



Short communication

# Government science and technology budgets in times of crisis

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## ABSTRACT

Following a recent paper by Filippetti and Archibugi [Filippetti, A., Archibugi, D., 2011. Innovation in times of crisis: National systems of innovation, structure and demand. *Research Policy* 40(2), 179–192], this article aims to contribute to the sparse literature on the impacts of the recent economic downturn on the government expenditures and innovative activities of the countries of the enlarged European Union (EU-27). Using Eurostat's socio-economic objectives i.e. the Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS 2007 classification), this paper addresses the impact of the recent economic downturn on governments' science and technology (S&T) budgets across the 27 EU countries. Most countries followed a pro-cyclical pattern, where the government S&T budgets in most NABS shrunk along slowing gross domestic product growth in similar pace with total government expenditure. The new member states of Eastern Europe were the most affected.

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## 1. Introduction

As Filippetti and Archibugi (2011) point out, the evident lack of participation of economists of innovation in the debate on the causes and impacts of the ongoing economic crisis speaks volumes (also Archibugi and Filippetti, 2011; Paunov, 2012). This likely stems from the lack of timely and updated statistical data. However, now that European statistics officials have updated their databases for the years since the crisis struck, we can estimate the early impacts of the economic crisis. There is a long-standing research on the dynamic of government expenditure over the business cycle (e.g. Afonso and Furceri, 2010; Prasad and Gerecke, 2010). Furthermore, the effects of the recent economic downturn on innovative activities of firms have been investigated (Filippetti and Archibugi, 2011). However, the impact of the European-wide recession on governments' science and technology (S&T) budgets has not thus far received much attention. Therefore, this paper aims to fill a gap in the literature on the impacts of the recent economic downturn on the S&T budgets of national governments according to Eurostat's socio-economic objectives i.e. the Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS 2007 classification). Thus, this paper aims to repeat the analyses carried out by Filippetti and Archibugi (2011), with firm-level data, but

with data on government S&T budgets. The debate in this paper focuses on reactions to the crisis through the dissonance between the pro-cyclical and counter-cyclical hypotheses of government expenditure and business cycles.

## 2. Literature review: government expenditure and business cycles

In the literature on government expenditure on innovative activities and business cycles, two opposing hypotheses stand out: (1) pro-cyclical and (2) counter-cyclical. The first, pro-cyclical, hypothesis predicts that expenditures on innovative activities decrease along with a downturn in the economy. The first hypothesis is intuitively clear: a decrease in available economic resources will lead to a subsequent decrease in the allocation of these diminishing resources to innovative activities. In fact, following Schumpeterian tradition on investment and innovation over the business cycle (Schumpeter, 1939); Freeman et al. (1982) have claimed that during an economic downturn, the pessimistic mood reduces such investment. The second, counter-cyclical, hypothesis states the direct opposite: that during an economic crisis, expenditures on innovation actually increase; in periods of high gross domestic product (GDP) growth, few resources are allocated to innovative activities, whereas during low growth periods, resource allocation to innovative activities is high (Wälde and Woitek, 2004). Empirically, this would mean that resource allocation to S&T budgets should correlate negatively with GDP growth

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rates. The reasoning behind this counter-cyclical hypothesis can be found in the assumption that an economic downturn triggers a greater need to invest in innovation, as nations struggle to once again achieve competitive advantage in order to survive the harsh economic conditions.

In relation to government spendings, during economic downturns, government budgets tend to increase both automatically (social security, etc.) and as a consequence of trying to sustain the economy through Keynesian budget-spending policies (e.g. Romer, 1993). However, there is wide regional variation, with developed countries exhibiting the most counter-cyclical spending (Prasad and Gerecke, 2010). Furthermore, in contrast to counter-cyclical Keynesian expenditure patterns, it seems that many countries follow pro-cyclical expenditure patterns (see Lane, 2003a,b; Abbott and Jones, 2012). Pro-cyclicity is often caused by policy reactions driven by the voters (Arestis and Sawyer, 2003; Alesina et al., 2008). For example, during election times all government expenditure categories tend to show an upward drift (van Dalen and Swank, 1996). It should be noted, though, that the empirical evidence on the pro-cyclical or counter-cyclical pattern of government spending is mixed. Thus, although several authors have raised the debate of business cycles and government spending to the fore of their analyses, there is no clear consensus on which of the two hypotheses, likely to vary across countries and different types of budgets, is more accurate (e.g. Lee and Sung, 2007; Woo, 2009; Abbott and Jones, 2011; Durevall and Henrekson, 2011).

