Research Policy 44 (2015) 623–633

Contents lists available at ScienceDirect

Research Policy

journal homepage: www.elsevier.com/locate/respol

Can R&D subsidies counteract the economic crisis? – Macroeconomic effects in Germany

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ARTICLE INFO

Article history:
Received 14 February 2014
Received in revised form
15 November 2014
Accepted 26 November 2014
Available online 3 February 2015

Keywords:
Economic crisis
R&D subsidies
Stabilization policy
Macroeconomic effects
Backward multipliers
Input–output model

ABSTRACT

During the economic crisis of 2008 and 2009, governments in Europe stabilized their economies by means of fiscal policy. After decades of absence, deficit spending was used to counteract the heavy decline in demand. In Germany, public spending went partially into R&D subsidies in favor of small and medium sized enterprises. Applying the standard open input–output model, the paper analyzes the macroeconomic effects of R&D subsidies on employment and production in the business cycle. Findings in the form of backward multipliers suggest that R&D subsidies have stimulated a substantial leverage effect. Almost two thirds of the costs of R&D projects are covered by the enterprises themselves. Overall, a subsidized R&D program results in a production, value added and employment effect that amounts to at least twice the initial financing. Overall, the R&D program counteracts the decline of GDP by 0.5% in the year 2009. In the year 2010 the effects are already procyclical since the German economy recovered quickly. Compared to the strongly discussed alternative uses of subsidies for private consumption, R&D spending is more effective.

1. Introduction

At the end of 2008, a severe economic crisis dealt a heavy blow to the global economy as a whole. The decline of effective demand caused by a loss of confidence and long-term expectations led to a worldwide economic slowdown which had negative effects on production, employment, investment and consumption. Consequently, in 2009 the gross domestic product of the four largest economies in the Euro Zone declined by between 3 and 6% (see Fig. 1). Most national governments used fiscal policy measures to support and stabilize the demand side of the economy. In Germany, this fiscal policy included public spending in various areas, among them the Research and Development (R&D) activities of private enterprises.

The role of R&D in economic growth has been a subject of economic literature for many years. It is generally acknowledged that investments in R&D contribute to growth and competitiveness through product and process innovations. Endogenous growth theory shows that spillover effects from R&D investments are essential for long-term economic growth (Grossman and Helpman, 1992; Romer, 1986, 1990). In practice, SMEs typically face problems in recruiting sources to finance their own R&D (Czarnitzki and Hottenrott, 2011; Rammer, 2009). During the crisis of 2008–2009 this challenge became even greater and small companies in particular faced difficulties in keeping their level of R&D investment (European Commission, 2011; Archibugi and Filippetti, 2011; Paunov, 2012). Hence, in order to counteract the negative implications of the economic crisis and to encourage long-term economic development, the German government decided in February 2009 to increase the budget for one of the largest German R&D programs, the "Central Innovation Program for SMEs" (ZIM), by 900 million Euros for the years 2009 and 2010. At the same time, the German government decided to enlarge the group of firms eligible for this program going beyond the official definition of SMEs (up to 250 employees). A temporary opening for firms with up to 1000 employees took place due to the serious and extraordinary situation. This was a political decision like all actions undertaken as fiscal policy measures during that time (OECD, 2009). The focus of the R&D program, however, was kept on SMEs. Stabilization of production and employment are fundamental arguments in favor of budget increases and widening of the scope of firms eligible for

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http://dx.doi.org/10.1016/j.respol.2014.11.012
0048-7333/

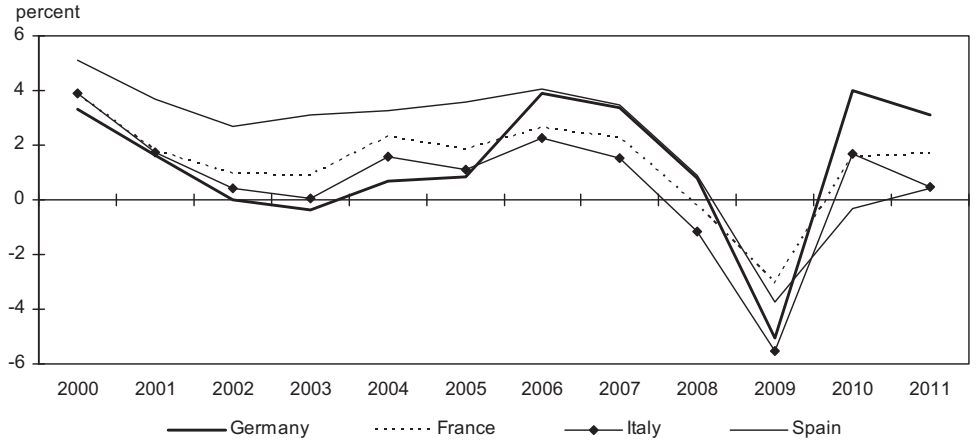

Fig. 1. Growth rates of GDP in the four largest economies of the Euro Zone since 2000.

