

The Role of Government Venture Capital Funds: Recent lessons from the UK experience

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Abstract

We investigate the effectiveness of government backed venture capital schemes (GVCs) in funding early stage entrepreneurial ventures. Addressing fundamental issues of additionality, crowding out, economic impact and sustainability, we discover that UK GVC-backed schemes have evolved to provide more effective, targeted, funding for high growth potential firms. Combining primary data from a number of sources, we discover positive impacts of increases in turnover and employment in funded ventures, along with effective targeting of specific funding gaps. Significant issues remain, including a lack of liquidity in follow-on funding and a requirement for longer time horizon in funds, as firms typically fall behind in development schedules. There is, therefore, a need for greater flexibility in GVC-backed funds. Policy designers should be cognisant of the changing external financing ecosystem when designing co-investment schemes.

Keywords: Government venture capital funds (GVCFs); Global financial crisis (GFC); Co-investment funds; Venture capital; Business angel financing.

Introduction

Many of the most successful venture capital (VC) markets globally are catalysed by government support (Lerner, 2009, 2010, 2011). Since the global financial crisis (GFC), government VC (GVC) scheme investment has intensified. This has been driven by governments' desire to support innovation, diversification and business growth (Lerner, 2010; Mazzucato and Penna, 2014; see UK BIS 2011, The Plan for Growth), by assisting potential growth businesses and enhancing the 'Vital 6%' of businesses that provide over half of all employment generation (Nesta, 2009). This has required addressing the broken seed and early stage finance escalator investment gaps created by retrenchment to later stage funding by bank debt and private VC finance (Cowling et al., 2012; North et al., 2013; Wilson and Silva, 2013). It also attempts to attract private investment, enhanced by increasing ability to attract foreign inward investment in the global information age (Hopp, 2010; Lerner, 2010; Lerner et al., 2005).

Within Europe, Cumming et al (2014) highlight the huge deficit of VC investment when compared to the US (in 2010 European VC investment represented 0.03% of GDP, compared to 0.09% in the US), pointing out that this has led to far greater levels of GVC scheme development to compensate. Indeed, European GVC doubled to €1.6bn between 2007 and 2011, increasing its share from 9.9% to 39.1% of the VC market (EVCA, 2013). In the UK, since the Dotcom crisis, the proportion of government funding in seed and early stage VC increased (Murray, 2007). Mason and Pierrakis (2013) found a rise from 20% to 68% between 2000 and 2008. This trend has undoubtedly continued post GFC, given that British Venture Capital Association (BVCA, 2013) member seed and early stage VC investments in 2011 and 2012 were similar (£350m) to 1999, prior to the Dotcom bubble. This phenomenon alongside recent large-scale data which cast questions over the value of GVC schemes (Grilli and Murtinu, 2014; Munari and Toschi, 2015), makes it apposite to take a closer look at recent post GFC developments in the UK.

In this paper we focus on GVC supply-side theories to assess scheme evolution and impact on the UK market, utilising a range of comparable early and mid-term assessments of the main UK GVC funds (GVCFs) operating in this period, namely the Enterprise Capital Funds (ECF), UK Innovation Investment Fund (UKIIF) and Angel Co-investment Fund (ACF). All three GVCs are hybrid co-investment schemes (Murray, 2007), designed to encourage matching public-private sector investment, with the private sector taking the lead in portfolio business investment selection (Lerner, 2010), and to be complementary in addressing different aspects of the seed and early stage entrepreneurial finance market (Baldock and North, 2015; Mason and Baldock, 2015). In combination these three schemes have, since 2006 had capacity to

invest upwards of £1.1bn¹, directed towards seed and early stage UK innovative and potential high growth businesses.

The paper initially summarises the theoretical context relating to the evolution and development of the UK's main GVCs before outlining the methodology used in the assessments of the GVCs. We then outline the key findings and consider the impact of the GVC schemes, before considering the implications for future research and policy development in conclusion.

Underpinning theories of GVC development

The main focus of this paper is supply side GVC theories, which relate to the rationale for government intervention in VC markets, addressing an equity gap and developing a VC ecosystem (Lerner's 2010 vision of developing professional VC support services). This includes the related design and implementation of GVC schemes, addressing the fit for purpose question. Demand side theories relate to the entrepreneurial ecosystem and whether there is an adequate supply of suitable young investible potential high-growth businesses (Mason and Brown's enterprise pipeline, 2013). As Cumming et al. (2014) note, if demand and supply are not adequately met, schemes tend to fail, underlining the importance of GVC design and targeting implementation.

Establishing a new UK finance escalator – overcoming escalator finance gaps

The need for GVCs arises on account of the break-down of the so-called funding escalator (NESTA, 2009), a supply-side theoretical representation of the different types of entrepreneurial finance available to businesses as they progress from seed finance through the stages of development to trade sales or IPO² (Deakins and Freel, 2012). This adopts Berger and Udell's (1998) entrepreneurial finance model explaining how the range of finance available to businesses changes and increases as they become less opaque and overcome information asymmetries with funders, demonstrating the importance of risk equity finance from business angels and VCs at the earlier funding stages. Mason and Baldock (2015), also adopt Myers and Majluf's (1984) pecking order theory of entrepreneurial preferences for types of finance, suggesting that within equity finance, some entrepreneurs will prefer more personalised and tailored angel finance over the more formal and less intensive support of VC managers.

Indeed, post-GFC the role of business angels as a source of early stage risk capital increased significantly within the UK and internationally (Wilson and Silva, 2013; OECD, 2011). There was no decline in business angel investment in the immediate

¹ ECF's (£850m UK government funding from three tranches – ongoing investing); UKIIF (£150m UK government funding matched by European Investment Fund and additional private funds – fully invested); ACF (£100m UK government funding – ongoing investing)

² Initial public offering (IPO) on a public equity market

Table 1: Summary of key trends underlying the evolving UK Finance Escalator

1. Banks retreated to a 'new norm' of not providing equity finance under loan terms and conditions and, therefore, not funding early stage businesses with less than two year trading records (Davis, 2011).
2. Private VCs continued to retreat from early stage investment, a trend traceable to the Dot.com collapse (Wiltbank, 2009) and evidenced by Murray (2007) and Mason and Pierrakis (2013).
3. A much tougher post-GFC investment exit market for trade sales and IPOs (given the illiquidity of the UK AIM³ public feeder market for small cap firms, Baldock, 2015) led to the extension of investment horizons (Mason et al., 2010; CfEL, 2013).
4. This led to the locking-in of angel and VC funds as investors were forced to maintain and continue to finance those companies in their portfolios that were unable to exit⁴ (or abort and lose investments).
5. Whilst angel capital groups have formed and moved upstream with larger size deals (GLA, 2013; UKBAA, 2013), the introduction of the Seed Enterprise Investment Scheme (SEIS) investor tax incentives in 2012⁵ revitalised the seed investment market, encouraging private seed VCs, emerging crowd equity (Seedrs, Crowdcube) and business angel activity, notably in London's Tech City (Baldock and Mason, 2015; UKBAA, 2015).
6. The exacerbation of the 'Rowlands gap' (Rowlands, 2009; SQW, 2009) for patient capital. Recent evidence from Baldock et al. (2015) found two persistent gaps for longer horizon (R&D taking 5 years plus to reach market) early and growth stage finance (particularly in the 2-5 year trading stage): first, the classic £200,000 to £2m gap which the UK's ECF and ACF are seeking to address and the second is the 'series A-B time-bomb' where larger scale £2 to £10m plus finance is required for relatively young pre-trading or early trading businesses with under the £5m annual sales turnover qualification for the Business Growth Fund (BGF)⁶. This has been addressed in part in the UK by UKIIF (which is key long horizon sector restricted) and potentially by the ACF's and enhanced ECF's⁷ ability to provide follow-on funding.

³ The UK Alternative Investment Market (AIM) for small cap firms, typically with less than £100m asset base.

⁴ More recently the UK exit markets have improved, with AIM becoming more liquid and attractive in 2014 (Baldock, 2015).

⁵ SEIS applies to investments into UK based companies with under 25 employees and up to £200,000 in assets with a maximum company allowance of £150,000 per annum and individual investment allowance of £100,000 per annum. Offering a maximum of 50% Income Tax relief and Capital Gains Tax exemption if shares are held for at least 3 years (HMRC, 22/10/2013)

⁶ The Business Growth Fund (BGF) was established in 2011 by five major UK banks to fund businesses with annual sales turnover of between £10m-£500m with between £2m-£10m. The initial threshold was subsequently lowered to £5m.

⁷ UK state aid limits were raised in January 2014 from £2m initial investment in portfolio companies to £5m, with total funding raised from 10% of fund limit (typically £3m) to £12m; representing an upper cap of 15% of enlarged funds, which are likely to at least double, with the doubling of the public fund contribution cap to £50m and a minimum match of one third private funds.

aftermath of the GFC, in marked contrast to trends in bank lending and venture capital investment (Mason and Harrison, 2015). This fundamentally damaged the, often critical, complementarity between business angel and VC funds, which, in turn, severely undermined the funding escalator (Gill, 2010; Mason et al. 2010) and necessitated angels to group together in order for follow-on investment to bridge the widening VC gap. Table 1 provides a summary of key trends, developed from Baldock and Mason (2015), which highlights the need for GVC intervention in the UK seed and early stage entrepreneurial finance markets, and notably to enable substantive capital investment for longer horizon R&D (Baldock et al. 2015) in order to facilitate a more fluid and efficient finance escalator.

