The Equity Gap and Knowledge-based Firms:

Executive Summary

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Executive summary

In this paper[1] we first review the relevant literature concerning equity gaps. We distinguish a first equity gap for seed and early stage start-up firms from a second equity gap relating to firms moving beyond start-up to the growth phase. We then outline the **empirical strategy we adopt to examine the equity gap** for knowledge intensive sectors and firms in relation to follow-on capital.

Section A: Theory

The equity gap can be defined as 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. The **equity gap is an outcome of market failure** arising from imperfect or asymmetric information between finance providers and viable businesses. The sub optimal provision of funding to firms with growth potential provides **a rationale for government intervention** in venture financing. A further argument for intervention is the existence of **innovation spillovers** i.e. positive externalities to R&D spend and innovation. The argument in favour of positive externalities is particularly strong.

It is increasingly recognised that the nature of the equity gap has changed over time along with the growth of the knowledge intensive (KI) sector[2] and 'combinatorial innovations' in recent years. The scale of the equity gap is **clearly exacerbated by recession** and by the decline in bank lending in recent periods.

Sources of informational asymmetry and market failure in the knowledge intensive sector relate to the **longer development period** required by knowledge intensive firms in order to reach the point of generating stable revenues and accessing mainstream finance. For knowledge intensive firms revenue generation takes longer after product/service development since customer bases are more complex, necessitating greater sunk cost investment and oftentimes repositioning of the business in the process of developing sales before cash flows are generated. The '**relationship specific investment'** in the customer-base required to make sales and retain customers can be very high and longer term.

The **valuation of such knowledge intensive** businesses by venture capital firms poses major challenges in a sector with large numbers of new entrants and evolving complex and combinatorial technologies. In the absence of clear information about the acceptability of the product in the market or the size of the market, or where assets are intangible, classic valuation techniques are of little use. Knowledge-based businesses generate cash flows from investments in intangibles rather than from physical assets and labour. Investment in **intangible knowledge-based assets** includes R&D, design, brand equity, software, and human and

[1] A full version of the paper is available from the authors.

[2] We identify primary industry sector using standard industrial classifications and NACE code classifications of technology and knowledge intensity. NACE (Nomenclature of Economic Activities) is the European statistical classification of economic activities. NACE groups organisations according to their business activities.

organisational (relational) capital. This is both difficult to value and does not provide clear collateral for investors.

The challenges are exacerbated in rapidly changing environments, such as internet technology, apps, etc. In such circumstances, knowledge intensive firms may need to run the existing and new business model side-by-side, at least for a transitional period. **As such they are likely to require significant injections of equity funding.** There may be insufficient expertise and slack amongst existing employees to make the change, requiring funds to hire new recruits. **To the extent that under-performing knowledge intensive ventures in the 4-12 year age range are maintained in a portfolio rather than liquidated these are likely to be ventures where there are expectations of improved performance rather than unviable ventures being propped up.**

Not all SMEs have growth ambitions requiring equity funding. However, about 72% of established SMEs are actively seeking to grow but about a quarter of firms believe that lack of access to finance had constrained their intentions to grow.

Venture Capital and Private Equity (Supply-side)

A general trend in the UK venture capital and private equity market is for funds to move away from smaller, early stage investments. Despite the growth in investable opportunities data from the venture capital industry shows that the number of companies receiving **VC investments experienced a modest rise up to 2007 but then fell sharply during the recessionary period**. While there was a slight recovery in 2011 and 2012, this was short-lived and numbers declined again in 2013 and still stand some way below the level of a decade earlier. The numbers of companies invested in are largest for early stage VC and lowest for seed stage. Interestingly, numbers are lower for later stage VC than for early stage VC.

Private equity has been a major player in the provision of growth finance and finance for restructuring. However, throughout the 2000s, the trend in the number of deals completed has fallen sharply. Moreover investment deals by private equity firms show a sharp decline in the post recession and recovery period from 2009.

Traditional **private equity** firms typically possess more financially oriented expertise and may be **limited regarding the expertise required to assess and add value to firms in this sector with knowledge-based activities.** Our analysis of the sectoral distribution of UK management buyouts and buyins shows that most management buyout and buyin activity in these size ranges involves firms in more traditional sectors such as leisure, and retail and wholesale distribution, where there are typically substantial tangible assets, and significant cash flows. Other traditional sectors to figure highly are business services and manufacturing where there are stable cash flows. A much lower level of buyout and buyin activity is evident in more knowledge intensive sectors.

Section B: Empirical strategy and exploratory analysis

Our empirical strategy in identifying the nature and scale of the equity gap in the UK corporate sectors and more specifically in ‘knowledge intensive’ sectors is guided by the theoretical

literature, propositions and the extant evidence. There is no one accepted methodology for estimating the nature and size of the equity gap and indeed there is limited previous empirical work in the area. Therefore we adopt a range of exploratory analysis of data using a combination of descriptive and advanced econometric methods.

We combine a number of unique and relevant data sources to provide a comprehensive analysis of the UK corporate sector, including observed venture capital and private equity investment over a period covering two cycles. The core database is constructed from the filings of all limited companies to Companies House over the period from 1995-2015. A company level data panel rich in constructed financial and non-financial variables has a core of around 28 million company-year observations. However we restrict much of our analysis to the period 1998-2013 and select only companies that are 'active' which reduces the sample to some 18 million company-years. Industry codes and incorporation dates are used to match industry and age variables to each firm in the panel. Industry codes are matched to NACE codes.

