

From start-up to scale-up: examining public policies for the financing of high- growth ventures

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ABSTRACT

We examine the challenge entrepreneurial companies face in going beyond the start-up phase and growing into large successful companies. We examine the long-term financing of these so-called scale-up companies, focusing on the United States, Europe and Canada. We first provide a conceptual framework for understanding the challenges of financing scale-ups. We then show some data about the various aspects of financing scale-ups in the US, Europe and Canada. Finally we raise the question of long-term public policies to support the creation of a better scale-up environment.

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This paper is forthcoming in 2018 in Mayer, C., S. Micossi, M. Onado, M. Pagano and A. Polo (eds) *Finance and Investment: The European Case*, Oxford University Press

This paper was developed through CEPR's Restarting European Long-Term Investment Finance (RELTIF) Programme, which is funded by Emittenti Titoli. Financial support was also provided by CEPR, Assonime, the John Fell and Saïd Foundations.

The authors would like to thank roundtable participants at the 1st Oxford Entrepreneurship Policy Roundtable (May 2015), Bruegel (September 2015), The Quebec City Conference Tech Innovation Platform (March 2016), the Oxford roundtable for the Barclays scale-up report (May 2016), and the RELTIF workshops in Milan (January 2016) and Capri (June 2016), including our discussants José Liberti and Andrew Ellul, for their many helpful insights and suggestions. Finally the authors sincerely and gratefully thank the research assistants David Cartwright, Denis Frydrych, Carolyn Hicks, Kaushal Inna and Christian Rauch.



1. Introduction

Over the last two decades Europe and Canada have experienced a 'start-up' revolution. In the last decade of the twentieth century, technology-based start-ups were widely seen as the prerogative of the US, with Silicon Valley being at the epicentre. However, over the last decade and a half, other countries have successfully developed an ecosystem for technology start-ups. Whilst Europe and Canada almost have comparable numbers of tech start-up companies, there remains a concern about their growth performance. With the US still producing the vast majority of success stories, the challenge in Europe and Canada has become how to succeed at the later stages of the entrepreneurial development process. This is the so-called 'scale-up' challenge.

While the use of the terminology varies, we apply the term 'scale-up companies' or 'scale-ups' to entrepreneurial companies that are past their initial exploratory phase, have found their initial product/service offering and market segment, and are entering a growth phase where they seek significant market penetration. The term scale-up is reserved for companies that are aiming for fast growth, possibly seeking to become so-called 'gazelles'¹. In the context of venture-capital backed companies, scale-ups can also be pragmatically defined as companies that have passed the Seed and Series A stage and are entering Series B or higher. In principle scale-ups can occur in any industry sector, but we focus on those sectors that attract venture capital. By-and-large this means we are focusing on innovation-based companies that involve some aspects of technology. This includes the information technology sector broadly defined, the life sciences, as well as miscellaneous other science and technology-driven sectors.

There are a multitude of factors that are likely to influence scale-up success, including market conditions, management, strategic choices, regulation, and finance. In this paper we explicitly focus on the financing of scale-up. We examine the alternative methods by which companies can fund their ambitious growth plans, and ask what types of investors are needed. In the terminology of Wilson and Silva (2013), we are focusing on supply-side factors of financing entrepreneurial companies, whilst remaining cognisant that the scale-up process is also influenced by demand-side factors (such as market conditions and management quality) as well as the broader regulatory environment (such as taxation or legal system).

In this paper we ask three closely related questions. The first question is conceptual: What are the alternative options of funding scale-ups, and what are underlying challenges associated with each of

¹ A standard definition of a gazelle or (successful) scale-up is a company with an average annualised growth in employees or turnover that is greater than 20 percent over a 3-year period. Alternative definitions add a minimum number of employees (say 10 employees), and possibly add a maximum age (say less than 5 years old).

those options? The second question is empirical: What are the differences in the way that scale-up companies are currently financed in the US, Europe and Canada, and what explains these differences? The third question is normative: What is the possible role of government and public policies in supporting the financing of scale-ups?

To answer these questions, we divide our analysis into three parts. In the first part, we develop some simple conceptual frameworks for analysing the financing choices at the scale-up stage. Using the analogy of a car at a crossroad, we examine companies' choices between scaling-up as a privately-held company, as a publicly-listed company, or being acquired by another company. We argue that scale-up investors need to satisfy four important criteria that we label 'deep pockets', 'smart money', 'networks', and 'patient money'. We also explain the importance of providing investors a well-defined path to liquidity.

In the second part of the paper we review descriptive data about scale-up in the US, Europe and Canada. We recognise the US as the leader in scale-up, and then focus on Europe and Canada as two of the important geographic areas that have burgeoning start-up activity, but still lack in terms of scale-up activity. Canada is interesting because of its geographical proximity to the US, and its relatively well developed entrepreneurial ecosystem. The Canadian government has also been an active supporter of the start-up environment, and is increasingly looking at the importance of scale-ups. Europe is obviously a large economic region that is also increasingly developing its entrepreneurial potential. In order not to dilute the core messages of our analysis we choose to analyse Europe as one entity, without disentangling the differences amongst the various European Countries. The related work of Hellmann *et al* (2016) provides some comparison of the UK versus the rest of Europe. While we acknowledge the importance of the East Asian economies, we do not attempt an analysis of their scale-up environment.

Some of the key data findings are that the US has more later-stage equity investors that have access to deeper pools of money. We provide data that shows the importance of venture capital fund sizes at the scale-up stage. The US has developed a market for venture debt, which remains in its infancy elsewhere. The stock market environment remains stronger in the US, although there is a recent trend toward private liquidity which requires a market for secondary shares². While there are some efforts to develop such markets in North America and Europe, this market is not particularly well developed anywhere yet. The lack of financing options for scale-up in Europe and Canada often implies that companies sell earlier.

² Note that what we refer here to as secondary shares are company shares that are bought from one investor to another. This is not to be confused with the market for secondary partnership shares of private equity funds, where limited partners can buy and sell their interests in funds. Nor should it be confused with second tier stock markets, such as the AIM market in the UK or the TSX-Venture market in Canada, which are less regulated segments of the stock market.

We synthesise our empirical analysis into six challenges that Europe and Canada face in terms of catching up to the US role model. We also discuss the likely root causes that underlie the European and Canadian scale-up gap. For this we take a longer-term perspective, and emphasise that it takes time to build an ecosystem with the appropriate expertise and experience to successfully finance scale-ups.

In the third part of the paper we examine the role of government policies. We describe the main policies currently used by governments to address financing gaps, focusing on supply side financial interventions and selected regulatory framework policies. We explore the underlying rationales for government intervention in this market, and discuss the potential strengths and weaknesses of different policy approaches to help provide a framing for countries seeking ideas regarding policies for financing scale ups.

To set expectations, it is worth mentioning what this paper does not try to achieve. First, our analysis does not try to characterise the challenges of company growth in general, it only focuses on the scale-up challenges of technology-based start-ups broadly defined. Second, this paper provides descriptive statistics, but it does not perform any econometric analysis to explain specific causal relationships. Third, this paper acknowledges the importance of both supply- and demand-side factors, but it cannot cleanly disentangle those two factors. While we provide some evidence that suggests that financing is an important factor, we cannot assess its importance relative to other factors. Fourth, while we try to identify some of the deeper structural factors that explain the gap between Europe and Canada to the US, we do not explain the origins of the structural differences, as this would take us far beyond the scope of this paper.

This paper builds on multiple prior literatures. The conceptual analysis draws on the large and growing academic literature about venture capital financing, as well as the larger literature on financial markets. A useful reference for the venture capital literature is the survey article by Da Rin *et al* (2013). We also draw on the academic work of Axelson and Martinovic (2015), as well as Reynolds and Samel (2013). Our empirical analysis draws on a practitioner-oriented literature that documents the problems of scale-up companies, including Coutu (2015), Hellmann *et al* (2016), and Yaletown (2016). Our policy analysis builds on the work of the OECD including Wilson (2011) and Wilson and Silva (2013) and Wilson (2015). It also draws on the work of Lerner (2008) and Brander *et al* (2015).

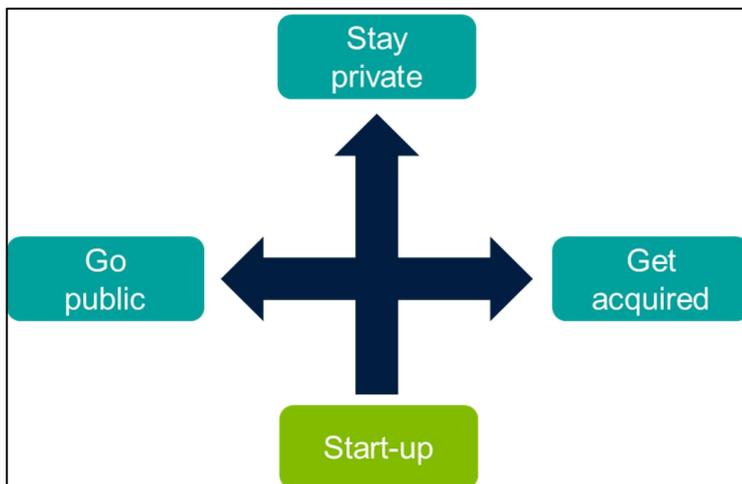
2. Financing scale-ups: a conceptual framework

2.1. The crossroads of scale-up financing

Let us start with an analogy. Think of entrepreneurship as a car journey. At the start the car (read: start-up) needs an engine (read: technology), a driver (read: management), some fuel (read: financing), tires (read: momentum), and hopefully a road map (read: strategy) and navigator (read: mentors). Along the road the driver encounters variable road conditions (read: market demand), traffic jams (read: competition), and traffic police (read: regulators). The journey is full of risks, where there can be delays (read: business challenges), U-turns (read: turnarounds), and breakdowns (read: failures). Of particular interest here are the crossroads (read: decision points), where decisions have to be made about the best path (read: scale-up) to get to the desired destination (read: success).

