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## The equity gap and knowledge-based firms

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## ABSTRACT

The equity gap, the difference between the amount of (risk) capital that would be invested under conditions of well-informed and competitive markets and the amount of capital actually invested, covers both startups and ventures moving beyond startup to the establishment and early growth phase. We provide estimates for the size of the equity gap for firms facing later stage financing issues, the second equity gap. This 'second' equity gap relates to a second so-called 'valley of death' in financing the growth phase, and is particularly pertinent for knowledge-intensive (KI) firms. We utilize a unique panel database covering the population of limited companies, which includes 2852 VC backed companies and 4048 deals. Using propensity scoring methods and multivariate models determining investment demand we screen the corporate population for potential VC investments and estimate the size of the equity gap in total and the KI firms that face, potentially, the second equity gap as a subset of our total estimates.

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## 1. Introduction

There is a long-standing and contentious debate about the funding gap or valley of death in funding private entrepreneurial ventures. The 'Valley of Death' literature identifies a funding gap during the stages in the innovation process beyond basic research to the formulation of a business plan for the commercialization of products and services (e.g. [Auerswald and Branscomb, 2003](#); [Beard et al., 2009](#); [Frank et al., 1996](#); [Wessner, 2005](#)). Much of the extant theoretical literature on funding gaps focuses on credit markets and debt finance ([De Meza and Webb, 1987](#); [Stiglitz and Weiss, 1981](#)), but more recent attention has also highlighted the gap in provision of equity finance ([Cosh et al., 2009](#); [Cressy, 2012](#); [Cumming and Johan, 2013](#); [Lopez de Silanes et al., 2015](#)).

Building on recognition of its presence, we estimate the size of the equity gap for which there is little systematic quantitative evidence using data from the UK corporate sector. The equity gap concerns the difference between the amount of (risk) capital that would be invested under conditions of well-informed and competitive markets and the amount of capital actually invested. It is an outcome of market failure arising from informational asymmetry issues when entrepreneurs have more knowledge than potential investors, when customer-bases, markets and technology are new and when potential investees have no or little credible track record ([Busenitz et al., 2005](#)). These problems are likely to be heightened in knowledge intensive firms which require greater sunk cost investment and are likely to take longer to generate revenue after product/service development since their customer bases and offerings are more complex and/or client specific and assets are intangible. The challenges are exacerbated in rapidly changing environments, such as web-based technology, apps, etc.

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These factors combine to make risk assessment, viability and revenue projection problematic for venture capital investors (VC) that are reluctant to invest, thus increasing the equity gap. Valuing firms with innovative but complex business models, intangible assets (and hence low collateral value) and where founder/directors have a wide range of technical and business expertise is challenging. Enterprises successful in acquiring equity investors are able to overcome informational asymmetries by demonstrating, communicating and signaling desirable attributes to outside investors. Equity gaps tend to be persistent in comparison to the transitory rationing of loan finance due to disequilibrium in credit markets related to changing demand (excess demand) and supply conditions (reduced supply) (Atanasova and Wilson, 2004). The scale of the equity gap is clearly worsened by recession, as in recent periods, when the supply of VC investment fell alongside a severe decline in bank lending (Fraser, 2012).

Few papers have rigorously directly estimated the size of the equity gap (see Cressy, 2002, 2012 for reviews). Lopez de Silanes et al. (2015) estimate the finance gaps of SME's in an empirical study of five European countries (Germany, France, Netherlands, Poland and Romania). The authors estimate demand and supply for both loans and equity finance for all SME's using a combination of aggregate publically available data on SME finance and SME survey data. The authors report estimates of equity gaps ranging from around 1 to 13% of GDP in the selected countries, some three to five times larger than estimates for the US economy. However, the authors do not investigate subsamples based on industry, technology, age, size etc. Cosh et al. (2009) and Lockett et al. (2002) show that SMEs and high tech firms face financing constraints in accessing equity capital. Harding and Cowling (2006), on the basis of GEM data and a survey of industry experts, find evidence of an equity gap in the UK in the £150,000 to £1.5 million range in the period 2001–3.