Source: Eurostat.

R&D subsidies in Germany. Therefore, this paper deals with an empirical investigation of whether and to what degree this increased R&D program counteracted the decline in effective demand during the economic crisis (business cycle). The long term growth effects which become effective much later due to innovations in the form of new products or production processes also exist, but they are not related to stabilization policy in the present and thus not subject to this paper.

At the macroeconomic level, empirical analyses of the impact of R&D spending focus on productivity spillovers (e.g. Guellec and van Pottelsberghe de la Potterie, 2001; Levy and Terleckyj, 1983; OECD, 2008). Some attempts have also been made to quantify the impact of non-material capital on the development of economic productivity (van Ark et al., 2009).

Existing macroeconomic studies typically focus on R&D as a means that in the medium to long-term contributes to an expansion of the production potential and thus to economic growth. In contrast to this view and with respect to our subject – R&D as a short-term remedy in an economic crisis – we are interested in the economic effects which occur immediately when running R&D projects.

In order to investigate the short-term stabilization effects of R&D empirically, we need to capture the demand brought about by additional R&D projects, in other words the pressure on production (and employment) in supplier industries as well as the effects of the income generated, which in turn stimulates production in consumer goods industries and so forth. In order to study the short-term effects of the German R&D program, we have applied the input–output method.

A major innovation of this paper is the fact that we treat R&D in the input–output model as a process of capital formation (investment) and not as a consumption process, as is usually the case in national accounting. The re-definition of R&D as an investment is made because it comes much closer to capturing the nature of R&D. In practice, R&D contributes to the stock of knowledge and does not disappear in one production cycle like an intermediate product; rather, the results of R&D endure for a longer period. Current discussions are aimed at changing national accounts on exactly this point (European Commission and United Nations, 2009), but this has not yet been realized. We anticipate this insight in this paper and provide a macro analysis where R&D is treated as a capital good.

The next two sections describe the methodology and the data set used. Section 4 applies the method and analyzes the leverage effect as well as the effects on production and employment. A discussion of the results and concluding remarks follow in the last section.

2. Conceptual framework

2.1. Literature review and subject of analysis

R&D subsidies are subject to many theoretical and empirical studies. One important strand of literature deals with the selection problem of R&D and innovation programs (e.g. Busom, 2000; Segerstrom, 2000; Takalo and Tanayama, 2010), another with the signaling effects of R&D subsidies (e.g. Lerner, 1999; Kleer, 2009; Meuleman and De Maeseneire, 2012). Furthermore, in recent times there is a growing literature dealing with the effects of R&D subsidies on the economic performance of firms using microeconometric methods and micro data (e.g. Alecke et al., 2012; Czarnitzki et al., 2011; González and Pazó, 2008; Schwartz et al., 2012). David et al. (2000) in a larger meta study of this type of empirical analyses find mixed results, particularly with respect to crowding out effects. The objective of these microeconometric studies is not to quantify the macroeconomic effects of R&D subsidies but to focus on firm level behavior and individual performance effects. Finally, there are analyses with a macroeconomic perspective and methodology, too. The main focus is long term growth and productivity effects of R&D as a consequence of knowledge production and enlargement of the production potential (supply side) of an economy (for an overview see e.g. OECD, 2008), productivity effects that improve national competitiveness, and the capability of exports in the long run. The objective of our paper goes beyond these empirical studies. We are interested in the short term stabilization effects of R&D resulting solely out of the increase of demand for domestically produced products when running R&D projects. That means, we switch on the demand side of the economy. A typical method to quantify the macroeconomic demand side effects is the input–output analysis (Miller and Blair, 2009). The methodology will be explained in more detail below.

Several studies also use the input–output method to analyze inter-industry flows of embodied R&D. Here it is assumed that an initial innovation is incorporated in the industry's product, which may involve a new or improved commodity or simply the improvement of the production process. The product is regarded as a carrier of technological progress. Since other industries use this product as an intermediate input, the innovation becomes embodied in all products, including those used for final demand (consumption, capital formation and exports). This type of inter-industry diffusion is traditionally analyzed by backward and forward multipliers in an input–output context (Haukness and Knell, 2009). In this context, two questions can be answered: (1) How much R&D is embodied in the final output of industry **j** or (2) what portion of R&D