The decisions taken at the crossroad are crucial for getting to the final destination, so let us take a closer look at the road signs. Figure 1 illustrates the simple but far-reaching decisions that define companies' strategic scale-up choices.

Figure 1: The crossroads of scale-up



To scale up, start-up companies take one of three fundamentally different paths that we described as follows:

1. STAY PRIVATE: Keep driving straight ahead; please refuel first.
2. GO PUBLIC: Turn left onto the fast lane; please pay at the toll.
3. GET ACQUIRED: Turn right; please make room for a new driver.

The crossroad represents a fundamental choice about organizational structure, with far-reaching implications for the strategy, governance and financing of the company. For the first two options (stay

private or go public), the company scales up as an independent entity. The difference between the first two options is that publicly-listed companies (should) have better access to inexpensive capital. However, there is a high cost of going and staying publicly-listed. Being public also exposes the company to the short-term pressures of quarterly earnings expectations, and makes risky investments more difficult (see Asker, Farre-Mensa and Ljungqvist, 2016, and Bernstein, 2015).

The third option of getting acquired by another company fundamentally reshapes the company and the way it grows. In some cases the acquirer leaves the operations in place but grows them within the confines of its corporate structure. In other case, however, the start-up gets largely absorbed within the acquirer's existing operations. In some extreme cases, the acquirer 'shelves' the start-up to eliminate a competitive threat, in which case scale-up doesn't really take place. Acquirers are also often from a different jurisdiction and may relocate some of the activities of the start-up. Note that corporate acquirers are sometimes also called strategic buyers. They should be distinguished from financial buyers that may also acquire the company, but then continue to run it as a private independent entity. In our crossroads framework, we can think of financial buyers as driving straight ahead, i.e. staying private.

How long-lasting are the decisions at the crossroad? An acquisition by another company is by and large a final decision³. An IPO is also a strong commitment, in the sense that it is difficult to go back on it.⁴ By contrast, the decision to stay private is essentially a temporary one. It allows the car to drive straight on until it reaches the next crossroad, where it faces the same three choices.

How long can a company can drive straight, ie how long can it stay private? This depends partly on strategic factors (how long is it efficient to remain an independent entity), and partly on the liquidity needs of the investors. By going public investors can sell their shares after the IPO. In an acquisition, investors receive cash or stock from the acquiring company. However, remaining private gives no immediate prospects for liquidity, except in cases of a financial buyout or so-called secondary share purchases⁵. Hence the pressure to take a left or right turn at some point.

³ Technically speaking the acquirer could spin-out the division at a later point.

⁴ It is possible to go private at a later stage by structuring a buyout. However, the option of getting acquired remains open even after going public – see Zingales (1995).

⁵ An alternative model would be extremely patient investors that are willing to hold on to the company's stock for the indefinite future. In this case the return to investors has to come from dividends or share repurchases, funded by the company if and when it becomes cash flow positive. This model is problematic for most venture capital funds that have long but finite investment horizons, and that require liquidity to pay back their limited partners at the end of their fund lives.

2.2. The four requirements for scale-up investors

What are the financing options of scale-ups that want to stay private? The main source of funding is equity. This can be provided by a combination of new investors and old investors who invested at earlier stages. At the start-up stage the most common outside investors are angels, (early-stage) venture capitalists, and corporate investors. In recent years accelerators and crowdfunding platforms have also become more prominent. At the scale-up stages we again find (later-stage) venture capitalists and corporate investors, but also growth equity funds, private equity funds, hedge funds, cross-over funds, family offices, sovereign wealth funds, and institutional investors investing directly. We collectively call all these investors 'venture equity' investors, to account for the fact that their types go beyond the traditional venture capital model.

What are the requirements for scale-up investors, ie what characteristics do scale-up companies require from their venture equity investors? Based on the large prior academic literature, as well as our observation of industry practice, we identify four key requirements: (i) deep pockets, (ii) smart money, (iii) networks, and (iv) patient money. We now explain each of these in greater detail.

Deep pockets

'Deep pockets' pertains to the ability of scale-up investor to support large funding rounds. While the amounts of funding at the start-up stage are typically fairly modest, scale-up requires substantially larger funding rounds. In Section 3 we provide the relevant data. The question is how to assemble such large rounds. Basic maths suggests you either need an investor that can make a large investment, or you need a syndicate of several investors that collectively fund a large round. Two constraints are relevant. First, from an investor perspective there is a portfolio choice problem, where investing too much in any one company over-exposes the fund to idiosyncratic risk. Standard limited partnership agreements also set a limit on how much a venture funds can invest in any one company, typically in the 10-15 percent range. Second, from a company perspective, having too many small investors may create an unwieldy ownership structure that imposes costs on management and limits strategic flexibility. Both of these suggest that investors need to have sufficiently large funds to fund scale-ups.

The concept of deep pockets also pertains to the ability of investors to provide additional funding if and when needed. Some early stage investors like smaller angels or accelerators quickly lose the ability to continue funding in later rounds. The same is true for smaller venture capital funds at the scale-up stage. From a company perspective, the continued involvement of inside investors is beneficial in terms of providing continuity, and because inside investors have an economic interest in defending the

company's valuation. From an investor perspective, however, continued involvement requires patience. We discuss this further under the fourth requirement.

Smart money

'Smart money' refers to the value-adding capabilities of scale-up investors. A prior academic literature establishes the importance of venture capitalists' expertise. Beyond financial engineering, successful venture capitalists need to have specific sector knowledge, general business expertise, and possibly even entrepreneurial experience (Bottazzi *et al*, 2008; Zarutskie, 2010). Industry experience and deep domain expertise are of central importance in venture capital, both at the start-up and scale-up stage. Smart money pertains to investment selection, and to post-investment value adding (see Sorenson, 2007). At the selection stage, business experience and domain expertise are needed to make good investment decisions. This requires judgment about technology, markets, and management (ie knowing how to check the engine, road conditions, and the driver). After the investment is made, scale-up investors play an important role in guiding the company through its growth challenges and helping with the professionalization of its management structures, ie knowing how to change a tire, navigate the backroads, or pep up the driver (Hellmann and Puri, 2002).

Networks

The requirement for 'networks' is closely related to 'smart money' but adds the notion of access to resources that are beyond the reach of the company. Well-networked investors can help the company reach two types of networks: business networks and financing networks. Business networks are needed for a large variety of growth challenges, such as providing access to international markets, strategic partners, industry talent, or regulatory authorities (see Hochberg, Lindsey, and Westerfield, 2015, Hochberg, Ljungqvist and Lu, 2007). Financing networks are needed to create attractive choices at upcoming crossroads. For turning left (ie going public), well-networked investors can help the company identify the right investment bankers and potential management team members. For driving straight (ie remaining private), they can help to bring in additional investors with complementary skills and networks as well as identify senior executives to join the company or board. For turning right (ie getting acquired), they can initiate discussions with potential acquirers.

Patient money

The final requirement of 'patient money' is premised on the fact that scale-ups are risky and require long-term investments. A fundamental difference between privately-held and publicly-listed companies concerns their investment horizon. Stock markets impose short-term discipline on companies, focusing

them on meeting quarterly earnings expectations. Privately-held scale-ups by contrast have the ability to look at multi-year investments without pressures for short-term performance. Venture capital investors take a longer-term perspective, but still have a finite horizon, ie they cannot hold on to the equity indefinitely. This is because most funds have a limited life structure, the norm in venture capital being 10 years.

An interesting question is what factors affect investors' costs of holding illiquid equity. Traditional venture capital funds are under pressure from their limited partners. This is especially true towards the end of a fund, as the limited partners want to get paid in cash or liquid assets. However, even before that, venture capital firms are already under pressure to show realised returns, especially when they raising the next fund⁶. Overall we note two important aspects about patient money. First, the nature of scale-ups requires investors to be willing to make illiquid long-term investments. Second, there is a limit to investor patience, and therefore a desire for investors to create liquidity opportunities.

3. Comparative evidence on the financing of scale-ups

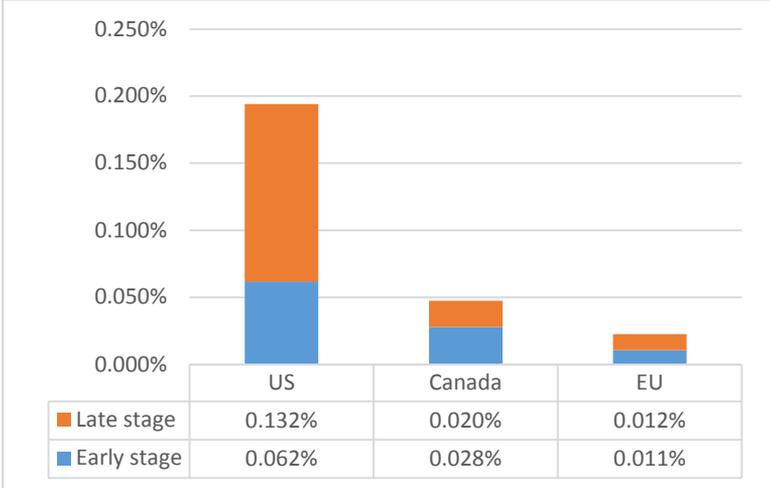
We now examine the main evidence on the differences between the US and Europe in terms of financing of scale-up. Where possible we also include data on Canada. It should be noted in this context that there is no comprehensive international data source for venture capital. In this paper we draw data from diverse sources that are not always fully consistent with each other. In the appendix we provide a brief description of each of those datasets.

3.1. Venture funding of start-ups and scale-ups

Figure 2 shows that amount of venture capital as a fraction of GDP, for the period 2007-2014. The data comes from the OECD which obtains the data from the respective venture capital associations, namely NVCA for the US, CVCA for Canada, and Invest Europe (f.k.a. EVCA) for Europe, and then processes it to make it more comparable. Figure 2 shows a clear pecking order, with the US being by far the largest market for venture capital, followed by Canada, and then Europe. Figure 2 also differentiates between the investment amounts at earlier stages (start-ups) versus later stages (scale-ups). In the US about two thirds of all venture capital goes to scale-ups, compares to less than half in Europe and Canada.

