&D and its squared term. In columns 2 and 4 the independent variables are the homogeneity index and its squared term.

Table 10 Nuts.b depicts the results of the enquiry about external R&D partners and the propensity to carry out product innovations. The dependent variable of the structural equation is the dummy product innovation. The independent variables are the share of external R&D differentiated for: (a) research supplied by external firms inside the group to which a company belongs; (b) universities and research centres; (c) other companies. Their respective squared terms are also considered among the regressors.

Table 11 Nuts.c - depicts the results of the enquiry about external R&D partners and the intensity of product innovation performance. The dependent variable in the structural equation is represented by the share of product innovation over total sales. The independent variables are the share of external R&D differentiated for: (a) research supplied by external firms inside the group to which a company belongs; (b) universities and research centres; (c) other companies. Their respective squared terms are also considered among the regressors.

Table 12 Nuts.d - depicts the results of the fractional probit model - structural equation for the intensity of product innovation performance. The dependent variable in the structural equation is the share of total turnover from innovative product sales. The independent variables are the share of external R&D, their respective squared terms and the homogeneity index. Among the independent variables are also included the share of external R&D differentiated for: (a) research supplied by external firms inside the group to which a company belongs; (b) universities and research centres; (c) other companies. Their respective squared terms are also considered among the regressors.

2. Experimental Design, Materials and Methods

The goal of our experimental design is to provide an empirical analysis of the external R&D and product innovation link, emphasising the non-linear form of this relationship and a possible over-outsourcing effect. We consider firms’ decisions to engage in R&D as an endogenous process and analyse the factors which may determine firms’ propensity to R&D commitment.

We employ an instrumental variable framework to compute the impact of external research on the probability of achieving product innovations and on the market success of new products. The latter is measured by the percentage of innovative products sales on total turnover. The analysis puts special focus on the potential role of the regional technological environment. The following Chart 1 depicts the econometric set up employed in the empirical analysis. The methodology is then specifically described.

Formally, the econometric approach consisted of the estimation of a two-equations model: reduced form equation (stage 1):

\[
\text{DUMMY}_{\text{R&D}} = \alpha_0 + \alpha_1 X_{1i} + \alpha_2 X_{2i} + u_i
\]

(1)

This is a linear equation where the R&D binary dependent variable is regressed on internal and external factors \((X_{1i})\). Internal factors refer to: Log of age of the firm, Log of number of employees in 2008, Dummy = 1 if the firm has exported before 2008, Dummy = 1 if the firm belongs to a group, Dummy = 1 if the firm is head of the group. External factors refer to: country dummy variables and industry dummy variables at NACE 2-digit level.
The equation also considers two excluded variables, namely lack of appropriate financing as factor hampering innovation and average business/public sector R&D expenditure over GDP by NUTS 2 regions. These latter are considered as an indicator of the technological geographical environment (Atzeni and Carboni [13]; Rodríguez-Gulías et al. [7]; Medda [8]; among others). The regional technological opportunities variables are the excluded variables and represent our instruments.

More in detail, we are hypothesizing that territorial conditions have a role in influencing firms' R&D decisions (a relevance condition for instrumental variables), but they are not correlated with the error term of the structural equation where firm’s innovation output is the dependent variable. The regional context impacts a company’s innovation output through its influence on each firm’s R&D (exclusion condition) and on other inputs in a firm’s knowledge production function. In other words, we separate inputs from outputs of innovative activity by the firm (Tavassoli [9]; Carboni and Medda [10]).

We use regional averages of government and business sector R&D intensities as an independent variable, relying on the fact that these variables are beyond the control of each single company (exclusion restriction). In our estimated models, the choice of firms to carry out R&D is found to be positively correlated with the density of R&D in the region they operate in (rel-
evance condition). Tests for the identification hypothesis allow us to reject the null hypothesis of variables coefficients jointly equal to zero. Although this is not a resolution of the potential endogeneity problem, we reasonably believe that it allows to sensibly mitigate the endogeneity bias.

**structural equation (stage 2):**

\[
y_i^* = \beta_0 + \beta_1 \text{DUMMY}_\text{R&D}_i + \beta_2 \text{EXT}_\text{R&D}_i + \beta_3 \text{EXT}_\text{R&D}2_i + \beta_4 X_{1i} + u_i
\]

where \(y_i\) is the innovation outcome of firm \(i, i = 1 \ldots N\).

It is worth underlining that although the dependent variables \((y_i^*)\) in the structural equations are \(a\) a binary product innovation variable and \(b\) the average share of turnover deriving from new products sales, we estimated the second stage equation using linear model techniques as suggested by Angrist and Krueger [5].

\(\text{EXT}_\text{R&D}_i\) represents the percentage of R&D acquired from each of the three types of external partners in some specifications and, the homogeneity index, in other specifications. Its square term is also considered in the regression to account for potential non-linear effects. The vector \(X_{1i}\) contains the internal and external indicators as in the reduced Eq. (1). The R&D external partners homogeneity index is constructed as the sum of the respective squared shares over external R&D of three modes of R&D acquisition, namely research supplied by external firms inside the group to which a company belongs, universities and research centres, and other companies. The index was 0 in the case of no external acquisition, 1/3 if the external acquisition was equally distributed between the three partner types, and 1 if the total R&D was supplied by only one type of external partner.