Critique of GVCFs and emerging role of CIFs

Co-investment Funds (CIFs) are a relatively recent public sector response to these structural changes in the supply of entrepreneurial finance, evolved during a period of increasing perceived need and reliance on government interventions world-wide (Murray, 2007; Mason and Pierrakis, 2013; Wilson and Silva, 2013) to address the seed and early stage funding gap post the Dot.com crisis (2001). The co-investment model is particularly welcome given the fluctuations in supply of venture capital over business cycles and financial market fluctuations (Gompers et al. 2008)(Jeng & Wells 2000).

Agency failures (i)

Very few GVCFs have been deemed successful (Brander et al. 2008; Lerner, 2009; Colombo et al. 2014). Many have experienced agency failures (Akerlof, 1976) leading to inadequate approaches to information asymmetries (e.g. ineffective due diligence) and policy implementation. This has occurred through too much government control with investment decisions made by bureaucrats rather than experts (Lerner, 2001), or insufficiently skilled local VC managers in the case of the UK Regional Development Funds in the 2000s (Munari and Toschi, 2014).

A major finding of Lerner (2009; 2010), stemming from Israel's Yozma funds transformation of Israel's VC industry from 1993, was the importance of enabling private sector VC leadership and attracting leading, experienced fund managers internationally to take the lead on investment decisions (Baldock and North, 2015). Studies point to the importance of experienced hands-on private sector fund managers, indicating that successful VCs have niche "hard to imitate" knowledge of sectors and stages (BIS, 2011) and are persistent performers who build on their experience over time (Gompers et al. 2010; Zarutskie, 2010). This argument can be extended to the key role of experienced business angels in leading angel investment groups (Mason and Harrison, 2015).

Murray (2007) describes the development of private VC led CIFs as 'hybrid funds', where government provides a proportion of funding to lever matched funding from private VCs; as adopted by the New Zealand Venture Investment Fund (NZIF) in 2002 and UK's Enterprise Capital Funds (ECF) in 2006 (Baldock and Mason, 2015).

For the NZVIF this involved at least a 50% matching for up to NZ\$25m, whilst for ECFs a minimum of one-third matching funds was available for up to £25m of government funding⁸. Lerner (2010) also notes the importance of providing private investor incentives to encourage private funding leverage into deals. These can be generated directly through scheme upside investment returns (e.g. UK ECFs⁹), or through indirect tax breaks such as the UK's Seed Enterprise Investment Scheme (SEIS)¹⁰ for angel investors (Baldock and Mason, 2015).

Whilst Lerner (2010) indicates GVCFs with private VC manager portfolio investment improves targeting into viable businesses, he recognises that investments require regular monitoring to avoid market distortion and duplication (Leleux and Surlemont, 2003).

Design theories (ii)

Mounting evidence has also led to key GVCF design theories (Baldock, 2016). First, Lerner (2010), Technopolis (2011), Cumming et al. (2013) and Baldock and North (2015) recognise that funds require sufficient size, scale and range. Small-scale, regional and sector specific funds often fail to find sufficient high quality investments, or have insufficient funding for follow-on investments into their better performing portfolio companies. This leads to a failure to achieve Markowitz (1952) optimal VC portfolio fund size and follow-on investment to keep their best portfolio firms to a point of optimal exit, typically via trade sale or IPO (Cumming et al. 2013).

Second, Lerner (2010) highlighted Yozma's 10 year restricted Limited Partnership funds as encouraging a cycle of dynamic fund investment and return redistribution into new funds, overcoming the potential for mission creep and poor incentive to deliver returns experienced by evergreen public VC schemes (e.g. Murray et al. 2009, GVCFs in Finland). However, investment horizons for early stage investments to reach exit, notably post-GFC, have doubled from four to eight years on average between 2000 and 2015 (Mason and Harrison, 2015; Waddell, 2013; Axelson and Martinovic, 2012), requiring flexible 'long game' thinking in relation to VC programme length (Lerner, 2010)¹¹.

Thirdly, this has brought into sharper focus the need for second fund financing rotation (Baldock, 2016; Dittmer et al., 2014), or to revisit evergreen funding options (Baldock and Mason, 2015 e.g. through deal-based CIFs).

Finally, Hopp (2010) and Baldock (2016) introduce VC management practice as a way of smoothing portfolio company funding continuity through improved syndication between VCs and angel groups, notably in developing international investment and market opportunities. From the business angels' perspective, Botelho

⁸ Since the EU raised the state aid threshold in January 2014, ECFs can now offer up to £50m in public funding.

⁹ ECF public sector returns are currently capped at 3%.

¹⁰ A parallel Enterprise Investment Scheme (EIS) also operates in the UK for larger SMEs with under 250 employees and £15m assets.

¹¹ For example, the UK ECFs are 10 year LPs, which the private fund managers can request to extend to 12 years

(2015) develops Wenger et al. (2002) communities of practice theory, suggesting that angel group and syndication investment can enable diffusion of best practice angel investment, raising investment quality and improving ability to syndicate, follow-on fund and successfully exit.

The emerging role of Angel-Oriented CIFs (A-OCIFs)

CIFs have evolved into two distinct government matching funding categories: private VC managers (discussed above); and individual private investor (business angel or VC) deals, as in the case of the ACF.

CIFs emerged from the early 2000s, focusing on providing government funding which could be matched to individual business investment deals. Many, such as the pioneering Scottish Co-investment Fund and New Zealand Seed Co-investment Fund, primarily operate with business angels in responding to the early stage funding gap vacated by private VCs during this period (Murray, 2007; Mason and Pierrakis, 2013). A-OCIFs are typically evergreen in design, working on a revolving fund principle of reinvesting returns. In the post-GFC economic environment with increased investment exit timetables, the greater flexibility afforded to the evergreen ACF is considered by industry experts (BVCA, UKBAA, EIF¹²) to be a considerable advantage (Baldock and Mason, 2015). Wilson and Silva (2013), along with EBAN (2012) and OECD (2011) reviews, indicate a small, growing number of A-OCIFs dedicated to angel investment operate at national and regional scales. They have several common features, typically investing up to a maximum of half the total investment in the business with an upper limit to the size of its investment under the EU state aid limit of £2m, matching funding on a like for like *pari passu* basis (i.e. with no direct private sector return incentive). An important contrast between A-OCIFs is whether they guarantee to match funds to approved investors, as in the case of the Scottish CIF, or assess each investment on a case by case basis, as in the case of the ACF's independent Investment Committee, which draws on a mix of experienced angel and institutional fund managers.

A-OCIFs appear to have significantly increased the volume of investment activity in the early stage equity market, enabling angels to participate in larger deals than otherwise possible (UKBAA, 2013; Hayton, 2008). However, they have limitations. First, like other GVCs, they are constrained by the supply of investable businesses, particularly in small regions. This can be overcome by operating at a national scale and across a wide range of sectors to ensure sufficient viable investable businesses can be found, and could include investing pan nationally, as in the case of some VC-led CIFs such as UKIIF (Baldock and Mason, 2015; Dittmer et al. 2014). Second, they require organised angel groups to partner to provide efficient gateways for collective angel funding into the schemes (Harrison and Mason, 2015). This limits their role in regions with undeveloped angel markets, or dominated by angels investing individually or in ad hoc groups. Therefore, abolition of the English Regional Development Agencies (RDAs) in 2012, which funded regional BAN development, may undermine the regional coverage of the UK ACF.

¹² British Venture Capital Association (BVCA), UK Business Angel Association (UKBAA) and European Investment Fund (EIF) representatives all supported evergreen approaches in January 2014

The recent emergence of managed angel groups – angels who invest together rather than as individuals or small ad hoc groups – has therefore been critical for the establishment of A-OCIFs, and notably in Scotland (Mason and Harrison, 2015). They emerged in response to VC funds withdrawal from the early stage market, which required angels to make larger investments and follow-on investments in a context where investment exit timetables were doubling (Axelson and Martinovic, 2012; Waddell, 2013). Now some larger angel groups make multiple rounds of funding, enabling businesses to exit without raising follow-on investment from VCs. Additionally, angels benefit from working together, by improving deal flow, superior evaluation and due diligence of investment opportunities, diversification and broader skills base to provide smart money hands-on assistance to investee businesses. This extends VC agency theory, highlighting the importance of experienced lead angel investor skills (to select viable investments and undertake due diligence) and their skills diffusion into the angel investor group base, potentially raising investment standards through communities of practice (Botelho, 2015; Mason and Harrison, 2015).

Despite their growth, there has been relatively little policy evaluation of CIFs. Moreover, the demand-side is often overlooked in such evaluations (Wilson and Silver, 2013). The recent study of UK GVCFs by Munari and Toschi (2014) focusing on fund exits as a barometer of success, highlighted the problems of fund evaluation, whilst Baldock and Mason (2015) and Baldock (2016) note that it is even more difficult to evaluate funds at an early stage, prior to exits.