⁶ In recent years there has been a growing interest in alternative venture structures that create longer horizons than those afforded in the traditional venture capital model. Of particular note are so-called 'evergreen funds' that can reinvest the returns from earlier investments, and that have no pre-defined end date.

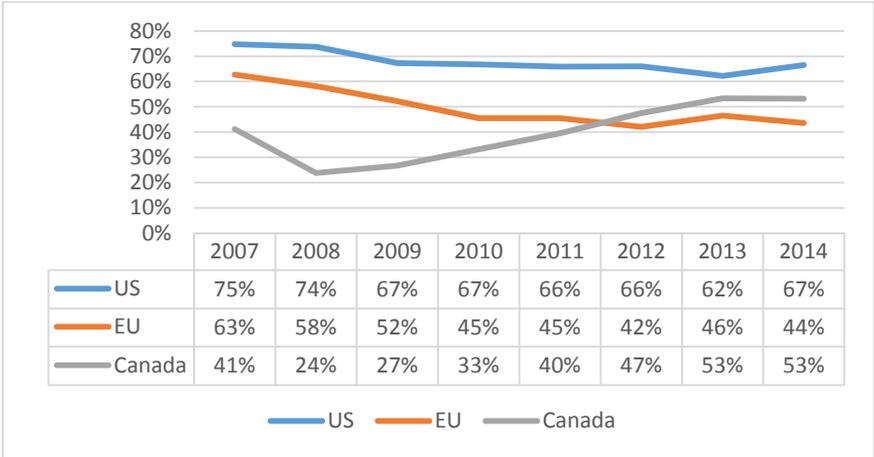
Figure 2: Venture Capital as a Fraction of GDP



Note: data is from the OECD for the period 2007-2014.

To get a better sense of the breakdown between early and late stage financing, Figure 3 uses the same data from the OECD, and shows the levels and time trends of the share of late stage financing for the US, Canada and EU. The figure confirms that the amount of funding going into later stages is highest in the US. While Canada had the lowest percentages before 2011, later stage financing is on the rise in Canada. The opposite trend applies to Europe.

Figure 3: Percentage of Late Stage Investment Amounts

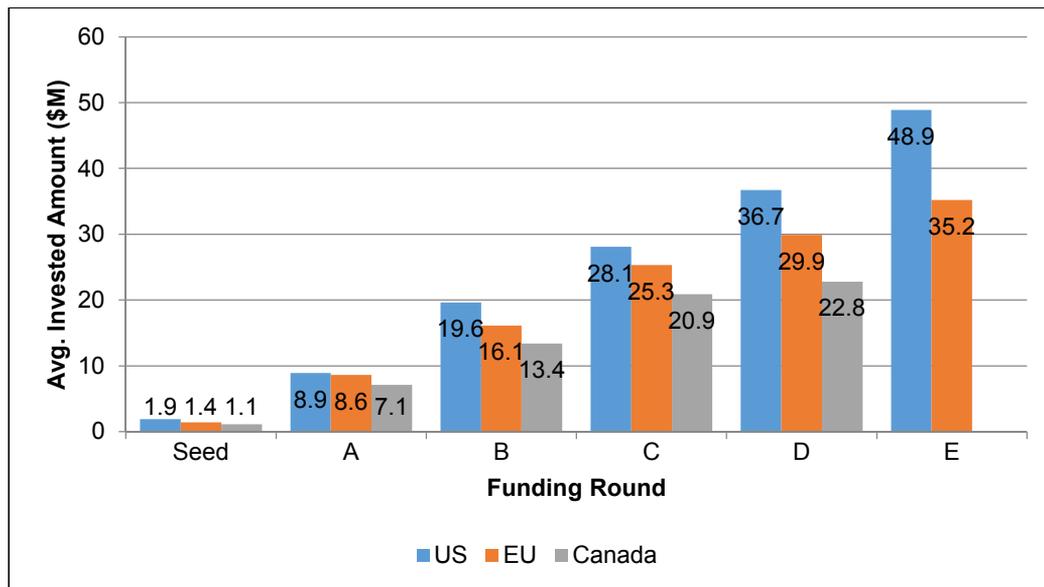


Note: Data is taken from OECD for the period 2007-2014.

Going beyond aggregate data, we consider individual deal level data from PREQIN, for the period 2010-2015. PREQIN records venture capital investments in the US, Canada and Europe. Figure 4 shows the

average size of investments across different rounds, for companies located in the US, Canada and Europe. We find that at the seed and series A stage (ie at the start-up stage), there is little difference between the US and Europe. However, after series A, (ie at the scale-up stage) US companies receive larger funding rounds⁷.

Figure 4: Average Investment Amounts by Funding Round

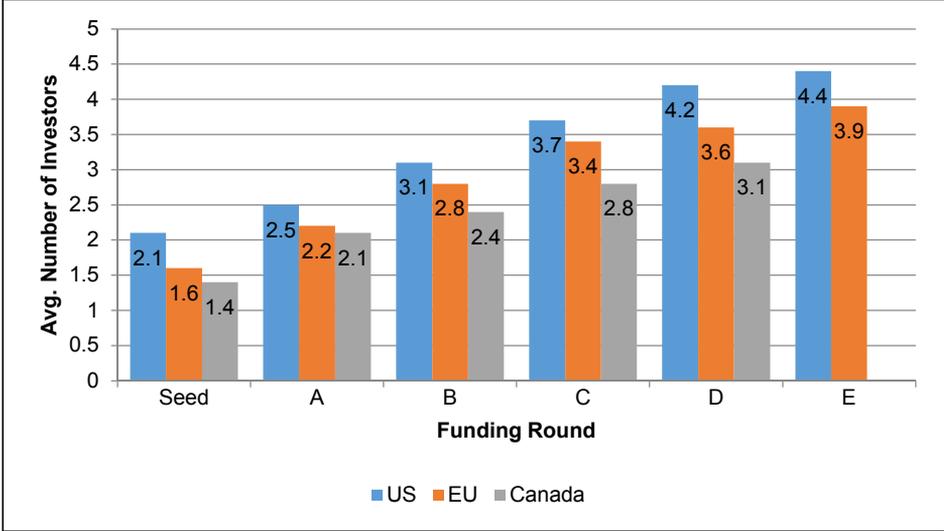


Note: Data is taken from the PREQIN Venture Capital database for the period 2010-2015. The Figure illustrates the average funding size across fundraising stages. Data for the EU represents the EU27 region.

Larger investment rounds can be structured by having more investors and/or by having larger investment amounts per investor. We therefore decompose the results from Figure 4. Figure 5 shows the average number of investors in an investment round, whereas Figure 6 shows the average investment amount per investor, sometimes referred to as ‘ticket size’. The main insight here is that while investment rounds have larger syndicate sizes in the US, there still remains a clear difference in the ticket sizes, with investors paying the highest ticket sizes when investing in US companies.

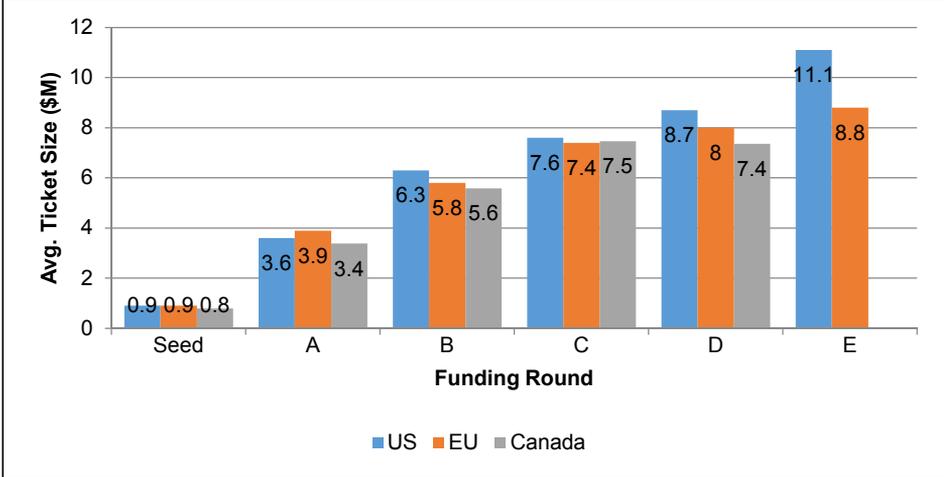
⁷ It is worth noting that the PREQIN data differs from data reported by Thomson One, another popular commercial data provider. In particular, the average investment amounts for seed and A round investments in PREQIN show relatively few differences between US, EU and Canada. The data from Thomson One, however, typically shows significant differences in average round sizes for early stage deals. The discrepancies between data sources are due to the different sampling methods used by the two data providers (neither of which is likely to fully capture the underlying population), as well as differences in the definitions of what constitutes seed and early stage rounds. We think it likely that the PREQIN data understates the differences between the US versus Europe and Canada.

Figure 5: Average number of investors



Data is taken from the PREQIN Venture Capital database for the period 2010-2015. The Figure illustrates the average number of investors in a funding round, across fundraising stages. Data for the EU represents the EU27 region.