Some studies are sanguine about the existence of an equity gap, pointing to the substantial extent of venture capital investment at lower value ranges suggesting that the problem essentially lies in poor quality demand (Library House/UBS, 2006). Other studies have debated whether the equity gap is spatially related (Aslesen and Langeland, 2003; Fritsch and Schilder, 2007; Mueller et al., 2012) in that both funders and investees may be regionally or locally clustered. Governmental funding initiatives have tended to address this equity gap for seed and start-up stage ventures requiring funding for the development of proof of concept and prototypes (Cumming and Johan, 2013; Cumming et al., 2016). However, these sources oftentimes provide little opportunity for the follow-on funding needed for these firms to grow beyond start-up.

Practitioners and policy-makers are therefore beginning to recognize the existence of a second valley of death (e.g. Sadler, 2016) which gives rise to a second equity gap involving somewhat older and larger firms beyond the initial startup revenue generation phase. Interview evidence from fund managers and business owners, for example, suggests that the equity gap in the UK is positioned well beyond the £2m investment level for early stage high tech ventures with long lead times to market and high set-up costs and as much as £10m some seven years ago (Baldock and North, 2012; SQW Consulting, 2009; Rowlands, 2009). There is evidence of an increase in the funding of growth stage deals in the above £10m investment category, but investment in the later venture stage between these two categories has declined (British Business Bank, 2014; BVCA, 2014). Clarysse et al. (2007) conclude from their study of spin-offs from universities that the availability of suitable funding sources is now more of a problem at the stage beyond start-up where the venture begins to need significant levels of funds to realize growth potential beyond initial revenue generation.

While this gap between initial funding provision and the venture becoming viable through generating significant revenues is recognized, there is an absence of systematic assessment of the size of this gap. This is an important omission both from a research perspective as well as for policy. For policy instruments, such as tax incentives (Litan and Robb, 2012), to be designed to encourage VCs to invest in these firms in order to address the gap it is important to have a clear understanding of the scope of the problem. In this paper, therefore, we seek in addition to estimate the size of this second valley of death equity gap for KI firms moving beyond the start-up to the growth phase. In doing so we outline a methodology for screening the corporate sector that may have utility for policy makers and practitioners.

Using data for the UK corporate sector, we construct a novel dataset covering the period 2004–2014 comprising 12.2 million 'active' company-years to which we match data on all known VC backed deals from proprietary databases.<sup>1</sup> In total we have data on 2258 individual VC backed enterprises over the period covering 4048 individual investments. In addition to compiling a panel of financial and non-financial company characteristics we match firms to manufacturing and service technology or knowledge intensity, using NACE codes.<sup>2</sup> We construct variables from 'event' filing and director and shareholder records that capture relational capital, expertise and resource-combination 'signals' that differentiate target VC investees from other companies. Thus we profile the financial and non-financial characteristics of VC backed enterprises in the period before investments. For the corporate population we construct variables capturing director and board characteristics and ownership structure. Foreign owned firms, subsidiaries, listed companies and companies that are part of a group can be identified and eliminated as potential VC targets. Analysis of shareholder records facilitates the identification of companies that have received equity finance during the time period so that these can be eliminated from the VC target sample. A proprietary database<sup>3</sup> of all private equity backed firms is used to profile PE targets as distinctive from VC targets. We use a combination of matching techniques and multivariate propensity score modeling and derive the equity gap from estimating the total potential demand and subtracting the known supply of venture capital.

Our study, therefore, contributes by providing novel in-depth quantitative evidence on the size of a second equity gap or valley of death for KI firms that have been neglected by prior research. Our findings emphasize the importance of looking beyond the first equity gap for very early stage firms. The method explores the potential of screening the corporate population for VC targets a technique that may have utility both for practitioners and policy makers.

The structure of the paper is as follows. We first review the relevant literature concerning equity gaps. We discuss the distinctive characteristics of firms that seek equity finance. We then outline the empirical strategy we adopt and provide estimates of the size of the gap.

<sup>1</sup> NESTA and Zephyr.

<sup>2</sup> NACE is the acronym for "Nomenclature statistique des activités économiques dans la Communauté européenne", the European statistical classification of economic activities.

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