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The effect of public support on investment and R&D: An empirical evaluation on European manufacturing firms

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ABSTRACT

This paper investigates the effect of government support on investment and on R&D expenditure. The empirical analysis is based on a large representative and cross-country comparative sample of manufacturing firms across seven European countries. Estimates from a non-parametric matching procedure suggest that public grants have a positive effect both on firms' investment and R&D, implying that recipient firms spend more than they would have without public aid. This may suggest that the possibility of perfect crowding out between private and public funds can be rejected. More in detail, grants appear to consistently affect traditional investment and similarly, R&D incentives have a positive impact on research spending. The paper also finds that grants trigger the use of long medium term credit suggesting that public policy may possibly help firms facing financial constraints and foster their growth. Finally, the analysis reveals some heterogeneity across the seven countries considered.

1. Introduction

Government financial support has become common in industrialized countries. It is believed that public grants will result in additional private investment that would not occur without public aid. Market failures in real and financial markets offer support for this, as the return may not be sufficient to justify private investment. The large consensus on the use of public support is based on the inefficiencies of the market. These may cause gaps between private and social returns on investment, and as a result, less than optimal levels of physical capital and research. For instance, incomplete appropriateness of research output and externalities deriving from the public good nature of R&D are at the base of this (Nelson, 1959; Arrow, 1962). There may be asymmetric information about the expected outcome and sunk costs in R&D investment. Moreover investment in R&D is riskier than investment in physical assets, and as a result, there are likely to be more financial constraints (Hyytinen and Toivanen, 2005; Czarnitzki, 2006).

The main objective of this work is to estimate the effect of participating in a public programme in investment and R&D expenditure in a sample of European manufacturing companies. Data refer to firms in seven European countries, namely Germany, France, Italy, Spain, the UK, Austria and Hungary. Although there is common consensus about the importance of investment and R&D on competitiveness and aggregate growth, we observe a quite different variety of attitudes across firms and countries.

The analysis also attempts to specifically investigate the possible effect of R&D fiscal facilities on firms' research spending. The effectiveness of this type of incentive might well be different from others. It can be the case that firms use public support simply to substitute internal funding with public funding. On the other hand, tax facilities support private R&D that is actually realized by the firms. However, the actual impact of the tax credit on R&D spending may be overestimated given that, as a reaction to the tax credit, firms have an incentive to maximize their amount of reported R&D in order to qualify for the credit (Hall and Van Reenen, 2000).

The novelty of this work lies mainly in two aspects. First, it investigates the effect of different dimensions of government support (namely investment incentives and R&D direct and fiscal R&D incentives) of a firm's investment and R&D expenditures. Second, the empirical investigation is based on a new and wide survey with combined datasets of seven European countries which represent the largest economies in the EU. This differentiates it from previous works based on single country samples.

From a methodological perspective, this work applies a non-parametric matching estimate of the average treatment effect in order to measure the impact of subsidies on investment and R&D expenditure.

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The idea is to investigate whether the supported firms would have invested the same amount had they not received assistance, by comparing the results for participants in national support programmes with those of an appropriate control group of non-participants. Employing a selected group of covariates, the propensity score method (PSM) is employed to determine the probability of receiving support and to find counter-factuals for each recipient firm. Each subsidised firm is matched with a "twin" non-subsidised counterpart, which has the same probability of being subsidised.

The results indicate that grants have significant positive effects on both the level of investment in physical assets and R&D spending. This is in line with Czarnitzki et al. (2007), Görg and Strobl (2007), Aerts and Schmidt (2008) and Hussinger (2008). Firms receiving subsidies realize levels of investment spending that are greater than they would have been without public support. Hence, the hypothesis of full crowding-out effect of public funding can be rejected. From the analysis it emerges that grants positively affect the level of physical investment regardless of whether firms are R&D committed or not.

Given the substantial heterogeneity in the conditions for eligibility and granting decisions, the analysis is carried out at single country level. Country estimations reveal strong and statistically significant evidence of a positive impact of public support of a firm's investment for Germany, Italy, UK and France. No evidence is found for Spain, Austria and Hungary. It also emerges that the effect of R&D incentives is positive and statistically significant for all countries considered except for Hungary.

Finally, this paper also investigates whether grants affect the long-term bank financing that firms have access to (Atzeni and Carboni, 2008; Meuleman and De Maeseneire, 2012). The results show that subsidised firms receive additional benefits deriving from the influence that grants have on their use of long-medium term bank credits to finance investment and R&D activity. Long-term financing are in fact crucial for assets and projects, and thus for firms' growth. The analysis shows that granted firms make use of an additional 5% credit to finance their investment expenditure compared to non-granted firms. Hence, grants may be an important way of helping firms to overcome their financial constraints and thus boost investment (Hall, 2002; Hyytinen and Toivanen, 2005). This is in line with the idea that grants have complementary effects on credit financing with additional general effects on investment (Feldman and Kelley, 2006) .