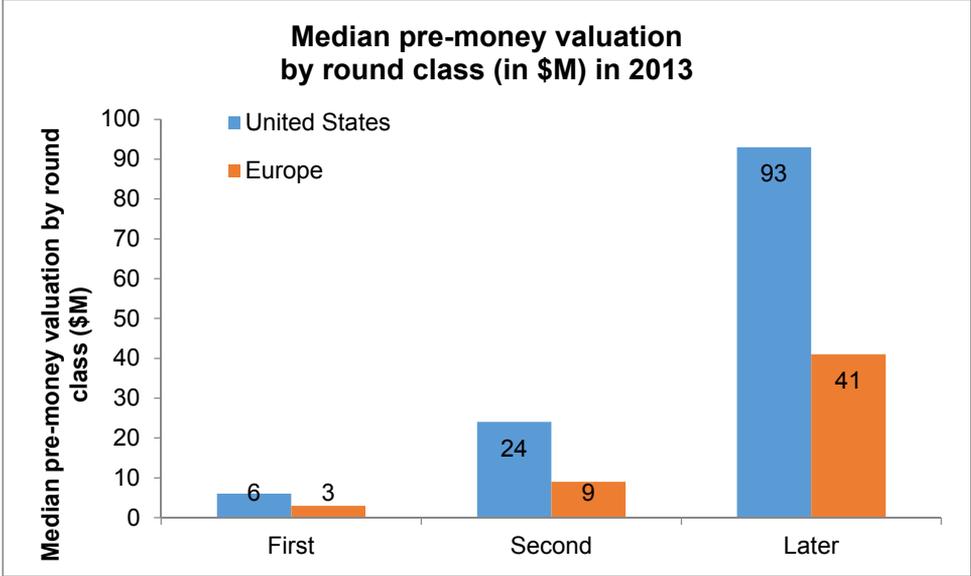
Figure 6: Average investment amount per investor



Note: Data is taken from the PREQIN Venture Capital database for the period 2010-2015. The Figure illustrates the average investment size per investor in a funding round, across fundraising stages. Data for the EU represents the EU27 region.

Obtaining data on valuations is inherently challenging, but VentureOne provided some data on valuations in 2013. Figure 7 reports median valuations in first, second, and higher rounds. It shows that US based companies receive significantly higher valuations. While European valuations may be attractive for investors, and may explain the increased investments of US investors in European companies, they also suggests that there is a problem: European entrepreneurs either have less valuable companies, and/or face less competition for their deals.

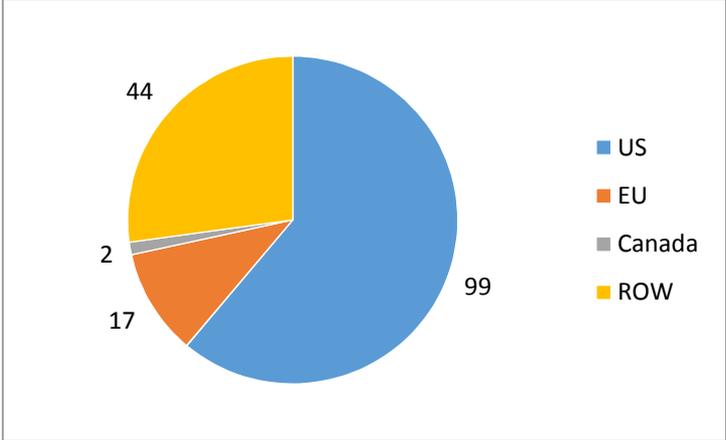
Figure 7: Valuations



Note: Data taken from VentureSource for 2013. The Figure illustrates the median pre-money valuation for European and US companies.

A recent trend is the rise of so-called ‘unicorns’, privately-held companies that are valued above US\$1B. While this measure is somewhat arbitrary, and can be easily manipulated with the use of preferred shares and other contractual clauses, a simple count of unicorns is still a useful measure of the success of countries to generate successful scale-ups. Figure 8 uses data from Crunchbase to show the global distribution of unicorns. The US clearly leads the count. Two things are worth noting about Europe and Canada. Both have succeeded in raising some unicorns. This refutes the more pessimistic view that Europe and Canada are simply unable to create entrepreneurial success stories. At the same time, it also shows that a gap persists, as European and Canadian unicorns still remain relatively rare.

Figure 8: Number of unicorns



Note: Data on unicorns is taken from CrunchBase and CB Insights as of March 2016.

3.2. Venture capital fund sizes

The amounts of funding required at the scale-up stage are considerably larger than at the start-up stage. What fund sizes are needed to support scale-up financing? For this we examine PREQIN data about venture capital fund sizes.

We first compare the sizes of venture capital funds in the US, Canada and Europe, looking at all funds for the vintage years 2005-2015. Figure 9 shows the fund size distribution, showing what fraction of funds fall into the respective size categories. Funds are allocated to countries on the basis of their headquarter locations. The Figure shows 28 percent of US funds are over \$250M, compared to 10 percent in the EU and 11 percent in Canada.

Figure 9: Fund size distribution

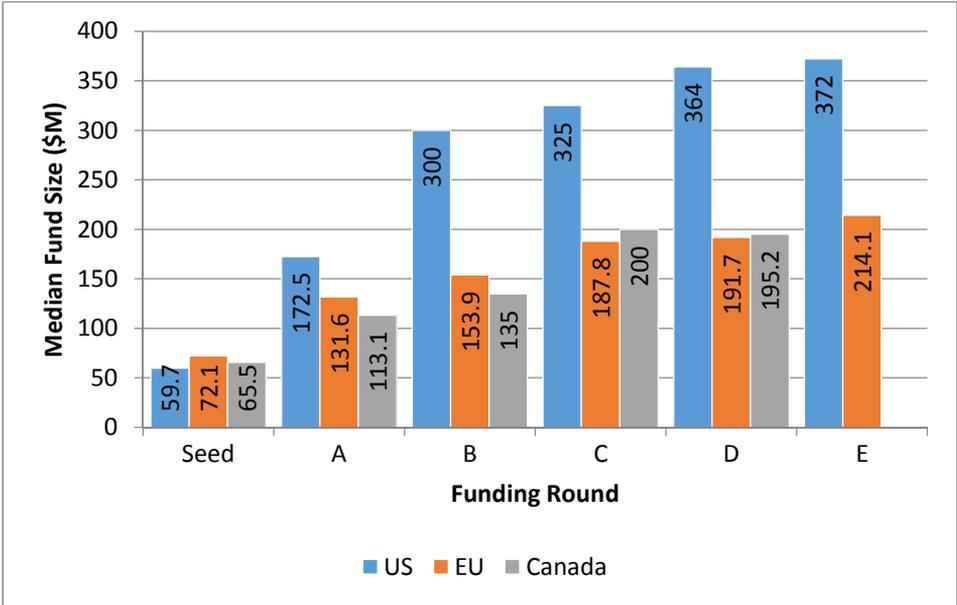


Source: Bruegel. Note: Data is taken from the PREQIN Venture Capital database, and shows all VC funds with vintage years 2005-2015. The Figure illustrates the fund size distribution. Data for the EU represents the EU27 region. Funds are allocated to countries on the basis of the fund’s headquarters location.

Figure 10 shows the median fund size of investors that invested across different rounds. The data comes from PREQIN, and looks at all deals for the period 2010-2015 by investment round. The figure shows the median size of all funds that invested in a deal of a given round (Seed, A, B...), in the company’s country (US, Canada, or EU). At the start-up stage (Seed and Series A), there is relatively little difference between European and US funds. However, at the scale-up stage US companies are funded by significantly larger

funds. The larger funding rounds observed in Figure 4 therefore come from larger funds. This data suggests that scale-up funding is related to the presence of large funds, be they local or foreign.⁸

Figure 10: Median fund size by funding round

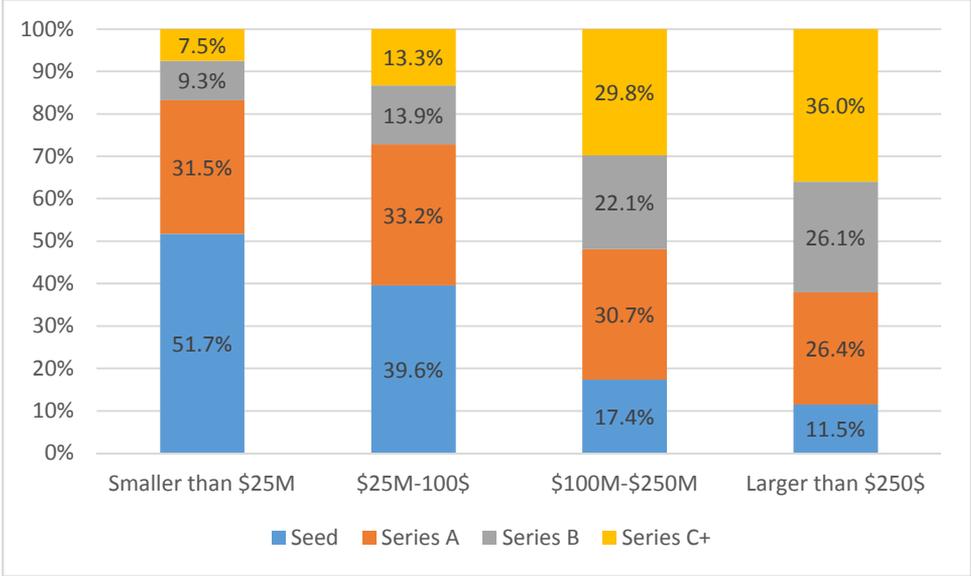


Note: Data is taken from the PREQIN Venture Capital database for the period 2010-2015. Funds are allocated to countries on the basis of the company's location.

Figure 11 looks at the same question from a fund perspective. Focusing on US funds (the Figure looks very similar if we also include Canadian and European funds), this Figure looks at the number of investments by stage, for funds across different size categories. It shows that smaller funds make the vast majority of their deals at the start-up stage. It is only for funds with over \$100M that the majority of deals are at the scale-up stage (Series B and higher).

⁸ In this context it should also be noted that beyond traditional venture capital funds, other types of funds are increasingly financing scale-ups in the US. These include growth equity funds which traditionally focus on funding growth of established and profitable mid-sized companies; they include cross-over funds, which invest in private companies with a view of listing on public markets and then holding them for the longer term; finally they include specialised buyout funds that are buying companies from the venture capitalists with a view of growing private independent companies. To date there is little systematic data about these new investor categories.