To the core data we match data on all known **private equity deals** in the time period along with deal and sector information. We have over 43,000 company year observations on private equity deals and are able to track these companies pre and post investment. We analyse information on a large sample of **companies known to have had VC investment** (first stage through to later stage), these firms are matched to the core database. The venture capital sub-sample has data on the year the company received venture capital funding and the amount of equity funding that was received. The characteristics of these companies in terms of age, financial profile and industry sector are available within the population database and therefore the VC backed enterprises can be analysed as a distinct subsample of the corporate population.

The **characteristics of the VC subsample** are analysed using data within a one-year period of the company receiving funding i.e. before they received the funding. In total we have data on **1,678 individual VC backed enterprises** using these sources. We analysed the VC sample characteristics pre and post investment including the total investments by age and size and the average investment level per company. Additional analysis found that VC invested firms are likely to use a combination of debt and equity and that there is no significant change in debt levels post VC investment i.e. firms do not use equity capital to repay debt. A further analysis of 'Equity finance' can be undertaken from an analysis of shareholder records that are available in the core database from 2006 onwards. Thus in the core data it is possible to identify the changes in share capital of individual firms over the time period of interest and identify firms that have received some external investment from venture capitalists (VC shareholding sample).

Section C: Trends in the panel data

Sections C and D provide context and background for our further analysis. In Section C we profile, using company level, data trends in corporate demographics and industry structure, financing and asset composition. We show data on the **growth in the knowledge intensive sector and increase in asset intangibility.** This section highlights the features of the lending market in the post-recession period and the heavy reliance of smaller firms on short-term

finance in the absence of strong bank lending. It is apparent that many smaller firms are financing growth with trade credit. We focus in Section D, in more detail, on the incidence and trends in the knowledge intensive sector.

Section D: Analyses of Knowledge Intensive sectors, growth and distress

Multivariate analysis explores the determinant of firm level growth and financial distress and failure. This analysis shows evidence of the **growth and complexity of the knowledge intensive sector and the relatively high levels of intangible assets compared to non-KI companies**. The analysis of financial distress and failure, within the context of multivariate failure prediction models demonstrates clearly that knowledge intensive firms have a longer incubation period during which they remain at a higher failure rate than non knowledge intensive firms. Whereas generally firms that survive to 8 years after incorporation are more likely to survive, **for the knowledge intensive subsample the estimated coefficients show that the age threshold before achieving stability is 11 years since the filing of the first set of accounts i.e. the 'active age definition'**.

Models predicting growth show the importance of changes in equity capital and **poor growth performance in the 5-12 years age group in recent periods** in contrast to earlier periods. The models highlight the prospects for growth of knowledge intensive companies indicative of particular problems accessing growth finance in the recovery period.

Section E: Private equity

Further detailed analysis of **private equity targets using our firms level panel data 1998-2013 supports the notion that private equity have and continue to target companies outside of the knowledge intensive sector** and choose targets that are more established, cash generative and profitable but can benefit from restructuring and further capital investment.

Section E provides evidence on the private equity target investments over the time period. Firms in High and Medium Tech Manufacturing and High Tech services are significantly positively related to being targets of private equity buyouts. Firms in knowledge intensive market and financial services sectors are significantly negatively related to being the targets of private equity buyouts.

Section F: Equity Gap Estimates

In Section F we utilise the sample of known Venture Capital backed enterprises in order to provide a profile that can be used to identify companies with similar characteristics that have not received funding. We use a combination of matching techniques and multivariate propensity score matching to create a treatment group (Firms that may require VC funding). A multivariate model determining the demand for Venture Capital is estimated and applied to this sample to determine the potential demand for VC funding. We identify firms that are likely to have received some external equity finance from shareholder records and exclude companies that are part of a group or have become insolvent.

The equity gap is thus derived from estimating the demand and subtracting the supply of venture capital. **The equity gap estimates represent a snapshot of unmet demand amongst the relevant company population at a given time. As such, they do not represent an annual requirement for firms, nor do they represent a lifetime figure of the companies funding needs. Instead they aim to provide an assessment of the typical funding required to overcome the market failure of information asymmetry at which point the firm should have reached a sustainable growth path.**

Consistent with the Rowlands report (2009)[3] we find evidence of an equity gap in the UK economy and particularly in the complex and fast growing knowledge intensive sectors where informational asymmetries and market failure are perhaps more acute. Moreover sectors where knowledge intensive technologies are combined (combinatorial technologies), provide a strong platform for growth in the UK economy.

The regression estimates suggest **a total potential demand for VC finance in the £10 to £15 billion range for the knowledge intensive sector.** Of course this is a potential unmet demand estimate but even if we assume that a small fraction of this sector of these are viable growth prospects that equity gap is still significant.

We are interested in estimating the maximum requirements to get over the market failure hurdle. We obtain estimates for knowledge intensive sectors within the range of £3 to £30 million per company investment. If we average fluctuations over the last 3 years in the sample this provides an investment range of £3.9 million for "other KI services" to £20.6 million for "KI-High tech services" required investment in KI firms. The data is consistent with support for equity investment up to £20 million for the knowledge intensive sector. The evidence suggested that KI firms take up to 10-11 years, using the active age definition, to establish and are in need of equity finance for longer periods than non KI firms. For KI firms we take a cautious approach and use the regression average since the median averages may be distorted by lumpy VC investments across the KI sectors. This is not the case for the non KI group. If we take a weighted combination for the last 3 years of the median averages (2011 -2013) and regression averages (2011-2013), for the non KI group, we arrive at a maximum average up to £14.4 million in equity support, who perhaps also have a shorter incubation period up to 7-8 years.

[3] Rowlands, C., *The Provision of Growth Capital to UK Small and Medium Sized Enterprises*, 2009