



# What are the conditions for good innovation results? A fuzzy-set approach for European Union<sup>☆</sup>



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## ABSTRACT

Innovation is one of the main concerns of European Union countries since the beginning of the century. Despite failing to reach their targets, innovation remains a priority because innovation enables countries to achieve better economic performance. This study analyzes the relation between the level of innovation and the economic effects and applies a fuzzy-set qualitative comparative analysis to study the relation between six conditions and two different outcomes. The data comes from the Union Innovation Scoreboard. The study finds that research systems, linkages and entrepreneurship, and intellectual assets are necessary conditions for the outcomes of a high level of innovation and positive economic effects. The main sufficient condition for both outcomes is a good research system.

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## 1. Introduction

Innovation remains an important debate in both political and academic circles. In the case of the European Union (EU), these debates focus on an investment target of 3% of GDP for research and development activities (R&D) in the first decades of the century (a goal that most EU countries did not achieve). The objective is to make the EU the most competitive and dynamic knowledge-based economy in the world.

The literature contains several studies about innovation. Some studies analyze the role of innovation as a driver of sustainable economic growth that then leads to higher levels of output and citizens' better well-being (e.g. Romer, 1986, 1987, 1990; Solow, 1957). This is one of the reasons why public decision-makers aim to stimulate innovation. A large number of studies describe innovation typologies and/or specific models (e.g., Bessant & Tidd, 2015).

The empirical findings on the effect of innovation on economic growth appear in works such as Romer (1990), Grossman and Helpman (1991), and Giménez and Sanaú (2007). However, the present study goes beyond the fundamental relation between innovation and economic growth and examines the relation between the level of innovation activity and the economic effects of those activities.

The main objective of this study is to find which conditions are important and significant to achieve good innovation outcomes. The study performs a macroeconomic analysis that uses data from the Innovation Union Scoreboard (IUS) and that uses the fuzzy-set qualitative comparative analysis (fsQCA) approach to identify the combination of conditions that lead to higher outcomes. The results provide a basis for the decision process on economic and social policies for European innovation.

The structure of the article is the following: Section 2 presents the literature review; Section 3 presents the data and the fsQCA; Section 4 presents the results; and Section 5 presents the discussion of the results and the conclusions.

## 2. Literature review

The literature contains some examples of studies that address the results of innovation activity. For example, Pavitt (1984) argues that, for the specific case of science-based firms, in-house R&D is the main determinant of those firms' innovative output, but the author does not find other linkages between innovative activities and their results. Capital expenditure is another variable with influence on a firm's innovative output (e.g. Baum, Caglayan, & Talavera, 2012; Hall & Ziedonis, 2001; Piergiovanni & Santarelli, 2013; Terleckyi, 1974).

The above studies analyze in detail the microeconomic effects of innovation. However, when regarding innovation as a macroeconomic issue, the variables that influence innovation results are different: R&D expenditure, the capacity of each national system, human capital (experience, education or skills), and cultural factors (e.g. Romer, 1990; Varsakelis, 2001, 2006).

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