Figure 11: Stage investing by fund sizes

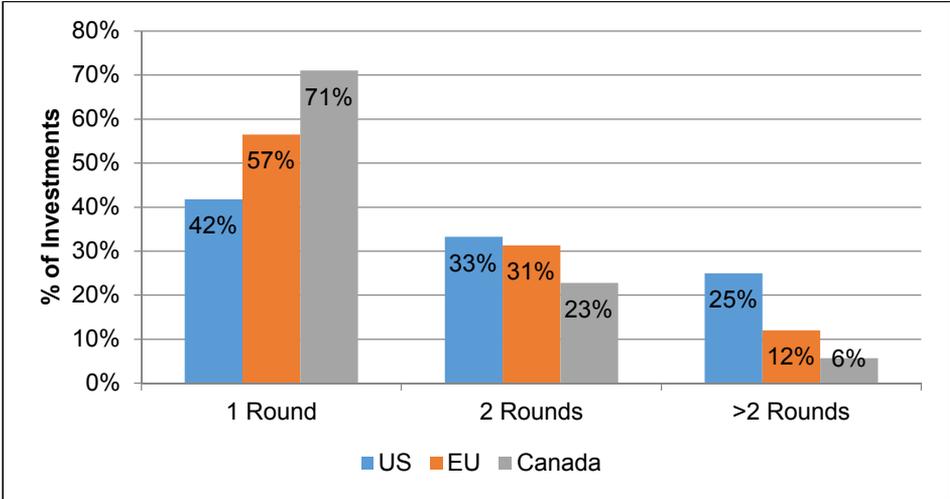


Note: Data is taken from the PREQIN Venture Capital database for the period 2010-2015.

As noted in section 2, deep pocketed investors can not only afford larger funding rounds, they are also more likely to invest in a company over multiple rounds, thus providing greater funding continuity.

Figure 12 looks at the propensity to fund a company over multiple rounds (as measured at the end of 2015). On the low end of the distribution, European companies have 57 percent of their investors investing in a single round, compared to 42 percent in the US. On the high end of the distribution European companies have 12 percent of their investors investing in three or more rounds, compared to 25 percent in the US. This suggests that US companies have investors that are more willing to invest for longer.

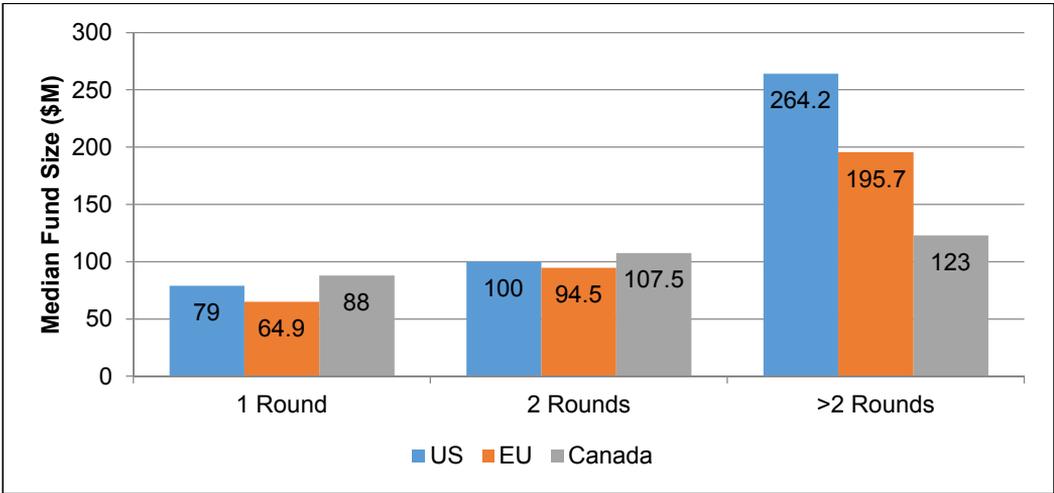
Figure 12: Multiple round investors



Note: Data is taken from the PREQIN Venture Capital database for the period 2010-2015. The Figure illustrates the frequency of multiple investments by funds in the same company. Data for the EU represents the EU27 region.

One may expect that the ability to invest for more rounds is related to fund size. Figure 13 looks at the median fund size when the company received one, two, or more that two rounds of financing from that investor. The Figure shows that those investors who invest over multiple rounds are also larger, especially those that invest in more than 2 rounds, and especially in the US.

Figure 13: Multiple round investors and fund sizes

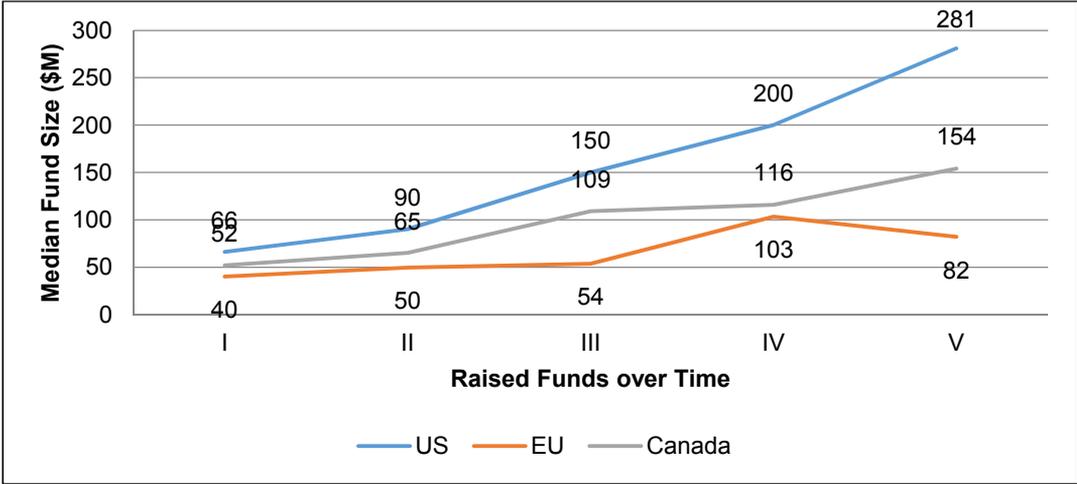


Note: Data is taken from the PREQIN Venture Capital database for the period 2010-2015. The Figure illustrates the median size of funds investing in multiple rounds of the same deal. Data for the EU represents the EU27 region.

What explains the lower fund sizes in Europe? Doubtlessly one can point to the relative youth of the industry, and the shorter track records of European venture capital firms. However, there may be further factors at play. One interesting exercise is to compare how funds grow over successive fundraisings.

Figure 14 examines the evolution of fund sizes as venture capital firms proceed from one fund to another. US funds are larger at each stage, and the differences grow over time. After their second fund, the median fund size is two to three times as large in the US than in Europe.

Figure 5: The evolution of fund sizes



Note: Data is taken from the PREQIN Venture Capital database for the period 2010-2015. The Figure illustrates the fund size evolution over successive funds. Data for the EU represents the EU27 region.

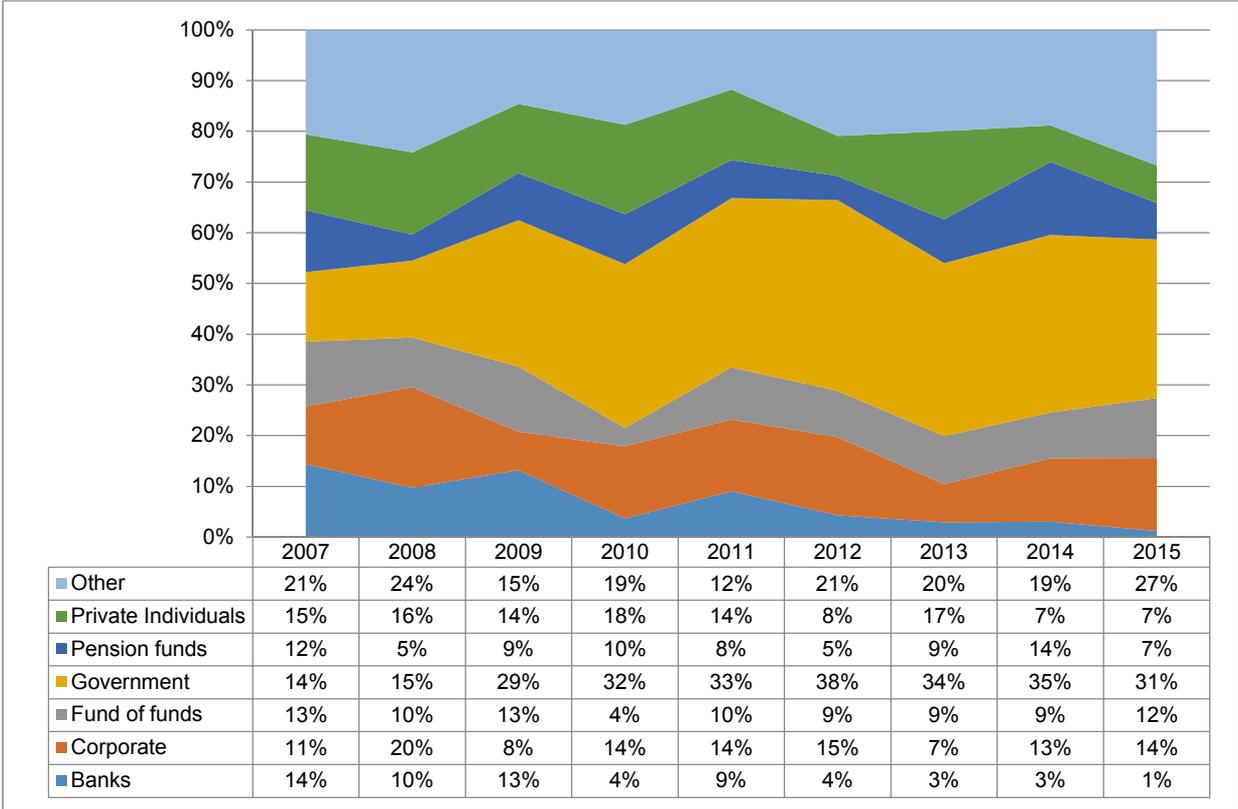
There may several possible explanations for this pattern. One is the relative lacklustre returns generated by European venture capital funds. While the data on returns remains patchy, a report by the European Venture Capital Association (EVCA 2014) reported a net-pooled IRR of 1.68 percent for venture capital funds with vintage years 1980-2013.