However, as Lerner (2010) suggests, early stage evaluations are about addressing *agency* and programme *design* and delivery issues to refine schemes, ensuring that they are operating efficiently in addressing a market gap, demonstrating additionality, avoiding duplication and displacement and avoiding mission creep. At the early stage, therefore, focus should be on scheme processes such as promotional visibility and accessibility (including timelines to accessing finance), additionality and spillover measurements (Baldock, 2016; Baldock and Mason, 2015) and assessments of displacement (Lerner, 2010) between public funds and crowding out of the private sector (Leleux and Surlemont, 2003). Lerner (2010) also highlights the importance of establishing a well networked VC support services system (e.g. accountants, solicitors, advisors, referrers¹³), whilst Wilson and Silva (2013) find that A-OCIFs give little consideration to investor training which, given the importance of their working with organised angel groups, may form an important agency related policy consideration.

¹³ DETI (2015) The Future of Early and Growth Stage Finance in Northern Ireland study found that many finance intermediaries were under informed about GVCFs.

ECF, UKIIF and ACF in context

Enterprise Capital Funds (ECFs)

Enterprise Capital Funds (ECFs) are a rolling £840m programme of 26 funds¹⁴ established since 2006, with a planned 10–12 year individual fund life cycle, addressing the equity gap facing high growth potential SMEs (Table 2). Government funding is used alongside private sector funds to invest directly into businesses, targeting investments of up to £2m with potential to provide a good commercial return. Here we focus on the first two tranches of fifteen ECFs operating under private sector VC fund management, with funds ranging from £10m to £30m. These ECFs focused on different stages of business development, typically early stage and including specialist seed (Passion Capital) and expansion funds (Catapult). Some were generalist, covering a broad range of sectors (Seraphim Capital Fund), while others specialized for example in new media (Dawn Capital Fund) and medical and healthcare investments (Oxford Technology Management Fund), reflecting the areas of fund management expertise.

UK Innovation Investment Fund (UKIIF)

The UK Innovation Investment Fund (UKIIF), established in 2010, aimed to stimulate private VC investment into intensive R&D sectors (Table 2). The £150m of UK government funding was matched by a further £180m of public and private funding from two ‘fund of funds’ managed by the Hermes Environmental Innovation Fund and the European Investment Fund’s UK Technologies Fund. UKIIF operates *pari passu* at arms’ length under the scrutiny of the British Business Bank¹⁵. As it is private sector led and can invest in innovative businesses globally, there are no European Union (EU) state aid restrictions on the size of initial or follow on investments. The fund focuses on life sciences, cleantech, digital technology and advanced manufacturing sectors and must invest at least £150m into UK based businesses during its expected 12–15 year life cycle.

Angel Co-investment Fund (ACF)

The UK government’s £100m¹⁶ Angel Co-investment Fund (ACF), launched November 2011, invests between £100,000 and £1m in SMEs alongside syndicates of at least three business angels¹⁷ (Table 2). Lead angels from the syndicates are required to bring cases they wish to invest in, but require further funding for, to the scheme. Qualifying SMEs must have under 250 employees, €50m annual sales turnover and €43m of assets on their balance sheet¹⁸. All sectors are eligible, with investments addressing the current equity finance gap for early stage, potential high growth firms. The ACF is evergreen, with reinvested investment returns enabling its perpetual

¹⁴ In Spring 2018 - includes the Catalyst Fund which tops up multiple private funds to enable fund raising closure.

¹⁵ Prior to the British Business Bank being formed in 2014, Capital for Enterprise Ltd (CfEL) was the UK government’s body overseeing its equity programmes.

¹⁶ The ACF initially received a £50m Regional Growth Fund endowment with returns being recycled, doubling to £100m in July 2013 through a British Business Bank 15 year term non-subordinated loan.

¹⁷ Specifically, matching business angel funding in the £200,000 to £2m range, although total round sizes, including all investors can be larger.

¹⁸ Complying with European Union state aid requirements for SMEs

Table 2: Profile comparison between UK GVCs studied

Enterprise Capital Funds (ECFs)
<p>Established: 2006</p> <p>UK Government funding contribution: 2006: £240m; 2010: £200m; 2014: £400m.</p> <p>Fund matching restrictions: at least one third contribution from private VC that manages the investments; maximum government funding of £25m, increased to £50m in 2014; maximum single firm initial investment £2m or 10% of total fund value with follow-on funding, increased to £5m initial funding and 15% of total fund value or £12m cap if follow-on funded.</p> <p>Investor matching criteria: private investor upside with 3% public sector profit cap.</p> <p>Aims:</p> <p>To fund potential high growth businesses in the seed, early stage and early growth stages; to provide demonstration effect to encourage early stage VC market development.</p> <p>Status: Open for investments with rolling 10 years funds.</p>
UK Innovation Investment Fund (UKIIF)
<p>Established: 2009</p> <p>UK Government funding contribution: £150m with additional £150m of European Investment Fund (EIF) and £30m of private VC investment. Umbrella fund of funds structure leading to further private funding leverage of specialist sector funds that select and manage portfolio company investment. Ability to invest substantially over the £2m EU state aid limit (prior to 2014) into individual companies.</p> <p>Investor matching criteria: pari passu.</p> <p>Aims:</p> <p>To provide substantial early and growth stage funding to key long horizon sectors: low carbon cleantech (green energy and recycling), advanced manufacturing, life science and digital technologies; pan European funds with global investment ability, enabling viable niche sector fund development and international syndication, required to invest at least the minimum UK government share of funds into UK based companies</p> <p>Status: Closed, fully funded 12-15 year life cycle funds</p>
Angel Co-investment Fund (ACF)
<p>Established: 2011</p> <p>UK government funding contribution: 2011: £50m; 2013: £50m top-up.</p> <p>Administered by the British Business Bank, investments are selected by an independent Investment Committee, providing up to 49% match funding, ranging from £100,000 to £1m with angel syndicates with a minimum of three investors. For every £1 invested, £1 is held back for follow-on funding provision.</p> <p>Investor matching criteria: pari passu</p> <p>Aims:</p> <p>To provide gap funding to potential high growth seed and early stage businesses through stretch funding angel syndicate investment and enabling follow-on funding rounds; encouraging angel group syndicate investing (minimum 3 members) and raising the standard of angel due diligence and investment practices.</p> <p>Status: Evergreen through ongoing fund recycling</p>

Note: Qualifying SMEs have under 250 employees, €50m annual sales turnover and €43m of assets on their balance sheet.

operation. Initially, restricted to England, following Parliamentary Assent in Spring 2014, it has a UK-wide investment mandate. At the time of our assessment (February, 2014) 39 ACF investments were in England.

The ACF operates as a private company limited by guarantee, at arm's length from Government with British Business Bank oversight¹⁹. It is not involved in investment decisions, which are made by an independent Investment Committee (IC) of private angels and institutional investors, based on a view of a business proposition paper and telephone interview with the lead angel. It can contribute a maximum 49% of deal investment, typically averaging 25%-30%, with the maximum permissible company shareholding being 30%. Investments are pari passu on equal terms with private investors. After 26 months, £67m had been invested into 39 companies and nine follow-on investments, including over £13.75m from the ACF²⁰.

Research Questions

Following our review of GVCF agency and design theories and the specific roles of the three main UK schemes in addressing the broken post GFC finance escalator, we examine the following research questions:

1. Are schemes meeting specific gaps in the UK entrepreneurial finance market? Finance escalator theory suggest there is a gap requiring specific types of GVC scheme interventions, notably early stage and long horizon R&D investment (Baldock, 2016).
2. Are schemes adding value and avoiding duplication or crowding out of the private sector (Lerner, 2010, Leleux and Surlemont, 2003)?
3. What early stage economic impacts are the schemes making? What evidence is there to support Lerner's (2010) contention that GVCFs can make a difference to business growth and innovation?
4. How well adjusted are schemes to the lengthening exit timetables experienced post GFC (Axelson and Martinovic, 2012)? Do they have the flexibility and follow on funding capability (Cumming, 2011) which Lerner (2010) advocates for long game investment?
5. Do schemes have the size and scale to make a lasting legacy impact on the early stage entrepreneurial finance market in the UK? Lerner's (2010) ultimate aim is for GVCFs to catalyse private VC entry and create a sustainable VC ecosystem.

¹⁹ The Board comprises the original bid partner organisations: Oxford Investment Opportunity Network, Braveheart Investment Group Ltd, Octopus Investments, Hotspur Capital Partners.