The above controversy provides the basis for the first research question of the paper: Do the S&T budgets of governments shrink along with sluggish economic growth (pro-cyclical) or do governments invest more in S&T during economic crises (counter-cyclical)? This question is further elaborated in accordance with the total public spending of EU nations, to conclude whether the government S&T budgets are more or less affected than total government expenditure? Recent studies have postulated that in the European context, the crisis affects new member states of the EU and, to some extent, the Southern European countries more due to their vulnerable S&T infrastructure and financial institutions (Archibugi and Filippetti, 2011; Filippetti and Archibugi, 2011). These notions give rise to the second research question of the paper: In a geographical sense, how do the government S&T budgets of the 27 EU countries compare with each other in relation to their responses to the economic crisis?

### 3. Data and methodology: government S&T budgets

As Richardson et al. (2004) state, a government's primary influence over science comes through the budget. The governments' investment decisions on S&T are frequently scrutinized in terms of allocation between disciplines, for example, and serve as a tool for competing interests in arguments for increased funding. In fact, the scientific community has been able to successfully argue for more and more funding; an enduring trend of S&T budgets has been a nearly constant increase in funding (cf. Richardson et al., 2004; Benavente et al., 2012). In response to the recent economic downturn, however, many European governments have had to reduce spending, which will also likely affect government S&T budgets.

Because good S&T statistics require the sustained effort of national statistics agencies (Stead, 1992), it is appropriate to use ready-made data provided by official statistics authorities. For this reason, we obtained our data from the databases of Eurostat (2012). The data used here are based on government budget appropriations or outlays for research and development (GBAORD). Previous studies have utilized GBAORD data for measurement and estimates of national S&T activities (e.g. Niwa and Tomizawa, 1996; Ebersberger, 2005; Moon and Lee, 2005). These data differ from

**Table 1**

Eurostat's Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS) 2007 classification.

(1) Exploration and exploitation of the earth
(2) Environment
(3) Exploration and exploitation of space
(4) Transport, telecommunication and other infrastructures
(5) Energy
(6) Industrial production and technology
(7) Health
(8) Agriculture
(9) Education
(10) Culture, recreation, religion and mass media
(11) Political and social systems, structures and processes
(12) General advancement of knowledge: R&D financed from General University Funds (GUF)
(13) General advancement of knowledge: R&D financed from sources other than GUF
(14) Defense

Source: Eurostat (2008).

the more commonly used government-financed gross domestic expenditures on research and development (GERD) in two main respects (OECD, 2002; Dinges et al., 2007): (1) government-financed GERD data are based on reports by research and development (R&D) performers, whereas GBAORD (derived from annual budgetary accounts) are based on reports by funders; (2) the GERD-based series cover only R&D performed on national territory, whereas GBAORD also includes payments to foreign performers, including international organizations [about 5–20% of the national S&T budgets of most countries are allocated to international science activities (Wagner, 2002)]. Here, we used the NABS classification of 2007 (Table 1) to evaluate different socio-economic objectives to provide information on priorities and shifts in public R&D funding (also OECD, 2003; Dinges et al., 2007). However, it is acknowledged that public R&D is also likely to be shaped by scientific opportunities and not merely by socio-economic objectives.

The data were gathered from 2006 to 2010. To correspond to the analysis by Filippetti and Archibugi (2011); 2009 served as benchmark year signaling the onset of the recent economic crisis, but with these later data, we carried out comparisons and standard statistical tests between 2010 and a time period preceding the crisis (2006–2008) in order to answer the research questions presented earlier. Unfortunately the data do not cover 2009–2010 for Greece (probably the most interesting country case to investigate in light of the heavy cuts and savings programs imposed to secure state loans). Thus, the response to the crisis in terms of Greece's government S&T budget is unobservable with the data used here. Additionally, a few individual values (ca. 0.9%) are also missing from in the dataset.

### 4. Results

Despite the recent economic downturn, in absolute terms, government S&T budgets are still growing in many EU countries (Appendix 1). However, in only a few countries did the growth pace of government S&T budgets continue to increase. In most cases, such growth has either leveled off or decreased along with the slowing GDP growth (Appendix 1). Prior to the crisis, only two countries (Sweden and the United Kingdom) had a negative growth pace of total government S&T, unlike twelve countries after the crisis struck. A general observation from the data is that, where the total general government expenditure has decreased (Appendix 1), the S&T budgets have shrunk accordingly (Fig. 1): the ratio of the S&T budgets share of the total government expenditure has remained roughly the same in most countries. There were, however, regional variations: some countries exhibited relatively stronger decline in S&T budgets than in total government expenditures. This applies in particular to Latvia and Lithuania. In Ireland the S&T budget was cut

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