The low returns of the average venture capital fund are naturally a concern, but they are unlikely to explain the whole phenomenon. First, they pertain to historic data which should not be the only reference point for estimating future returns. The European VC started later so some of this may just a sign of a slow but normal market evolution. Second, even if the average performance was low, the performance of the top funds remained respectable. Specifically, EVCA (2014) reports an IRR of 18.51 percent for the top quartile of venture capital funds. Yet even among the top performers it appears that relatively few grew into large funds.

Another interesting issue concerns the funding sources of European venture capital funds. Venture capital firms can be funded from a variety of sources, including banks, insurance companies, corporations, fund-of-funds, government programmes, pension funds, private individuals and others. Based on Invest Europe data, Figure 15 shows the evolution over time of the funding sources. An important trend is the relative rise of government funding. This is in largely driven by the decline in

private but not in public funding sources. While different governments use different approaches, there is a tendency, especially amongst some European governments, to disperse their venture capital investments over a large number of smaller funds. This may also help to explain the size distribution of European VC funds.

Figure 15: Funding source for European VC funds



Note: Data is taken from the EVCA (2007-2015). Other includes Academic institutions, Capital markets, Endowments and foundations, Family offices, Insurance companies, Other asset managers (PE houses other than fund-of-funds), Sovereign wealth funds, and unclassified investor types (definitions are taken from EVCA).

3.3. Venture debt

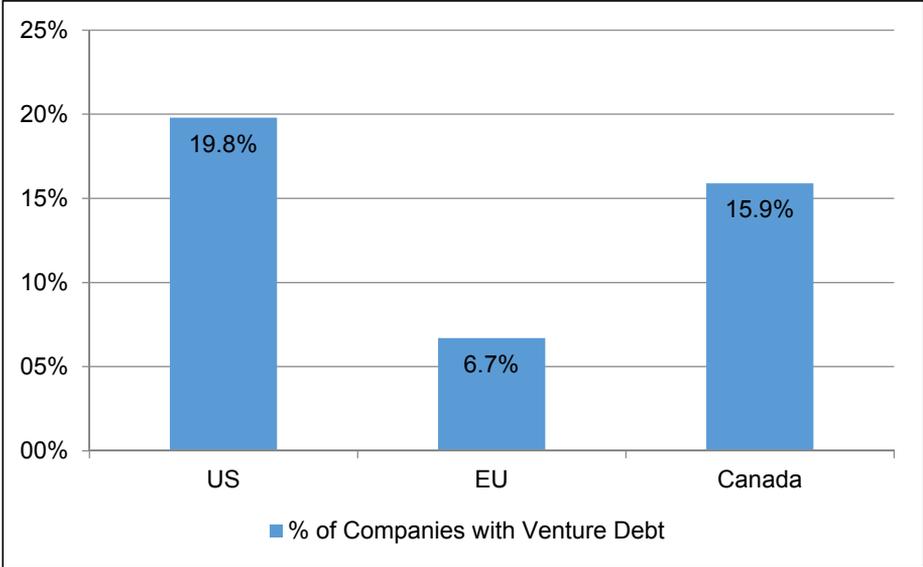
Our discussion so far focuses on venture equity investors. In addition to equity, scale-up companies can sometimes access debt financing. Some debt is linked to specific business processes, such as assets leasing, or lines of credit for working capital. In addition, there is venture debt, which we can think of as term loans to scale-up companies. This is relatively rare at the start-up stage but becomes more common at the scale-up stage. Venture debt does not fit banks’ standard loan criteria, as borrowers have negative cash flows and few collateral assets. Loan payback is expected to come from one of three possibilities: the company may turn cash flow positive before loan maturity, it may get acquired before then, or the company may raise a fresh round of equity.

In practice venture debt is typically issued by companies that also have venture capital investors, and where the debt providers rely in part of the due diligence and support of the venture capitalists (Hochberg, Serano, Ziedonis, 2014). There are two distinct types of venture debt providers: banks and venture debt funds. Given the high risk and limited upside of venture debt investing, banks sometimes justify this type of lending with building client relationships (see Hellmann, Lindsey and Puri, 2008 for a related argument). Venture debt funds, on the other hand, entirely rely on a financial return. To justify their loan investments, they require some upside returns in the forms of equity or warrants.⁹

Data on venture debt remains sparse, and there is no universally accepted definition of what constitutes venture debt. The common understanding in the industry is that venture debt is associated with companies that also raise venture capital. Consequently we can obtain some idea of the venture debt market by looking at the PREQIN data, which collects information on venture debt for those companies that also raise venture equity.

Figure 16 shows the fraction of companies in PREQIN that raise some venture debt. We find that 20 percent of US companies raise venture debt at some point, compared to 16 percent for Canadian and 7 percent for European companies.

Figure 16: Percentage of companies raising venture debt

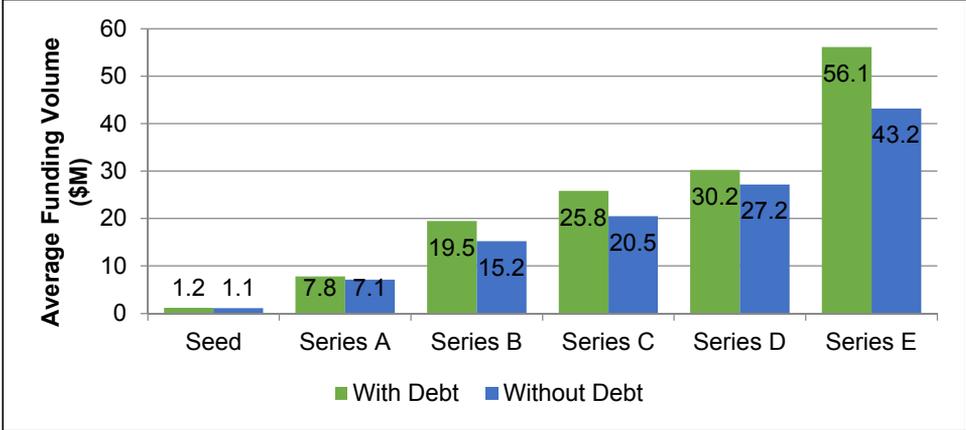


Note: Data is taken from the PREQIN Venture Capital database for the period 2010-2015. Data for the EU represents the EU27 region.

⁹ Venture debt providers typically do not satisfy the four requirements of venture equity listed above. While they help to address the need for deep pockets, they are unlikely to have the same expertise or networks of venture equity investors, and they are typically less patient investors that expect to get repaid within the medium-term.

Is venture debt just a substitute for venture equity, or do companies raise more money by also going to the venture debt market? To examine this we look at the amounts of equity raising, comparing companies with and without venture debt. Figure 17 shows that companies with venture debt actually raise more equity than those without. This is true even without counting the amount of venture debt. It suggests that venture debt is a complementary tool for scale-up companies that have significant funding needs. European scale-ups, however, seem to have less access to this complementary form of funding.

Figure 17: Equity fundraising with or without venture debt



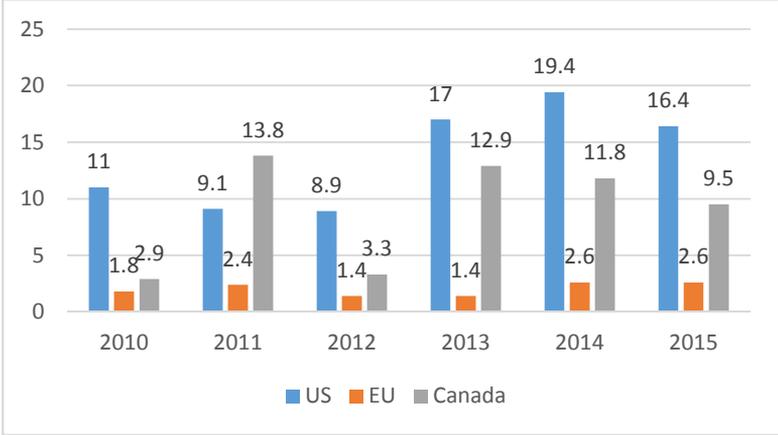
Note: Data is taken from the PREQIN Venture Capital database for the period 2010-2015. The Figure illustrates the average funding volume per round for deals with and without venture debt.

3.4. Exits

Exits are of central importance to the investment cycle. Based on our framework of the crossroads of scale-up financing (see Figure 1), we consider IPOs, private secondary sales, and acquisitions. In theory stock markets should play two important roles for scale-up companies. They should be a source of primary funding for companies, and they should give investors liquidity by allowing them to sell their shares either at or after the IPO. However, there is widespread concern in the industry that stock markets rarely succeed in playing these roles for the vast majority of scale-up companies. There are also marked differences in the way that stock markets work in different countries, how different segments of the market work within a country, and how receptive stock markets are over time to listing new companies. For a more comprehensive discussion see Ritter (2014), Ritter, Vismara and Paleari (2012) and Wilson and Silva (2013).

The main point we want to establish here is that IPOs play a relatively minor role in the financing of European scale-ups. Figure 18 shows that amongst all the exits of European VC backed companies, less than 3 percent went public. In the US this percentage hovered between 9-11 percent between 2010 and 2012, and climbed to 20 percent in 2014. In Canada it lay between 9-13 percent since 2013.