²⁰ ACF Presentation to UKBAA, London 29/01/2014 At the end of 2015 (Real Business, 04/04/2016) indicated 59 company investments with average ACF first investments of £345k and overall funding round investment of £1.4m (£82.6m in total associated round funding), including 35 follow-on investments. The ACF has so far invested £27.5m of its own funds with an average share contribution of 33%. <http://realbusiness.co.uk/article/33464-exclusive-these-numbers-show-uk-angels-are-providing-stairway-to-entrepreneurial-heaven>

Methodology

This paper draws on a mixed methods approach (Creswell, 2003), seeking to triangulate and confirm data from a range of sources. Findings are derived from primary demand and supply side evidence, drawn from semi-structured interviews undertaken face to face and by telephone with the CEOs and CFOs (chief executives and finance officers) of GVCF assisted businesses (alongside some policy-off counterfactual interviews with businesses that applied, but were unassisted). Additionally there were interviews with 19 lead business angel applicants (16 successful and five unsuccessful²¹) to the ACF scheme.

Supply side evidence comes from interviews with 16 fund managers and three ACF Investment Committee (IC) members who dealt with GVCF applications, alongside 16 interviews with alternative private investors and 6 interviews with finance industry experts drawn from trade associations, trade news, private VCs, angel capital groups, accelerators and equity crowd funding platforms (not directly linked to the focus GVCFs), SME finance support organisations and relevant funding bodies (Table 4).

Whilst our sample size is relatively small, our methodology provides rich data and unique insights into the role and operation of GVCs in the UK from all participants. Our novel approach affords a comprehensive assessment and analysis of recent UK experience in the operation of GVCs

Business manager interviews

The owner-managers of 43 successful business applicants to the three GVCF schemes were interviewed face-to-face or by telephone, with purposive selection to provide sector and UK-wide coverage presented one third of the schemes' funded businesses (43/135) at the time of survey (Table 3)²². Initial interviews were undertaken for ECF in February 2010, UKIIF in February 2012 and ACF in February 2014. Survey questions were broadly aligned across the schemes and included business characteristics, external financing requirements and knowledge, degree of success in obtaining external finance, terms and conditions, and the impact and additionality experienced and forecast from the funding received. Further follow up telephone interviews took place with 24 of the ECF and UKIIF recipient businesses in May 2013 to assess development since the initial funding.

Survey survival bias and scheme additionality are critical to scheme assessment (Baldock, 2016). However, for early assessments the focus should be on scheme additionality and minor adjustment to ensure that schemes are meeting their operational aims (Lerner, 2010), since even at mid-term assessment it remains notoriously difficult to evaluate scheme impact (Baldock and Mason, 2015) as the better performing businesses often exit far later in the cycle of the fund (Wiltbank,

²¹ A couple of lead angels had multiple ACF applications, including successful and unsuccessful ones.

²² Mann-Whitney tests two-tailed 'U' tests revealed no significant differences between the purposive survey samples and overall scheme assisted business samples in terms of sector and location distribution, the only exception being at .05 level (Z-score: -2.305, p=0.02088 and U-value of 9.5 where critical value is 13) for the ACF survey, which is explained by under representation of online services, including retail, lettings and fashion activities. Exclusion of this sector leads to U-value of 8.5, at above the critical value of 8.

2005). We therefore focus on comparisons with policy-off applicants' performance (five ECF and 4 ACF applicant companies) and longitudinal interviews with surviving ECF (8) and UKIIF (14) investee companies that were available to be interviewed within the timeframe of the follow-up short telephone interview research with CEO/CFOs in May 2013.

Table 3 Business interviews by GVCF

Programme	Successful recipients	% of business investments* (n=)
ECF	12	21% (57)
UKIIF	16	41% (39)
ACF	15	38% (39)
Total	43	32% (135)

Note: *At the time of survey: ECF initial survey 2010; UKIIF initial survey 2012; ACF single survey February 2014.

Fund Provider Interviews

Face-to-face interviews were undertaken with eight UKIIF⁵ and eight ECF fund managers and three ACF Investment Committee members (the independent expert investors who select scheme investments), alongside a comprehensive two hour induction meeting and ongoing information from the ACF administration team at the British Business Bank. These semi-structured face to face and telephone interviews, supplemented by scheme administrative and review documentation provided insights into their structure and operation, the type and range of applications, decision-making criteria, the effectiveness of their investments and assessment of whether funds were addressing an equity gap. These represented all of the programmes' operational funds at the time of survey (Table 4).

To enrich our understanding of the new and early stage VC market, interviews were also conducted with 22 expert informants (detailed in Table 4). These were also broadly aligned to explore issues around the perceived equity finance gap for seed and early stage innovative and potential high growth UK companies. We also investigated the complementarity, added value or duplication of schemes, and their likely impact on developing a new post GFC UK finance escalator and creating a lasting legacy on the UK finance markets.

Key Findings

Are schemes addressing early stage finance gaps?

The surveyed businesses fitted each scheme's target profile, typically being young, early stage businesses established since 2000. Over half of recipients were pre-trading at the time of interview, undertaking R&D and developing prototypes or in the initial stages of launching products and services. Most, including all 16 UKIIF businesses, were undertaking market leading activities, developing leading edge software,

Table 4 Breakdown of fund manager and investor interviews

Fund	Location
<p>Enterprise Capital Funds (ECFs): The Catapult Growth Fund (ECF) IQ Capital Fund Oxford Technology Seraphim Capital Fund Sustainable Technology Partnership Amadeus and Angels Seed Fund Dawn MMC</p>	<p>Leicester Cambridge Oxford London London Cambridge London London</p>
<p>UK Innovation Investment Fund (UKIIF): Hermes GPE Environmental Innovation Fund. European Investment Fund UK Future Technologies Funds. Underlying funds: Zouk Cleantech II. Scottish Equity Partners Environmental Energies. WHEB Ventures. DFJ Esprit. Advent Life Sciences. Gilde Healthcare III.</p>	<p>Fund of funds manager, London. Fund of funds manager, Luxembourg. Hermes fund, London. Hermes fund, Glasgow and London. Hermes fund, London. EIF UKFTF fund, London and Cambridge. EIF UKFTF fund, London. EIF UKFTF fund, Utrecht and Cambridge USA.</p>
<p>Angel Co-Investment Fund (ACF): 19 Lead business angel investors from investment syndicates, of which 16 had been successful and five had been unsuccessful. 3 (of the 10) Investment Committee (IC) members, including experienced angel and institutional investors.</p>	<p>10 angel groups, 5 in London, 2 in South East, 1 East Midlands, 1 in South West England and 1 in Scotland. UK-wide representation.</p>
<p>Alternative Investors and Experts</p> <p>13 alternative private investors: Private VCs (4) and seed VCs (3), Venture Capital Trusts (3) Angel Capital Groups (3)</p> <p>6 industry stakeholders and experts: British Venture Capital Association (BVCA), UK Business Angels Association (UKBAA), Angel News, St John’s Innovation Centre, European Investment Fund (EIF), Professor Dylan Jones-Evans (Finance Wales reviewer)</p>	<p>8 in London, 1 North East, 1 Yorkshire and Humber, 1 Scotland. UK-wide coverage.</p>

medical and low carbon technologies, and demonstrating global market leading export aspirations.

Equity finance was perceived as the only viable option for raising finance due to a lack of financial assets, insufficient trading record, and owners' unwillingness to secure/guarantee debt finance against private property. Funds were mainly being sought for later stage R&D and market testing, and this frequently involved hiring specialist technical staff for software development, and also sales and service support teams, with product prototype manufacture typically being subcontracted out. The amount of equity sought by the 12 interviewed ECF recipients ranged from £300,000 to £3m (median £750,000) and typically involved first round VC funding. The 15 ACF recipients initially sought between £260,000 to £2.3m (median £880,000), often entailing second round angel funding to levels that stretched well beyond the £500,000 (UKBAA, 2013) limit of contemporary angel syndicate deals. It is notable that ACF investments are skewed towards shorter horizon digitech solutions with software, gaming, online and financial services representing over half of the investments, and this has perhaps been influenced by UK investor taxbreak policy²³. The 16 UKIIF recipients sought between £75,000 and £10.4m (median £2.4m), demonstrating demand for early stage longer horizon R&D equity finance at beyond the EU state aid cap of £2m at the time of funding²⁴, supporting the Rowlands gap (2009) hypothesis and subsequent findings of Baldock et al (2015).

The majority of businesses were small when funded (Table 6). ECF and ACF recipients had mean employment size of 9.5 and 11 respectively (medians of 4 and 5 employees). UKIIF recipients had a mean size of 38 employees (median 11) and included three established medium sized businesses undertaking new innovative product development cycles, including a recycling company diversifying into bio fuel production and a lightweight plastics manufacturer, both with over 150 employees; the latter being effectively subject to a new company management buy-in to facilitate new technological advanced manufacturing.

Are schemes adding value or crowding out?

Leleux and Surlemont (2003) underline the importance of ascertaining the level of funding duplication existing between public or private funding opportunities. Overall there was little or no evidence from the management surveys of funding duplication either between public funding, or in crowding out private funding (see additionality measures below), particularly as the businesses "*required funding within certain time parameters, crucially in order to retain market primacy*", typically within a 6-12 months period (Baldock and Mason, 2015). For example, half of the ECF and virtually all of the UKIIF cases had sought other forms of external finance, mainly from private VCs, and in some more mature trading cases from banks, but few had received offers, due to their being "*too early stage for private VCs*" and being told to "*come back when the company has several years market traction*". In the case of the ACF, these businesses typically had existing angel investors and their first preference was to seek further angel investment – a pre-requisite of the scheme.

