

## **Proposal Innovation in newly public firms: The influence of government grants, venture capital, and private equity**

### **1 Summary**

Countries within the EU have devoted significant resources to promoting innovation within small and medium-sized enterprises (SMEs) and facilitating their access to capital. A particular focus has been on ensuring that companies get access to resources with which to engage in innovation and R&D, which is argued to have flow-on benefits for the economy.

Governments have focused resources on facilitating innovation in SMEs by both encouraging early-stage VC and PE investment and by funding grants. In relation to research, Ireland spent €802 million on innovation-incentives in 2012 (Ferguson, 2013). Ireland is not alone in pursuing this R&D led growth policy and in the current economic climate it is essential to analyze and optimize the benefits of such investment. Outside of Europe, the Australian government budgeting AUD 332.7 million for the 2012 financial year (Innovation Australia, 2012, p158). However, it is almost a decade since Ireland's Enterprise Strategy Group's (2004) policy report (Ahead of the Curve- Ireland's place in the 21st Century) recommended that Ireland needed to build its technological and applied research and development (R&D) capability, to support the development of high-value products and services. And, it remains unclear whether such grants encourage innovation. Similarly, several countries have directed resources towards incentivizing VC funds to invest in innovative start-ups, such as the 'Innovation Investment Fund' (IIF) scheme in Australia. Yet, there is a lack of evidence on whether such schemes achieve the goal of facilitating innovation and the best way for governments to target such incentives.

There is currently little large scale empirical evidence on the factors that drive innovation, the role of grants in innovation and attracting private-sector investment, and the subsequent role of such investment in influencing innovation. The most relevant recent European research is in Roper and Arvanitis (2012), who focus on innovation in Ireland and Switzerland. Using survey data, they examine the innovation value chain (IVC), and separately analyse whether in-house R&D and other factors (including government support) help drive product and process innovation, and sales from innovation. They also examine the link between productivity (measured using value-added per employee) and innovation, and find some evidence that process (product) innovation increases (decreases) productivity. Other factors, however, are likely to moderate the benefits to innovation, including corporate governance and industry characteristics (see e.g. Giroud and Mueller, 2010, 2011). Furthermore, there is little direct evidence on the inter-relationship between government grants and VC/PE funds, and innovation, and the role of such grants in attracting private investment.

This project aims to address the gaps in the evidence on the role of grants and VC/PE funds on innovation. The study will analyze several issues: (1) Do government grants tend to achieve their purpose of encouraging innovation in SMEs? (2) Can the presence of a grant attract future funding for SMEs in the form of access to VC/PE investment? (3) Does such VC/PE investment help to encourage innovation and does it complement government grants? (4) What types of VC/PE funds are most apt to encourage innovation in SMEs; and thus, which funds should governments target with incentive schemes?

### **2 Methodology and research strategy:**

This study involves empirical investigation of innovation in SMEs. The study focuses on a detailed dataset from Australia, which can yield implications for Europe. Analyzing the Australian market provides several advantages. Latent macroeconomic factors that could drive innovation (see e.g. Anokhin and Wincent, 2012) are subdued. In high-innovation regions (i.e. the U.S. and Europe), it can be relatively more difficult to identify whether funds cause an increase in innovation, or whether innovativeness arises due to other macroeconomic factors. That is, it is relatively more difficult to eliminate macroeconomic factors as an alternative explanation for observed high innovation levels. By contrast, Australia is a country that has strong sovereign governance and well-developed principles of corporate governance (Humphery-Jenner and Powell, 2011; Gallagher et al., 2012), but has historically

featured relatively low levels of innovation (Gans and Stern, 2003; Gans and Hayes, 2010). Thus, in Australia, a relation between VC/PE backing and innovation is likely to reflect the impact of this backing; by contrast, in high-innovation countries the relationship between VC/PE backing and innovation may reflect other latent economic-growth factors. Further, the government grants in Australia are competitive, in contrast to semi-automatic R&D subsidies, assuring that the grants possess market-based characteristics.

The study will use a sample of 436 (already identified) firms that list on the Australian Stock Exchange (ASX) between January 1995 and December 2005. As in Bruton et al (2010), the study examine newly public companies at the point of their IPO (initial public offering). We analyze the level of innovation inputs (R&D expenditure) and outputs (patents), and the quality of those outputs (patent citations) and distinguish whether the company had a government grant, VC backing, or PE backing at the time of listing on the Australian Stock Exchange.

The study will analyze several models to analyze the innovation-benefits of grants and VC/PE backing. It will also analyze the role of different types of VC and PE funds in facilitating innovation.

$$Innovation_i = \alpha + \theta^{(1)}VC backed_i + \theta^{(2)}PE backed_i + \theta^{(3)}Grant_i + \beta^T X_i + \lambda_t + \delta_{i(j)} + \varepsilon_i \quad (1)$$

$$Innovation_i = \alpha + \theta^{(1)}VC backed_i + \theta^{(2)}PE backed_i + \theta^{(3)}Grant_i + \beta^T X_i + \psi^T F_i + \lambda_t + \delta_{i(j)} + \varepsilon_i \quad (2)$$

$$Innovation_i = \alpha + \theta^{(1)}VC backed_i + \theta^{(2)}PE backed_i + \theta^{(3)}Grant_i + \theta^{(4)}[VC backed_i \times Grant_i] + \theta^{(5)}[PE backed_i \times Grant_i] + \beta^T X_i + \psi^T F_i + \lambda_t + \delta_{i(j)} + \varepsilon_i \quad (3)$$

Where, *Innovation* represents the measures of innovation (i.e. *R&D spend*, *Patents*, or *Patent Citations*), *X* represents a vector of control variables, and *F* represents a vector of VC/PE-specific attributes. The terms  $\lambda_t$  and  $\delta_{i(j)}$  represent a set of year dummies and industry dummies, respectively, which we use to mitigate concerns about unobserved heterogeneity (Gormley and Matsa, Forthcoming; Petersen, 2009). The models are Tobit models with a lower bound of zero. All models cluster standard errors by industry group. The study will mitigate concerns over endogeneity and sample-section by using two-stage, propensity score, and weighting techniques, as appropriate.

The study will further examine the role of government grants in encouraging private-sector investment. It will do so with a model of the following form:

The model includes year dummies, industry group dummies, and clusters standard errors by industry group (following Petersen, 2009) and has the following form:

$$VC/PE Backing_i = \alpha + \varphi Grant_i + \beta^T X_i + \lambda_t + \delta_{i(j)} + \varepsilon_i \quad (4)$$

Where, *VC/PE Backing* is an indicator in three separate models that the IPO company receives either VC or PE backing, PE backing, or VC backing, *Grant* is an indicator that the firm received a government grant, *X* is a set of control variables,  $\lambda_t$  is a set of year dummies,  $\delta_{i(j)}$  is a set of industry dummies, and  $\varepsilon_i$  denotes the standard error, which are clustered by industry group.