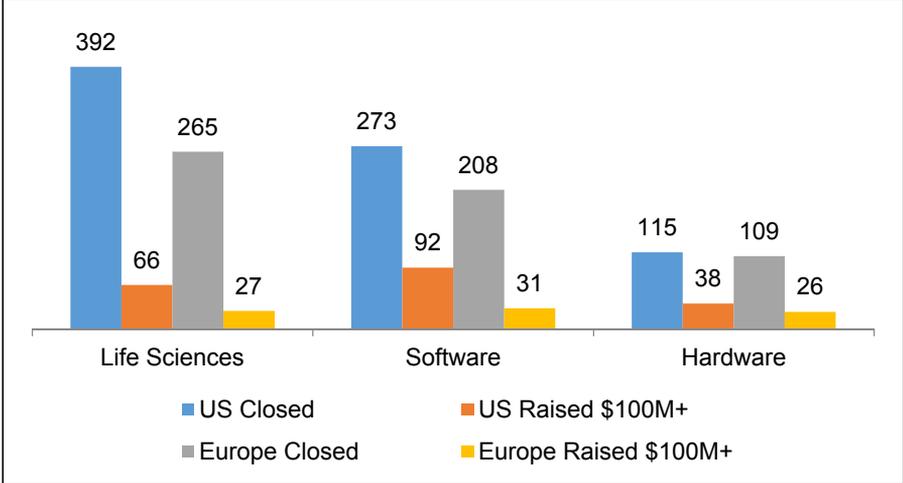
Figure18: IPOs as a fraction of VC exits



Note: Data is taken from EVCA, NVCA, and CVCA for the period 2010-2014. The Figure illustrates the IPO ratio of EVCA, NVCA, and CVCA reported exits.

Going public can mean very different things depending on where the company goes public and how much money it raises. Figure 19 uses data from Capital IQ for the period 2002-2015, focusing on three classes of technology scale-ups: life sciences, software and hardware. The Figure reports the number of IPOs as well as the fraction of IPOs that raised over US\$100M. Not only are the absolute number of IPOs higher, the fraction of large IPOs (ie those raising over US\$100M) is also higher in the US.

Figure 19: Tech IPOs

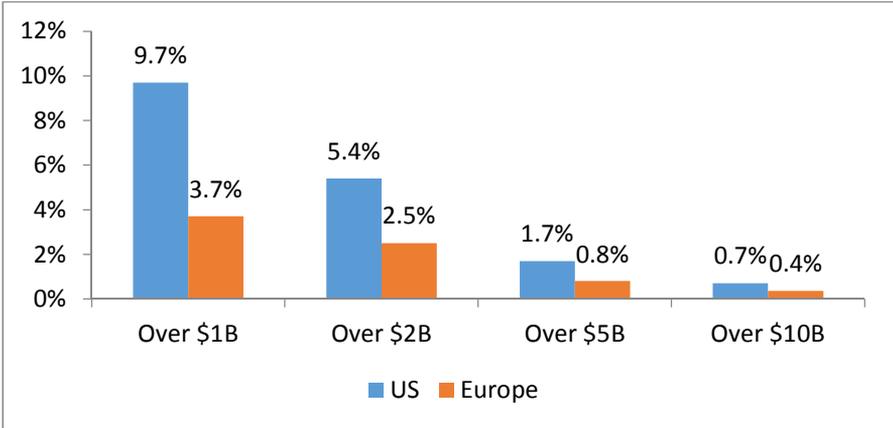


Note: Data is taken from Capital IQ for the period January 2002 – May 2015.

The growth performance of companies after the IPO does not seem to be the same in Europe versus the US. Figure 20 shows that the fraction of companies that went public over the period 2002-2015 that

grew into billion dollar valuations (as measured in May 2015). For each of the size categories we find that the fractions of public companies are larger in the US than in Europe.

Figure 20: Post-IPO growth



Note: Data is taken from Capital IQ for the period January 2002 - May 2015.

Unlike the US, Canada and some European countries have so-called second tier stock markets that have lower listing and disclosure requirements. Examples include the TSX Venture Exchange in Canada, or the Alternative Investment Market (AIM) in the UK. However, these markets are targeted at small and medium-sized business in general, and are rarely suitable for scale-ups. For example, there are two main stock market segments in the UK. For the period 2010-2015, the median IPO on the main board of the London Stock Exchange ranged between a low of \$50.5M (£32M) and a high of \$301.6 (£191M), whereas the median for the AIM ranged between \$6.3M (£4M) and \$20.5 (£13M), which is lower than the typical amount of funding sought by scale-ups (See Hellmann *et al*, 2016)¹⁰.

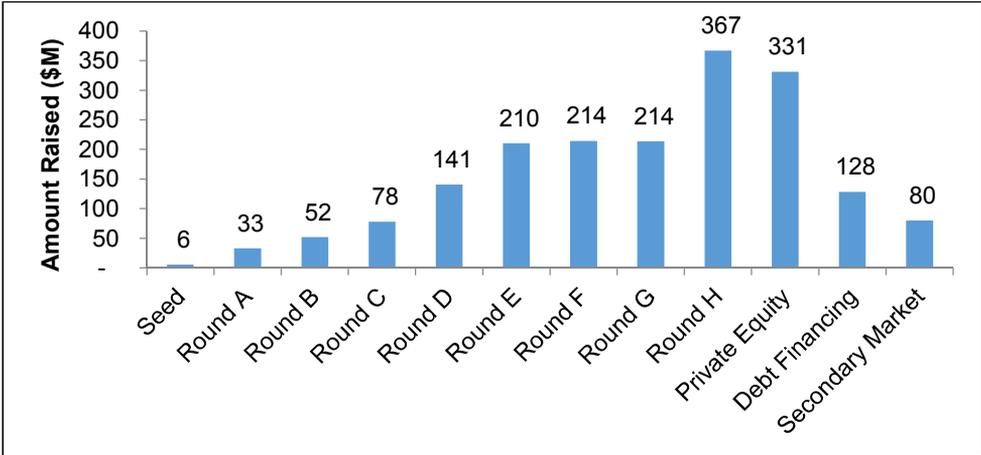
If a scale-up company wants to remain independent (ie not get acquired), and there is no stock market that can serve its needs, then we know from Figure 1 that it can only drive straight at the crossroad, ie a private company for some time longer. In recent years, this path has become increasingly more common, as witnessed by the rise of the unicorns. By definition these companies are outliers, but they still hold some useful lessons. Figure 21 is based on the Crunchbase data and shows the average investment size for unicorns. Compared to Figure 4, the funding amounts are much larger¹¹. Of particular interest to us here is the last column, which shows that the average amount of secondary transactions

¹⁰ The historic annual GBP-USD conversion rate has been applied for 2010-2015.

¹¹ Also of interest is the data about venture debt. Figure 21 shows an average amount of US\$128M of debt funding, which is the average amongst the 24 percent of unicorns that reported using any venture debt. Note that the average is affected by one outlier (Uber raised US\$1.6B of venture debt), but the median amount is still \$50M.

for unicorns reached \$80M for those unicorns¹². This highlights the fact that secondary transactions are becoming increasingly important as scale-ups want to remain private for longer¹³.

Figure 21: Funding of unicorns



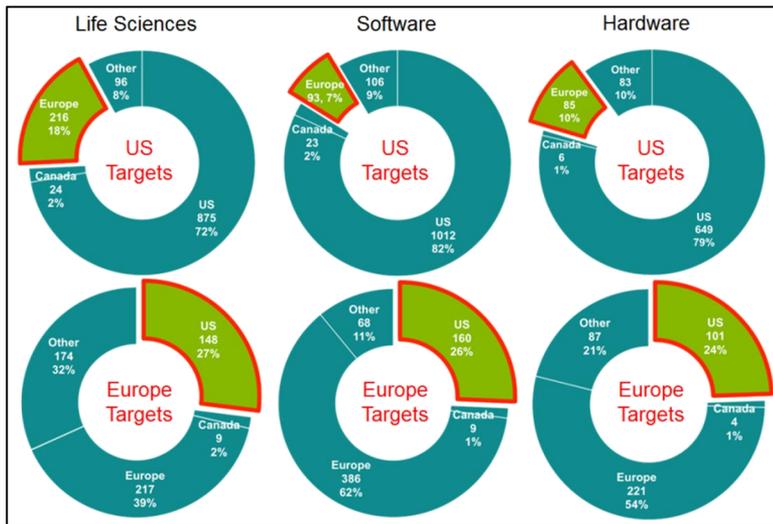
Note: Data on unicorns is taken from CrunchBase and CB Insights as of March 2016.

While IPOs and secondary sales allow successful companies to remain independent entities, the most common outcome for a successful start-up is to be acquired by another company. This is the end of the road for the start-up as a separate company. There is little data on how the acquired entities grow within the larger corporations. One of the concerns of policy makers has been the role of foreign acquirers, and the possibility of relocation. Unfortunately there is almost no data on relocation. What is more readily measurable is the incidence of foreign acquisitions. Figure 22 and 23 uses data from Capital IQ for the period 2002-2015, focusing on acquisitions valued over US\$50M. It shows that US companies were bought by European acquirers in 7-18 percent of all cases, whereas European companies were acquired by US companies between 24 percent-27 percent.

¹² Note that this average is merely based on 6 percent of unicorns that reported having secondary transactions and reported the values. The median was \$63M.

¹³ Apart from the above data on unicorns, there is very little data on the secondary sales of private shares. Moreover, this market remains fragmented and lacks transparency. In the US one of the leading marketplaces is called 'Secondmarket'. It gained some visibility around 2009 when investors wanted to buy and sell shares in Facebook before it went public. Trades on Secondmarket valued Facebook well above its eventual IPO price, causing some controversy. Secondmarket subsequently changed its business model towards helping private companies organise tender offers of their shares. It was acquired by NASDAQ Private Markets in 2015.

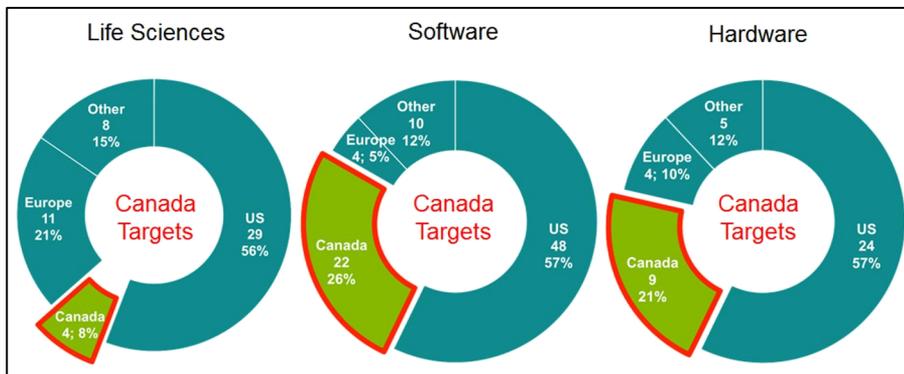
Figure 6: Large acquisitions – Europe



Note: Data taken from Capital IQ for the period January 2002 – May 2015.