²³ The UK Enterprise Investment Scheme (EIS) encouraging private high net worth investors to invest in SMEs, offers maximum tax breaks after only three years of investment (HMRC, 22/10/2013).

²⁴ Prior to raising of the EU state aid cap in January 2014

Survey findings revealed an intriguing dichotomy between managers with pecking order preferences for VC and the simplicity of raising finance from few or single sources of private sector investor. The latter is to “*avoid fragmented, complex and time consuming angel funding arrangements*” and therefore they sought ECF or UKIIF funding, which in many cases was deemed to be “*seeking far more funding than angels could be expected to deliver*”. Conversely, there were managers who preferred “the hands-on intensive business management support of angels” and felt that they would be “*less controlling and less likely to take the business out of their hands*.” The three schemes, therefore, appear to apply to three distinctively different market gaps, although there was evidence from the ACF that the larger series A funding rounds could include syndication with private VC. This underlines Hopp’s (2010) contention that this can increase round sizes, improve follow-on funding opportunities, market development (notably where VCs have niche export market skills), and more optimal investment exits. All factors that were mentioned by surveyed scheme assisted managers.

None of the schemes have a particular remit to generate additional private sector investment leverage. However, it is evident that each scheme was leveraging attributable²⁵ additional private sector matching funding into the GVCF assisted rounds. This typically represented leverage of 50 pence private funding for every £1 of public investment.

In the less than one in ten cases where alternative funding was rejected, this was mainly because the funding available was insufficient or in some cases because “*corporate VC is too restrictive in terms of product and market development*” and had “*nothing to do with the cost of the finance and everything to do with the compatibility of the fund manager*”. This underlines pecking order preferences and what Baldock et al. (2015) refer to as the necessary *meeting of minds* between managers and investors in equity investment, particularly in respect of industry sector and stage of development.

Additionality is measured from the CEOs’ judgment of the counterfactual policy-off scenario²⁶ and triangulated with assessments from fund managers and investing angels. A clear finding across all schemes is that financial additionality is judged considerably lower than project additionality, particularly in the case of UKIIF where over two-thirds of respondents felt that they would be able to raise all of the funding required without the availability of the scheme (Table 4). Triangulation of financial additionality findings with the views of fund managers reveals that surveyed business managers typically overestimate their abilities to raise funding, although it was clear from the UKIIF fund managers that they were selecting investee companies “*to maximise investor returns and perform within the upper quartile of VC funds*”. This suggests that they were not applying the same economic development criteria to fund Oakey’s (2003) *probably fundable* businesses, as opposed to the *definitely fundable* and potentially contributing to private sector crowding out (Leleux and Surlemont, 2003). However, it is clear from the project additionality that only between one fifth to a quarter of business managers believed that they would have gone ahead with the

²⁵ Where the surveyed manager indicated that the additional private funding was directly attributable to obtaining the GVCF funding.

²⁶ Adopting standard BIS protocols for the Early Assessment of Equity Schemes (2010), UKIIF (2012) and ACF (2014 unpublished).

project on the same time and size scales. This is an important factor, as faster delivery of investment can preserve market primacy (Baldock and Mason, 2015). Therefore, the traditional notion of crowding out needs to take on board funding timeframes, particularly given their lengthening timescales recorded in the post GFC period (Baldock and North, 2015).

Table 5. Funding and Project Additionality: Ability of recipient businesses to raise finance from elsewhere without government VC funding and undertake the proposed business project

Funding:	ECF	UKIIF	ACF
definitely would not have raised finance from other sources	2 (16%)	1 (6%)	2 (15%)
probably would not have raised finance from other sources	0 (0%)	0 (0%)	1 (7%)
no strong opinion	0 (0%)	0 (0%)	0 (0%)
probably would have raised finance from other sources	5 (42%)	4 (25%)	6 (39%)
definitely would have raised finance from other sources	5 (42%)	11 (69%)	6 (39%)
Total recipient businesses	12 (100%)	16 (100%)	15 (100%)
Project:			
would not have gone ahead at all, in any format	5 (42%)	1 (6%)	3 (22%)
would have gone ahead at the same time, but on a smaller scale	0 (0%)	5 (31%)	4 (24%)
would have taken longer to go ahead, but at the original planned scale	2 (16%)	3 (19%)	2 (15%)
would have taken longer to go ahead and on a smaller scale	2 (16%)	4 (24%)	2 (15%)
would have gone ahead at the same time and at the same scale	3 (26%)	3 (19%)	4 (24%)
Total recipient businesses	12 (100%)	16 (100%)	15 (100%)

A further indicator of funding additionality is to examine policy-off ‘dead deal’ cases where GVC funds were not provided, ostensibly because the business case was either rejected at a late stage in the application process, or terms were not able to be agreed by the applicant business. Four ACF and five ECF dead deals were examined, matching these with the timing of the initial survey of successful applicants and across similar broad sectors. Although only a small-scale qualitative sample, the findings are highly supportive of scheme additionality, with all of the businesses taking longer to obtain funding and in several cases failing altogether. Only one business subsequently performed better than expected and that was due to changing international export market focus, which proved highly successful. All of the

remaining businesses subsequently performed less well than the assisted survey sample and three had ceased trading.

What are the initial scheme impacts?

As Baldock (2016) and Baldock and Mason (2015) suggest, early scheme assessments are notoriously problematic when assessing the potential outcomes of investments and fund performance, notably because of the extending post GFC exit horizons (Axelson and Martinovic, 2012) and the propensity for better performing plum investments to take longer to mature (Wiltbank, 2005). However, it is possible to examine the initial economic development impacts of funding, in terms of investee business performance and economic multipliers/spill-overs (Baldock, 2016). Focusing on assisted businesses that had received funding at least one year prior to initial survey, it is evident that each scheme exhibits proportional net increases in employment and sales turnover (Table 6). The more mature, typically larger UKIIF businesses exhibited greatest sales increase, with ECF and UKIIF businesses doubling their employment. Projecting forward, forecasts for ECF and ACF demonstrate similarly optimistic median sales growth over the next year of £600,000 and £830,000 respectively. However, when examining longitudinal survey results for the surveyed surviving ECF (7) and UKIIF (12) assisted businesses, we find the reality is far less rosy, with median sales increasing by £380,000 over three years for ECF and £200,000 over one year for UKIIF businesses. This demonstrates the impacts of the GFC recession in slowing down growth and in the case of the ECFs, some “*difficulties accessing the follow-on financing rounds required to maintain development trajectory momentum.*” On a more positive note, employment generation was more consistent, with ECFs increasing from a median of 10 to 26 employees over the three years of the longitudinal survey (+160%), whilst UKIIF increased from 20 to 35 employees in just one year (+75%).

Some additional calculations were also undertaken for the ECF and ACF assisted businesses to more accurately attribute the direct impact of the respective GVC funding on assisted businesses, suggesting that this was catalytic. Managers estimate that each scheme contributed around 10% more to recorded post funding business growth outcomes than the proportion of government investment received in the overall funding round, a finding which provides weak support for the schemes’ ability to leverage other funds (Baldock and Mason, 2015).

Taking a broader economic development view (Baldock, 2016), these schemes appear to offer considerable assistance to business development. This occurs through management assistance from fund managers, or their appointed board members who fulfil expert managerial roles (e.g. financial management, sales and marketing) and in the case of seed VCs and lead business angels, highly specialist, intensive hands-on investor support (Gompers et al. 2010; Mason and Harrison, 2015). It was noted by both managers and investors that the improved management structures and business operations imposed by VC and angel investors can “*improve business performance and also enhance opportunities for follow-on funding*”. These findings have been strongly supported by the recent study of Baldock and Mason (2015) which found that 93% of managers from 75 surviving ECF assisted businesses reported improved

Table 6: Scheme Impact and Forecast Measures

Total Employment	ECF			UKIIF			ACF		
	N=	median	mean	N=	median	mean	N=	median	mean
Time of funding	12	4	9.5	16	11	38	10	5	11
1 year after funding*	12	10	12.9	16	20	58.4	10	7.5	22
2 years after funding***	-	-	-	14	35	69.1	14	14	29
3 years after funding**	-	-	-	14	60	84	-	-	-
4 years after funding*****	7	26	25.7	-	-	-	14	25	46
5 years after funding**	7	30	29.4	-	-	-	-	-	-
Annual Sales Turnover (£m)									
Time of funding	12	0	0.56	16	0	6.2	10	0.2	0.41
1 year after funding*	12	0	0.7	16	1.3	10	10	0.3	0.65
2 years after funding***	12	0.6	-	14	1.5	14.3	14	1.13	1.84
3 years after funding**	-	-	-	14	3.25	18.9	-	-	-
4 years after funding*****	7	0.38	1.62	-	-	-	14	6.25	10.17
5 years after funding**	7	1.2	2.17	-	-	-	-	-	-

* ECF surveyed February 2010, UKIIF surveyed February 2012, ACF surveyed February 2013; **Year 3 is the next year forecast for UKIIF; ***Year 5 is the next year forecast for ECF; ****Year 2 is the first year predictor for ECF and ACF; *****Year 4 is the three year predictor for ACF.