The paper is structured as follows. Section 1 briefly summarises the literature. Section 2 contains the characteristics of the data and the descriptive statistics. Section 3 describes the matching procedure. Section 4 outlines the conclusions.

2. Background and literature

The crucial role of investment in tangible capital as a source of economic growth as predicted by the growth theories (Romer, 1994) is commonly recognized. Investment is found to be among the most robust explanatory variables of a country's growth (Sala-i-Martin, 1997). At the same time, new models incorporating the idea of Schumpeterian imperfect competition have been built on the idea that growth is the result of intentional efforts by firms in carrying out R&D. Their main conclusion is that R&D expenditures are central for competitiveness of firms and for the sustained long-run growth of an economy (Grossman and Helpman, 1990; Romer, 1990).

R&D and tangible investments are strictly correlated under different aspects. Innovative activities may require additional facilities and equipment to be created and involve physical investment by the firm. According to Lin (2012) R&D expenditures increase the productivity of physical capital and reduce production costs, so that a firm's expected returns on physical investment are increased. Expecting higher returns on investments, R&D firms are more likely to bear high capital costs, and therefore invest more.

Given all this, the fact that gross capital formation decreased by 1.8% in Europe between 2004 and 2014 (Eurostat, 2015) is a source of concern. In 2007–2009 (the outbreak of the global financial crisis) for instance, the investment rate of non-financial corporations declined by over 12% in Spain, and by 3.1 and 2.6 percentage points, respectively, in Italy and the UK. In this situation it might be of particular value to examine the effects of government support on firms' physical investment and R&D expenditures.

In this framework the analysis of the driving factors of R&D represents a key topic for policies and scholars. The use of public incentives to stimulate private R&D activities is a common practice in many countries. According to Eurostat (2009), the public share in R&D activities in the period from the mid-1990s to the mid-2000s amounted to about 35% in the EU27, 30% in the United States, and 18.5% in Japan. Furthermore, a sizeable amount of public funds is actually used to subsidize R&D expenditures of private firms.

Generally speaking, public aid is designed to encourage firms to carry out investment by lowering marginal costs and decreasing the uncertainties that are typically connected to this activity. Particularly in the R&D field, financial constraints due to capital market imperfections have been considered as a major reason for government intervention in private R&D expenditure. From this respect, researchers and policymakers generally agree on the desirability of subsidizing private R&D activities (see Zúñiga-Vicente et al., 2014, and Becker, 2015 for a comprehensive literature review of the effect of public R&D policies on private R&D for different economies).

Commonly, public R&D policies are represented by tax allowances and direct public subsidies. The empirical evidence suggests that these two tools assert positive effects on private R&D investment particularly for small firms, which are likely to experience relatively more external financial constraints. Hall and Van Reenen (2000) for instance, conclude that, although there is considerable heterogeneity in the findings of different studies, tax credits positively affect R&D expenditure (Klette et al., 2000; Jaffe, 2002). However, it might also well be the case that the grants are awarded to larger firms that would have performed the R&D even in the absence of the public subsidy, in which case tax credit could be rather more an efficient policy tool as they support the private R&D that is actually expended by the firms.

Huergo et al. (forthcoming) found that Spanish firms can be induced to perform R&D activities by means of loans. Exploring the effect of public subsidies on corporate R&D investment in a sample of Chinese manufacturing firms, Dai and Cheng (2015) suggest that public subsidies follow an S-shaped relationship with the firm's total R&D and an inverted-U correlation with private R&D investment. In addition, positive indirect impacts are also expected to spill over to other firms in the system. For instance, Funk (2002) finds that that basic research generates large international spillovers and suggests that this should be considered by public research policies. These may have beneficial effects on the financial resources available to the firms. If these increase, the incentive has a positive effect on investment; conversely, subsidies turn into simple substitutes for financing, with negligible effects on investment. Carboni (2013) found that public programs positively affect firms' R&D external collaboration strategies.

Investment spending only increases if the grants stimulate firms to undertake projects that would be unprofitable in the absence of public support (Jaffe, 2002; Klette et al., 2000; Wallsten, 2000; Tokila et al., 2008; Carboni, 2011). Investment in fixed capital is costly, especially when investment has a low degree of reversibility. In real option theory, a generally negative relationship between investment and uncertainty is predicted, because high uncertainty is associated with high risk and therefore uncertainty causes investors to reduce investment in fixed capital (Pindyck, 1991). During recessions (as in the period considered here), firms may decide to cut investment to reduce costs.

Several studies have focused on the difference between the source of financing of physical investments and R&D. Mairesse et al. (1999) argue that the riskiness of innovation projects and the hidden-information nature of these projects induces firms to finance R&D internally. This is different from what happens for physical investments. However, they do

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