



## **POLICY NOTE OF WORKING PAPER 4.30**

### **DO FIRMS COOPERATE IN R&D PERSISTENTLY? EVIDENCE FROM SPAIN**

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#### **OBJECTIVE**

Our main objective is to analyse if R&D collaborative agreements are persistent at the firm level, and in such a case, to study what are the main drivers of this phenomenon. R&D cooperation activities at the firm level can be persistent due to true state dependence, this implying that cooperating in a given period enhances the probability of doing it in the subsequent period and it can also be a consequence of firms' individual heterogeneity, so that certain firms have certain characteristics that make them more likely to carry out technological alliances. A second contribution of the paper deals with the differentiated persistence pattern of collaboration agreements for three different types of partners: customers and/or suppliers, competitors and institutions. We specifically explore the degree of the persistence in R&D collaborative activities when considering them separately as well as the possibility of finding crossed-persistence across these different partner types.

#### **SCIENTIFIC METHODS**

The empirical approach follows the definition of cooperation persistence as “state dependence”, basically that having engaged in R&D cooperation activities increases the probability to engage in such arrangements currently. So, the study considers a dynamic random effects probit model which allows for state dependence and unobserved individual heterogeneity to analyse the discussed causal relationship. In addition, in order to distinguish whether persistence is due to true state dependence or to the spurious one, this dynamic framework accounts for unobserved individual effects correlated with the initial conditions.

We use the Technological Innovation Panel (PITEC)<sup>1</sup> produced jointly by the Spanish National Statistics Institute (INE), the Spanish Foundation for Science and Technology (FECYT) and the Cotec Foundation. The data come from different successive waves of the Spanish Innovation Survey conducted every year by the INE, which in turn is based on the Community Innovation Survey (CIS). An important advantage of using this database is that it allows us to study different issues related to

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<sup>1</sup> This database is available at [http://icono.fecyt.es/PITEC/Paginas/por\\_que.aspx](http://icono.fecyt.es/PITEC/Paginas/por_que.aspx)

innovation activities of Spanish manufacturing and service firms over time as it is specifically designed to analyse technological activities. Given the specific aim of this study and because the questions about cooperation are asked in a three-year period, i.e. the survey asks whether or not the firm cooperated in the period between  $t-2$  and  $t$ , we consider four waves of the PITEC: 2004 (wave 2002-2004), 2006 (wave 2004-2006), 2008 (wave 2006-2008) and 2010 (wave 2008-2010), covering the period 2002-2010.

## **POLICY VALUE-ADDED**

Our study is an attempt to analyse persistence in R&D cooperation activities and, as a consequence, understand innovation in a globalised environment. Initially, persistence in cooperation agreements is appealing, as it provides firms with a stream of information that becomes available thanks to being embedded in a network. The results show that there is a high persistence in R&D cooperation activities at the firm level. After discounting the impact of observed and unobserved firm characteristics, in the Spanish case, a firm cooperating in  $t-1$  has a probability of cooperating which is approximately 34 percentage points higher than that of a firm not having cooperated in the previous period. This could be explained by the knowledge accumulation and capabilities that may be gained from past experiences in cooperation projects, the barriers to enter and exit which can arise due to sunk costs, and the success and reliability in past cooperation agreements. In addition, we observe that firms with higher incoming spillovers, higher R&D intensity, large firms and firms that belong to a group of enterprises as well as firms that use protection methods (such as patenting, registered an industrial design, trademark or copyright) are more persistent in their technological collaborative agreements.

When taking into account the different types of partnership, we conclude that the highest persistence is found in the case of collaboration with institutions, followed by customers and clients. One potential explanation may be related to the relative limited spillovers risks in those types of alliances if compared to the one in agreements with competitors, which may imply a higher persistence of the former alliances. Finally, in all the types of partners, we obtain that cooperation agreements with one type increase the likelihood of cooperating in the future with a different type of partner, although with a much lower intensity than in the case of the same partnership group.

From a policy perspective, the fact of R&D cooperation being state dependent implies that collaboration-stimulating policy measures, such as government support programmes, are supposed to have a deeper effect because they do not only affect current collaboration agreements but are also likely to induce a permanent change in favour of cooperation. In addition, since persistence is also driven by certain individual characteristics of the firms, they could be taken into account when designing policies to stimulate cooperation in a persistent way: firms with high R&D intensity, large firms and firms that belong to a group of enterprises as well as firms that use protection methods. Policy makers could decide to focus resources on these “cooperation-survival-winners”.