management practices²⁷. The present qualitative study finds considerable evidence that Baldock et al.'s (2015) *meeting of minds* (between investors and managers) was a crucial element in adding value to business performance (Manigart and Wright, 2013; Clarysse et al., 2011). Many of the surveyed UKIIF managers that were at early market growth stages highlight that their VC managers had been “*excellent in opening up market opportunities and assisting with successfully negotiating complex and daunting export market opportunities*” (Lockett et al. 2008). In some cases this occurs through syndication with other overseas VCs (Hopp, 2010) with specialist market knowledge which could “*overcome technical market barriers, establish sales offices and develop customer links.*”

More specifically, it is clear that many of the assisted businesses subcontract out work, particularly manufacturing, but also technical support (e.g. specialist software, technical components, sales and marketing) in cases where it is not practical or possible to recruit appropriate staff. The Baldock and Mason (2015) study found that ECF assisted businesses created considerable subcontract employment opportunities, estimated at creating 2.7 extra jobs per assisted company, with many of these

²⁷ A survey commissioned by BIS, undertaken in February 2014.

undertaken elsewhere in the UK. Similarly, our ACF study found that two thirds of the 15 assisted businesses subcontracted work out, with a median of five jobs created and an average across the businesses of 3.3 jobs. Our studies of ECF and ACF also demonstrated that the vast majority of assisted businesses had raised their levels of innovation. ECF recipients exhibited high proportions improving products, services, marketing and business processes (all 75% or higher), whilst over half of the ACF firms had introduced new or improved patents and copyrights.

Finally, a strong contention of Herriott (2011) is that an important spillover impact of scheme investment is vestigial, pertaining to the residual ongoing impacts of failed businesses. Our study reviewed the outcomes from a small number of failed businesses (2 ACF and 5 ECF). A common factor in business failure was found to be the breakdown of the relationship between the investor and investee company management teams, and the collapse of the meeting of minds (Baldock et al. 2015). However, there was considerable evidence from the failed managers of spillover impacts which included two businesses being re-established and successfully trading. Several managers finding niche managerial roles in other companies in associated sector activities where their skills were adding value to these businesses and several instances of IP being held which might have future value.

Exit plans, follow-on funding and scheme adjustments

One of the most demanding requirements of GVCF scheme design and operation in recent years, notably post GFC (Baldock, 2016) has been the telescoping of investment exit timetables (Axelson and Martinovic, 2013; Waddell, 2013). This occurs through a combination of businesses taking longer to complete R&D due to shortages of funding and the requirements for more mature market traction to achieve successful IPOs or trade sales (Baldock, 2015). Therefore, there is a need for scheme flexibility to plan for the long game (Lerner, 2010).

Our longitudinal research of ECF and UKIIF underlines the above trends. Table 7 demonstrates that at the time of the initial early assessment survey, typically one year after funding, approximately one fifth of assisted businesses were slipping behind their planned development schedules. Our ACF study in 2014 indicates one third were already behind schedule. However, when we look at the longitudinal performance, we find that a further year on UKIIF businesses have slipped back (from 15% to 28% being behind schedule). Three years further on the majority of surveyed ECFs have fallen behind schedule, resulting in a median rise of 1.5 years in their estimated exit timetables (rising from 5 to 6.5 years). Another trend, which is evident in the post GFC period is the move away from IPO, due to “*lack of liquidity and uncertainties in the public equity market to raise sufficient funds to justify this type of exit*” (Baldock, 2015). Again, our more recent ACF research, during a period when the UK AIM public feeder market for early stage businesses was starting to recover in 2014, found that only one fifth of surveyed managers favoured IPO exits, suggesting continued uncertainties around public equity markets.

Table 7: Business performance, time and type of investment exit expected

Performance	Year 1 All* (Column %)	Year 2 UKIIF (Column %)	Year 4 ECF (Column %)
Better	33%	29%	0%
Same	48%	43%	40%
Worse	19%	28%	60%
Time to Exit			
Median	5 yrs	5 yrs	6.5 yrs
Range	2–7yrs	2–7 yrs	4–10 yrs
Longer	n/a	29%	80%
Same	n/a	64%	20%
Shorter	n/a	7%	0%
Type of Exit			
Trade Sale	67%	72%	80%
IPO	25%	21%	10%
Other	8%	7%	10%
N=	21	14	7

*At the time of initial survey: ECF surveyed February 2010, UKIIF surveyed February 2012.

An important consequence of these findings for time limited LP²⁸ funds, such as the ECFs and UKIIF underlying funds, is whether their lifespans and funding scales are sufficient to maintain and invest in their longer term plum portfolio companies (Wilbank, 2005) for long enough to enable them to reach optimal exit (Markovitz, 1952). Cumming (2011) has impressed on the importance of VC funds being able to maintain and grow their best portfolio businesses. Our interviews with ECF and UKIIF fund managers indicated that the smaller ECF funds with shorter lifespans (10-12 years) were under increasing pressures to make substantial follow-on funding (typically as part of rounds valued at over £2m) and to reach satisfactory investment exit points within 10 years. The vast majority of ECF fund managers indicated that they would be applying for the full two year extensions to their funds. Some also complained that they had insufficient funds, or were too restricted in their ability to fund individual portfolio businesses under the pre-2014 EU state aid restrictions²⁹. For some earlier stage seed VCs, there was recognition that they would syndicate with specialist later stage VCs to enable and relinquish their lead investor role (Hopp, 2010; Baldock, 2016). However, other VCs were more concerned about their ability to form second funds within a circa five year cycle, which would enable them to follow-on fund their portfolio businesses (Baldock, 2016). It is notable that few (3 ECF funds out of 15) had successfully applied for second funds and that these were taking longer than five years to achieve.

With regard to UKIIF, these longer timescale funds (12-15 years) designed to support long horizon R&D sectors were, at the time of interview, less pressured. However, there was recognition amongst surveyed fund managers of the likely large-scale of follow-on funding requirements and that these might well involve specialist

²⁸ Limited Partnership (LP) funds are the typical legal formation of VC in the UK, typically with 10 year lifespans.

²⁹ The 10% funding rule effectively restricted most funds to between £3-4m investment in any one of their portfolio businesses.

syndication (e.g. DFJ Esprit's connections with specialist US market VCs). However, some managers were also more reticent about potentially relinquishing their lead share through VC syndication, which might hold back follow-on funding in some cases (Baldock and North, 2016).

The ACF is an evergreen fund and was particularly favoured by the industry experts interviewed as having the scale and flexibility to meet the follow-on funding requirements of its portfolio businesses. More recent evidence from Real Business (2016) suggests that the scheme is following its aim of retaining 50% investment for follow on funding with 59 portfolio company investments undertaken by December 2015 and 35 follow-on investments completed. The scale of overall investment from the fund is typically £1.4m, requiring at least a 51% match from angels and other investors. Conversely, we surveyed one failed ACF business which had not received follow-on funding and, whilst it is not possible to obtain the scheme's determinants for rejection, the investing angel and business manager were both of the view that the failure to obtain follow-on funding – which would have unlocked other substantial private investment - was the main reason for business failure.

Discussion of market impacts

A critical role of UK GVCFs has been to act as demonstrators (ECFs) and encourage higher quality private investment, whether angels (ACF) or specialist niche sector VCs (UKIIF) within the UK and develop the seed and early stage market and its associated support infrastructure, following Lerner's (2010) principles. The question after nearly 10 years of the ECFs, six years of the UKIIF and four years of the ACF, is to what extent are these schemes making an impact on the market and, in the case of ECF's, leaving a Lerner-type legacy?

The first point, unanimously mentioned by fund managers and industry experts, is that it is far too early to tell – even in the case of the ECFs, particularly give the period of financial stress that that the UK market has undergone during and after the GFC. Lerner's (2010) long game view is critical, as there have not been sufficient exits to raise the profile of the funds and provide clear indication of their likely performance. Furthermore, as Baldock (2016) and Baldock and Mason (2015) found, it is not helpful to compare GVCFs with private VCs, given that they are often not operating in the same investment space (i.e. private VCs are often investing at later, less risky stages) and that the economic development aims of GVCFs may inevitably mean that they underperform private VCs (Rigos, 2010; Oakey, 2003). As Baldock (2016) also argues, recent UK and European studies comparing GVCFs with private VC performance are of old style funds (e.g. UK Regional Development Funds), with poor designs, small-scale and poor management, and not reflective of the more recent private sector led co-investment models exemplified by the three UK schemes in this study. What is clear from our findings is that these schemes are operating in different markets, addressing clear equity finance gaps – so not demonstrating private sector crowding out - and are complementing rather than competing against each other in forming the new UK post GFC finance escalator for early stage entrepreneurial finance (Baldock and Mason, 2015).