Finally, the error terms of the two equations follow the distributions:

\[
\begin{pmatrix}
u \\
v
\end{pmatrix} \sim N\left[ \begin{pmatrix}
0 \\
0
\end{pmatrix}, \begin{pmatrix}
\sigma_u & \rho \\
\rho & \sigma_v
\end{pmatrix} \right]
\]

where \(\rho\) indicates the correlation between \(u\) and \(v\), which is presumably different from zero, according to the hypothesis of endogeneity.

The implementation of the methodology just described allows us to control for the endogeneity in order to ease the bias in the choice of carrying out R&D. The results obtained from the different applications are described in detail in the previous section (Data Description) where the analysis specifically distinguishes respectively: for the variables age of firm, regional and industry aspects.

As a robustness check, when the variable under investigation was the share of total turnover represented by innovative product sales, we also ran our models employing the fractional response method to check the 0-100% bounded nature of this variable (Papke and Wooldridge [6]). The results of the fractional models remain stable supporting the reliability of our analysis.

The bounded nature of the dependent variable innovative product sales over total turnover and the possibility of observing values at the boundaries raise functional form and inference issues. The rationale is that since the dependent variable is bounded within 0 and 1, the effect of any particular \(x_i\) cannot be constant throughout the range of \(x\) (with the exclusion of small ranges of \(x_i\)). This implies that the predicted values from a linear regression non necessarily lie in the unit interval. Thus, the drawbacks of linear models for fractional data are similar to the drawbacks of the linear probability model for binary analysis. Hence, the fractional response specification employs quasi likelihood estimator.

**STATA Program Commands**

The STATA do_file code refers to the computations that generated and elaborated our Data. We used the cmp command in (Rodman [11]), which builds upon the maximum simulated likelihood analysis (Cappellari and Jenkins [12]). The do_file also contains the commands for the fractional probit model to check the 0-100% bounded nature of the variable under investigation (Papke and Wooldridge [6]).
Ethics Statement

None

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have or could be perceived to have influenced the work reported in this article.

CRediT Author Statement

Oliviero A. Carboni: Conceptualization, Methodology, Writing – original draft; Giuseppe Medda: Methodology, Software, Data curation.

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Supplementary Materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.dib.2021.107567.

References

[1] O.A. Carboni, G. Medda, External R&D and product innovation: is there an over-outsourcing issue? Economic Model. 103 (2021) 105601, doi:10.1016/j.econmod.2021.105601.
[2] Efige, 2015. https://bruegel.org/wp-content/uploads/2015/06/EFIGE_Truncated_1_updated.xlsx
[3] C. Altonome, T. Aquilante, The EU-EFIGE/Bruegel-Unicredit Dataset, BRUEGEL Working paper No. 753, Brussels, Belgium, 2012.
[4] Eurostat, 2015. Europe in figures-Eurostat yearbook.
[5] J.D. Angrist, A.B. Krueger, Instrumental variables and the search for identification: from supply and demand to natural experiments, J. Econ. Perspect. 15 (2001) 69–85, doi:10.1257/jep.15.4.69.
[6] L.E. Papke, J.M. Wooldridge, Econometric methods for fractional response variables with an application to 401(k) plan participation rates, J. Appl. Econ. 11 (1996) 619–632, doi:10.1002/(SICI)1099-1255(199611)11:6<619::AID-JAE418>3.0.CO;2-1.
[7] M.J. Rodríguez-Gullas, D. Rodeiro-Pazos, S. Fernández-López, The effect of regional resources on innovation: a firm-centered approach, J. Technol. Transf. (2020) On- line first, doi:10.1007/s10961-020-09811-8.
[8] G. Medda, External R&D, product and process innovation in European manufacturing companies, J. Technol. Transf. 45 (2020) 339-336, doi:10.1007/s10961-018-9682-4.
[9] S. Tavassoli, The role of product innovation on export behaviour of firms: is it innovation input or innovation output that matters? Eur. J. Innov. Manag. 21 (2) (2018) 294–314, doi:10.1108/EJIM-12-2016-0124.
[10] O.A. Carboni, G. Medda, Innovative activities and investment decision: evidence from European firms, J. Technol. Transf. 46 (2021) 172–196, doi:10.1007/s10961-019-09765-6.
[11] D. Roodman, Fitting fully observed recursive mixed-process models with CMP, Stata J. 11 (2011) 159–206, doi:10.1177/1536867X110100202.
[12] L. Cappellari, S.P. Jenkins, Multivariate probit regression using simulated maximum likelihood, Stata J. 3 (2003) 278–294, doi:10.1177/1536867X030030030.
[13] G.E. Atzeni, O.A. Carboni, ICT Productivity and Human Capital: The Italian North-South Duality, International Review of Economics and Business (RISEC) 51 (2004) 265–284.