That said, our study highlights a number of critical issues around scheme design that will require attention and adjustments, in order to achieve a more optimal performance. Triangulating findings from the respective business surveys, fund manager, scheme administrator meetings and assorted industry experts, it is clear that meeting the follow-on funding 'series A-B' scale funding is critical to maintaining portfolio business development trajectories and associated market primacy objectives of what are essentially highly innovative and market leading businesses with high growth potential. Most experts agree that funds require scale, which suggests that the original eight pathfinder ECFs, with average fund sizes of £35m, are inadequate (Technopolis study of European VC in 2010 suggests a minimum fund size of £40m) One way around this is to enable second funds within a five year cycle (Lerner and Hall, 2005) and another way is to expand the original fund size, which is effectively what the new EU state regulations applying to ECFs has done, post January 2014, in doubling their potential scale (UK government ceiling raised to £50m per fund) raising the initial portfolio business ceiling to £5m and their follow-on funding ceiling to £12m.

Consideration also has to be given to the ability to fund plum performing portfolio businesses (Wiltbank, 2005) through stage development (Cumming, 2011) to optimal exit (Markowitz, 1952), within an era of lengthening exit timescales and uncertain exit markets, typically via trade sales or IPOs. Apart from increasing fund sizes to accommodate this, there was a consensus amongst industry experts (notably trade associations like UKBAA and BVCA) and fund managers that there is a need for VC funds and business angels to take a far more proactive strategic view of follow-on funding and exit strategies from the outset of investments. This suggests the need for planned follow-on funding strategies such as the ACF's pound for pound approach to initial and follow-on funding allocation and increased VC and angel syndication linkages, as exemplified in the good practice activities of ECFs like Passion Capital seed fund and UKIIF's DFJ Esprit fund (Baldock and Mason, 2015; Hopp, 2010). There is also a need to consider whether the ECF time limited extension to 12 years will be sufficient and over time we will discover whether the UKIIF extended timeline of 15 years is sufficient for longer horizon sector investment. A potential solution to this is the timely development of second funds, if early enforced exit sales are to be avoided, which inevitably result in fund under performance and potential loss of IP and jobs to overseas trade buyers. Interestingly, findings from the more recent study of ECFs (Baldock, 2016) tend to support Lerner's global view of GVCs, in that whilst trade sales might result in overseas company takeovers, core R&D jobs can remain in the UK and the management skills and private proceeds of the trade sales are often redeployed and invested within the UK. Ultimately, however, as Rigos (2010) argues, optimal business exit, which can include IPO (Baldock, 2015), can potentially lead to £100m, 100 employee size businesses being created and remaining head quartered in the UK, with the resultant spillover and ongoing economic impacts that can really make a difference. This can include the revitalisation of the UK early stage private sector (VC and angel) markets.

Conclusions

Government participation in venture capital schemes and programmes is an increasingly prevalent model of private equity provision, and well established in most developed economies. Notwithstanding significant investment of public resources in equity provision to private enterprises, there is a paucity of research on salient aspects of government participation in venture capital schemes. We address financing gaps, additionality, crowding out, economic impact and long term viability by investigating three UK investment funds, the Enterprise Capital Funds (ECF), the UK Innovation Investment Fund (UKIIF), and Angel Co-investment Fund (ACF). Our findings in relation to these issues reveal nuances according to each market and situation, which are accentuated in the post GFC funding environment. For example, our finding that project additionality is relatively greater than financial additionality over similar time and size scales suggests that traditional conceptions and assumptions about crowding out are overly simplistic, and that GVC schemes enable firms to respond to investment opportunities faster than they would otherwise. This is particularly important in the post GFC environment, given the significantly altered funding landscape. Similarly, we find that the ‘financing gap’ addressed is not standardised but varies according to requirements and preferences of entrepreneurs. Each scheme is tailored to provide investment for a different type of ‘funding gap’. In this context, it is interesting to observe that GVC schemes have evolved and adapted to address the many and various requirements of early stage ventures.

Our findings reveal a number of areas of concern for policy makers, both in the UK and at regional (European) level. In addressing scheme design, policy makers should consider whether funding ceilings are significantly high to adequately serve the market, and more importantly enable greater scale by facilitating second funds within a limited time cycle. Investors and policy makers need to ensure early exit sales are avoided. This will involve ensuring sufficient liquidity in exit markets by developing follow-on funding, and extending the timeline to exit, particularly for ECFs. To achieve this, schemes require greater inbuilt flexibility along with more developed exit strategies.

Our study reveals important conceptual issues related to the provision of GVC in the post GFC funding environment. Future researchers should broaden this study to include a representative sample of GVC schemes, and conduct a comparative study with other co-investment and VC schemes. This will facilitate a more comprehensive assessment of the effectiveness of GVC, including economic impact. By conducting this analysis across economic cycles, we will gain a greater understanding of how GVC schemes can be better designed to respond to temporal changes in the supply of private equity. Future studies should also address perennial issues such as ‘financing gaps’, ‘market failure’, and ‘crowding out’ to include more comprehensive criteria other than financial or economic measures. A more holistic, nuanced approach to investigating these issues will provide a greater understanding of early stage entrepreneurial process, and will ultimately provide us with a greater understanding of returns on investment.

References

Aernoudt, R. San José, A. and Roure, J. (2007) Public support for the business angel market in Europe, *Venture Capital: an international journal of entrepreneurial finance*, 9 (1) 71-84.

Axelsson U, and Martinovic M. (2012) *European Venture Capital: Myths and Facts*. Report to the British Venture Capital Association

Baldock R. (2016) An Assessment of the Business Impacts of the UK's Enterprise Capital Funds. *Environment and Planning C: Government and Policy* DOI: 10.1177/0263774X15625995

Baldock R. (2015) What is the role of public feeder markets in developing technology based small firms? An exploration of the motivations for listing on AIM since the GFC. *Venture Capital: An International Journal of Entrepreneurial Finance*, 17: DOI: [10.1080/13691066.2015.1021028](https://doi.org/10.1080/13691066.2015.1021028)

Baldock, R. Deakins, D. and Savic, M. (2015) *Finance Pathways for Innovative SMEs: The New UK Finance Escalator*. Paper to the International Small Business and Entrepreneurship conference, Glasgow, November 11th and 12th

Baldock R. and Mason C. (2015) Establishing a new UK finance escalator for innovative SMEs: the roles of the Enterprise Capital Funds and Angel Co-Investment Fund. *Venture Capital: An International Journal of Entrepreneurial Finance*, 17 DOI:[10.1080/13691066.2015.1021025](https://doi.org/10.1080/13691066.2015.1021025)

Baldock, R., and North. D. (2015) The Role of UK Government Hybrid Venture Capital Funds in Addressing the Finance Gap Facing Innovative SMEs in the Post 2007 Financial Crisis Era. In J. Hussain and J. M. Scott (eds) *International Research Handbook on Entrepreneurial Finance*, Edward Elgar.

Baygen G, and Freudenberg M, 2000, "The internationalisation of Venture Capital Activity in OECD Countries: Implications for Measurement and Policy", *OECD Science, Technology and Industry Working Papers*, 2000/07, OECD Publishing. <http://dx.doi.org/10.1787/084236411045>

Berger, A. N., and Udell, G.F. (1998) The Economics of Small Business Finance: The Roles of Private Equity and Debt Markets in the Financial Growth Cycle. *Journal of Banking and Finance* 22 (6–8): 613–673. doi:[10.1016/S0378-4266\(98\)00038-7](https://doi.org/10.1016/S0378-4266(98)00038-7).

BIS (2013) *Small Business Survey 2012: SME Employers*, Report by BMG Research for the Department for Business, Innovation and Skills, April

BIS (2012) *Early Assessment of the UK Innovation Investment Fund*. Report by CEEDR for the Department for Business, Innovation and Skills https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/32234/10-1037-early-assessmentbis-equity-fund-initiatives.pdf

BIS, (2011). *Plan for Growth*, Report by HM Treasury and Department of Business Innovation and Skills.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/221514/2011budget_growth.pdf

BIS (2010) *Early Assessment of the Impact of BIS Equity Fund Initiatives*. Report by CEEDR for Department for Business, Innovation and Skills.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/32234/10-1037-earlyassessment-bis-equity-fund-initiatives.pdf

Botelho, T. (2015) *What drives the investment criteria used by business angels – heterogeneity, herd behaviour or communities of practice?* Paper to the Centre for Enterprise and Economic Development Research (CEEDR) seminar series, Middlesex University Business School, Hendon, London (04/11/2015)

Colombo MG, Cumming DJ, and Vismara M, 2014, “Governmental venture capital for innovative young firms”, *Journal of Technology Transfer*, forthcoming, available online: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2471469

CfEL (2013) *Capital for Enterprise Ltd: 2013 Survey of Fund Managers*, Report for Capital for Enterprise Ltd. by Daniel Van der Schans, May.

Collins, L., Swart, R. and Zhang, B. (2013) *The Rise of Future Finance: The UK Alternative Finance Benchmarking Report*. Nesta, London: Cambridge University and Berkeley University.

Cowling, M., Liu, W. and Ledger, A. (2012) Small Business Financing in the UK Before and During the Current Financial Crisis. *International Small Business Journal* 30 (7): 778–800. doi:10.1177/0266242611435516.

Creswell J.W. (2003) “Qualitative, Quantitative and Mixed Methods Approaches”, Sage Thousand Oaks.

Cumming D.J, Colombo M.G, Vismara S. (2014) “Governmental venture capital for innovative young firms”, *Journal of Technology Transfer*, forthcoming, published online 06/12/2014 DOI 10.1007/s10961-014-9380-9

Cumming D.J. (2014) “Public economics gone wild: lessons from venture capital”, *International Review of Financial Analysis*, 36(C): 251-260

Cumming D.J. (2011) “Misinforming the public about policy towards venture capital”, *Venture Capital* 13: 99-102

Davis, A. (2011) *Beyond the Banks: Innovative ways to finance Britain’s small businesses*, Report for the National Endowment for Science and Technology (NESTA), London

Deakins, D. and Freel, M. (2012) *Entrepreneurship and Small Firms*. London: McGraw-Hill.

Derrick S (2013) *The Super Angel investment phenomenon*. Growing Business Magazine <http://startups.co.uk/the-super-angel-investment-phenomenon/>

EBAN (2012) *Compendium of Co-investment Funds with Business Angels*. European Business Angel Network, BDO http://www.eban.org/wp-content/uploads/2014/11/EBAN-Compendium-Co-Investment-Funds-2012_final1.pdf

EC (2014) "State aid no SA.36428 (2013/N) - United Kingdom Amendments to the existing aid scheme Enterprise Capital Funds" (C 17/2004). European Commission, Brussels (22/01/2014)
http://ec.europa.eu/competition/state_aid/cases/249273/249273_1513304_102_2.pdf

EIF (2015) *European Angels Fund (EAF)*. European Investment Fund website (10/06/2015) http://www.eif.org/what_we_do/equity/eaf/

Gill, D. (2010) *The Collapse of the Funding Escalator – how it happened and what to do about it*. Paper to the Institute for Manufacturing, Cambridge University, Cambridge, June 24.

GLA (2013) *Access to SME Finance in London*, Report by CEEDR/SQW to the Greater London Authority.

Gompers, P., Kovner, A., Lerner, J., Scharfstein, D. 2008. Venture capital investment cycles: The impact of public markets. *Journal of Financial Economics*, 87(1), pp.1–23.

Gompers P, Kovner A, Lerner J, and Scharfstein D, (2010) "Performance persistence in entrepreneurship", *Journal of Financial Economics*, **96**: 18-34

Hayton, K., Thorn, G., Percy, V., Boyd, C. and Latimer, K. (2008) *Evaluation of the Scottish Co-Investment Fund: A Report to Scottish Enterprise*. Glasgow: Hayton Consulting/GEN.

Herriott W (2011) Financing UK Hi-tech Small Firms. Keynote speech, 19th *International High Technology Small Firms Conference*, 9th - 10th June 2011, Manchester Business School, Manchester

Hughes, A. (2009) Innovation and SMEs: Hunting the Snark: Some Reflections on the UK Experience of Support for the Small Business Sector. *Innovation, Management, Policy and Practice* 11 (1): 114–126. doi:10.5172/impp.453.11.1.114.

Jeng, L.A. and Wells, P.C., 2000. The determinants of venture capital funding: evidence across countries. *Journal of Corporate Finance*, 6(3), pp.241–289.

Leleux, B., and Surlemont, B. (2003) Public Versus Private Venture Capital: Seeding or Crowding Out? A Pan-European Analysis. *Journal of Business Venturing* 18 (1): 81–104. doi:10.1016/S0883-9026(01)00078-7.

Lerner J (2002) “When bureaucrats meet entrepreneurs: the design of effective public venture capital programmes”, *The Economic Journal*, **112**, F73-F84

Lerner J, Moore D, Shepherd S (2005) “A Study of New Zealand’s Venture Capital Market and Implications for Public Policy”, report to the Ministry of Research Science and Technology, Auckland. LECG Ltd.

Lerner, J. (2009) *Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital have Failed – And What to do About It*. Princeton, NJ: Princeton University Press.

Lerner, J. (2010) The Future of Public Efforts to Boost Entrepreneurship and Venture Capital. *Small Business Economics* 35 (3): 255–264. doi:10.1007/s11187-010-9298-z.

Lockett, A., Wright, M., Burrows, A. et al. (2008) The export intensity of venture capital backed companies, *Small Business Economics* 31(1): 39-58 <https://doi.org/10.1007/s11187-008-9109-y>

Mason, C. and Botelho, T. (2016) The role of the exit in the initial screening of investment opportunities: the case of business angel syndicate gatekeepers. *International Small Business Journal*, forthcoming.

Mason, C. M., Botelho, T., and Harrison, R. T. (2013) *The transformation of the business angel market: evidence from Scotland*. Working Paper, Adam Smith Business School, University of Glasgow.

Mason, C., and Pierrakis, Y. (2013) Venture Capital, the Regions and Public Policy: The United Kingdom Since the Post-2000 Technology Crash. *Regional Studies* 47 (7): 1156–1171. doi:10.1080/00343404.2011.588203.

Mason, C. and Harrison, R. (2015) Business angel investment activity in the financial crisis: UK evidence and policy implications. *Environment and Planning C: Government and Policy*, 33: 43-60

Mason, C., and Harrison, R. T. (2010) *Annual report on the business angel market in the United Kingdom: 2008/09*. Department for Business Innovation and Skills 2010.

Mason, C. M., Jones, L. and Wells, S. (2010) *The City’s Role in Providing for Public Equity Financing Needs of UK SMEs*, Report to the City of London by URS, March.

Munari, F. and Toschi, L. (2014) Assessing the impact of public venture capital programmes in the United Kingdom: Do regional characteristics matter? *Journal of Business Venturing*, 30(2): 205–226.

Murray, G. C. (2007) Venture Capital and Government Policy. In *Handbook of Research on Venture Capital*, edited by H. Landstrom, 113–151. Cheltenham: Edward Elgar.

Murray, G., Hyytinen, A. and Maula, M. (2009) *Growth Entrepreneurship and Finance, in Evaluation of the Finnish National Innovation System: Full Report by Evaluation Finland*.

Myers, S. and Majluf, N.S. (1984) Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics* 13 (2): 187–221

NESTA (2009) From Funding Gaps to Thin Markets: UK Government Support for Early-Stage Venture Capital, BVCA Report for NESTA, September.

North, D., Baldock, R. and Ullah, F. (2013) The finance escalator and the growth of UK technology-based small firms since the financial crash, *Venture Capital* 15 (3): 237–260. doi:10.1080/13691066.2013.804755

OECD (2011) *Financing High Growth Firms: The Role of Angel Investors*, Paris: OECD Publishing

Real Business (2016) *Exclusive: These numbers show UK angels are providing stairway to entrepreneurial heaven*. Interview by Zen Terrelonge (04/04/2016), sourced by author on 06/04/2016 <http://realbusiness.co.uk/article/33464-exclusive-these-numbers-show-uk-angels-are-providing-stairway-to-entrepreneurial-heaven>

Rowlands C. (2009) *The Provision of Growth Capital to Small and Medium Sized Enterprises*. Report for the Department for Business, Innovation and Skills

Scottish Enterprise (2013) *Scottish investment Bank 2012-2013 Annual Review*

SQW Consulting (2009) *The Supply of Equity Finance to SMEs: Revisiting the Equity Gap*. Report to the Department for Business, Innovation and Skills, URN 09/1573.

Swedish Agency for Growth Policy Analysis (Tillväxtanalys) (2009) *Competent Capital? Three countries, three attempts*, Östersund, Sweden.

Swedish Agency for Growth Policy Analysis (Tillväxtanalys) (2013) *Business Angel, Co-Investment Funds and Policy Portfolios*, Östersund, Sweden.

Technopolis (2011) *The Role of Different Funding Models in Stimulating the Creation of Innovative New Companies: What is the Most Appropriate Model for Europe?* Final Report to the European Research Area Board, October.

Tokila A and Haapanen M (2009) Evaluating project deadweight measures: evidence from Finnish Business subsidies. *Environment and Planning C; Government and Policy* 27(1): 124–140.

UKBAA (2015) *Nation of Angels: Assessing the Impact of Angel Investing Across the UK*. Report by the Enterprise Research Centre (ERC) for the UK Business Angel Association, January

UKBAA (2013) *Taking the pulse of the angel market*. Report by Deloitte for the UK Business Angel Association

Wenger, E, McDermott, R. and Snyder, W. (2002) *Cultivating communities of practice: a guide to managing knowledge*. Harvard Business School, Cambridge Massachusetts

Wilson, K., and Silva, F. (2013) *Policies for Seed and Early Stage Finance: Findings from the 2012 OECD Finance Questionnaire*, OECD Science, Technology and Industry Policy Papers No. 9.

Wiltbank, R. (2009a) *Siding with the Angels: Business angel investing – promising outcomes and effective strategies*. Report for NESTA, May

Wiltbank, R. (2005) *Investment Practices and Outcomes of Informal Venture Investors.* *Venture Capital Journal* 7 (4): 343–357. doi:[10.1080/13691060500348876](https://doi.org/10.1080/13691060500348876).