For Canada the numbers are more extreme, reflecting the smaller size of its economy, and its geographic proximity to the US. Over half of all Canadian targets were bought by US acquirers.

Figure 23: Large acquisitions – Canada



Note: Data taken from Capital IQ for the period January 2002 – May 2015.

4. Explaining the European and Canadian scale-up financing gap

Ideally we would like to identify the roots of the European and Canadian scale-up problem. Unfortunately this remains a formidable challenge. In this section we provide an interpretation of the empirical evidence, and discuss the likely underlying causes of the problem. At the same time we caution that much more research is needed to provide more definite answers to these challenging questions. So instead of asserting what the underlying causes are, we provide a discussion of what the likely roots of the problem might be.

4.1. An interpretation of the empirical facts

We begin our discussion of the roots by providing a summary interpretation of the evidence presented in section 3. The data analysis does not lend itself to any definitive conclusion, given the limitations of the underlying data and the lack of any natural experiments to establish causal relationships. However, it is still possible to generate some preliminary insights from the overall patterns that emerge from the descriptive data.

We synthesise the empirical evidence by identifying what we believe to be the core problems of financing scale-ups in Europe and Canada. We formulate these as six specific challenges that emerge from the data from section 3. These six challenges will also guide our policy analysis in section 5.

- *Challenge #1: Relative to the US, the European and Canadian venture capital market remain smaller. Importantly, the gap is larger at the scale-up stage than the start-up stage.*
- *Challenge #2: Financing scale-up requires large venture equity rounds, which in turn requires sufficiently large funds. Relative to the US, Europe and Canada has fewer large experienced venture equity funds.*
- *Challenge #3: Given the relatively lower access to scale-up financing in Europe and Canada, successful European and Canadian companies often seek to be bought out. Acquirers are likely to come from abroad, especially from the US. However, there is no systematic evidence about how this affects the underlying activities of the acquired companies.*
- *Challenge #4: Venture debt in the US complements venture equity as a source of funding scale-ups. However, the European and Canadian market for venture debt remains underdeveloped.*
- *Challenge #5: European stock markets have not been able to serve as a major source of funding for scale-ups, nor provide an important source of liquidity for venture equity investors.*
- *Challenge #6: Secondary sales of shares are an alternative for giving investors liquidity, but there are significant informational challenges in this market. Solutions are beginning to emerge in the US, less so in Europe and Canada.*

4.2. Towards an understanding of the underlying causes

Before we address how public policies can tackle the six challenges identified in section 4.1, we ask the more fundamental question about the underlying causes. What is at the roots of these six challenges, and what economic arguments can help us to disentangle them from each other. To answer this, we first identify the more immediate causes for each the six challenges. We then take a step back and ask about some of the more fundamental ultimate causes that can jointly explain the six challenges by taking a longer-term perspective.

Concerning the first challenge, the core question is what explains the apparent gap in European and Canadian scale-up financing. Importantly, this is a question about the current state of the European and Canadian scale-up ecosystem as a whole. A priori one cannot say how much demand versus supply side factors matter, ie to what extend the problem is one of insufficient investment opportunities (too few high quality companies), versus insufficient availability of investment capital (too few qualified investors). We are not aware of any study that provides direct evidence to this challenging question.¹⁴ However, we can still obtain some insights from more indirect observations. One significant indicator is the emerging interest of US investors in European and Canadian companies. In section 3.4 we already documented the importance of foreign acquirers. Hellmann *et al* (2016) provides related evidence on the role of foreign venture capital investors. If the problem of scale-up was entirely driven by demand side considerations that European and Canadian are of insufficient quality, then it would be hard to explain why sophisticated US investors were interested in investing in these companies, or why leading US corporations are interested in buying them. Moreover, while there no systematic data, there is growing concern that European and Canadian entrepreneurs relocate their companies to the US in order to access funding sources. All this supports the notion that supply-side factors are part of the scale-up problem. At the same time it is important to note that by no means are we arguing that demand-side factors are irrelevant. In fact, we see demand-side factors about the quality of start-ups deeply intertwined with supply-side factors. As discussed in section 2, venture capital is not merely the supply of capital, but is involves smart and networked investors that have an influence on the quality of companies too.

Concerning the second challenge, there is in principle a large amount of institutional investment in Europe and Canada which could be invested in larger venture funds. European institutional investors already invest considerable amounts into other types of alternative investments, such as private equity

¹⁴ From an economist's perspective, this is an econometric identification problem. To separate out the relative importance of demand and supply, one needs a natural experiment, or some exogenous shocks to demand and supply. Finding these remains a formidable empirical challenge, especially if it is to be applied to the market as a whole.

or hedge funds. The proximate cause for the lack of interest from institutional investors is doubtlessly the low historic returns to venture capital outside of the US. However, this is largely a backward-looking rationale. Going deeper, one likely contributing factor is the composition of European institutional investors. There is a lack of large university endowments, which in the US often adopt a much longer-term perspective than other institutional investors like banks. Another important reason is an overall lack of expertise at the European institutional investor level. There are relatively few venture experts at that level, largely due to the legacy of low returns. It is also worth noting that the data about European venture capital returns remains very unreliable, which is likely to perpetuate the beliefs about poor historic returns in general, without a more fine-grained picture of where the returns are higher or lower.

Concerning the third challenge, it is important not be alarmist: acquisitions are not bad by themselves, nor are foreign acquirers unwelcome. The most important economic question is what happens to the underlying economic activity after the acquisition. Two fears are common: that the acquirer doesn't actually grow the economic activity, or that the acquirer relocates the economic activity elsewhere, either to its home country for closer integration, or to some third country for lower costs. Unfortunately there is no systematic data about post-acquisition growth, due to the fundamental problem that activities of the acquired unit get intermingled with those of the acquirer. It is therefore not clear to what extent growth is enhanced or reduced when start-ups get acquired, and one would expect market forces to determine which acquisitions are creating value. Moreover, the highest bidder with the biggest economic gains is frequently a foreign acquirer, which is actually a reflection of well-functioning market forces. The main concern with acquisition is not that they are economically bad, but that the preponderance of acquisitions is a symptom of deeper structural problem with independent scaling up. In an economy in which virtually all start-ups get acquired, there is a lack of expertise on how to scale these companies independently. This gives start-ups a weaker bargaining position with potential acquirers, because the lack the outside option of remaining independent. Put differently, the preponderance of acquisitions is a sign that the ecosystem is not yet mature enough to properly support independent scale-ups.

The acquisition of successful start-ups or scale ups also creates a large amount of wealth for founders that often reinvest part of it in new start-ups by becoming angel investors and it enlarges the managerial talent pool available for other start-ups and scale ups to grow (Hellmann and Thiele, 2016).

Concerning the fourth challenge, the creation of a venture debt market faces two obstacles: regulation and banks' organisational practices. This does not concern venture debt funds, but it does affect mainstream banks, which play a central role in the European context. The regulatory burden on venture

debt remains considerable, as banks are required to hold significant capital against venture loans, which are considered high risk under the Basel rules. Beyond regulation, venture debt is a formidable challenge for banks, as it runs contrary to standard prudential thinking. It also requires a separate loan approval process that is run outside of the standard corporate lending operations.

Concerning the fifth challenge, NASDAQ remains by far the most liquid stock market for high technology companies. Stock markets benefit from thick market externalities, where more buyers attract more sellers, and vice-versa. There are also important economies of scale in the economics of analyst coverage. The biggest challenge in Europe is the fragmentation of stock markets.

Concerning the sixth challenge, the development of secondary markets for private shares remains a challenge everywhere. The core of the problem is the information asymmetry between buyers and seller in a highly illiquid market setting, with limited information disclosures. Solving these problems requires novel approaches to market design. The rise of crowdfunding and the related emergence of electronic trading platforms hold promise for an imminent development of this market.

We take a longer-term perspective to bring together the various potential underlying causes of the six challenges. The US venture capital industry is older and more established than its Canadian and European counterparts. We would argue that many of the differences across markets can be thought of as different stages of institutional market development. One of the core insights from section 2 is the importance of experience and expertise that defines smart and networked investors. This kind of experience is largely tacit, resides within individuals and organizations, and is built over decades rather than years. Over the last two decades, Europe and Canada managed to develop an emerging entrepreneurial ecosystem where such expertise was built around early-stage start-ups. Scale-up is the logical next challenge. However, scale-up expertise cannot be created overnight. Instead it is accumulated over time, as individuals and organizations learn how to help scale-ups to succeed. Moreover, foreign expertise and role models play an important role in this development process. In a related vein, Hellmann and Thiele (2016) provide a formal theory model that shows the importance of distinguishing between short-term and long-term effects of policies on entrepreneurial ecosystems, precisely because of the importance of accumulating expertise over time.

Taking this longer-term perspective helps to put the six challenges into perspective. In the short run there are important differences across countries, in terms of regulations, business practices, and levels of expertise. In the long run arguably all economic institutions are endogenous. The real challenge therefore concerns the medium term outlook: What does the US environment have that is currently

lacking in Europe and Canada, but that could be built over the medium term? What are the institutional constraints that can realistically be changed over the medium term? What are the likely policy levers?

We would argue that for each of the six challenges, there is no fundamental reason why in the long run, Europe and Canada cannot catch up to the US. However, for each of the six challenges there are clear short-term constraints that explain the difference with the US. Most important, for each of the six challenges, there is a potential pathway of catching up with the US over the medium term. Along this pathway, private market participants develop the expertise and experience to effectively provide financing to scale-ups. Public policy makers can support this process, mostly by removing obstacles along this path, and possibly providing a catalyst to certain targeted activities. The analysis of section 5 provides a road map for policy makers on how to do that.

In this context it should also be mentioned that alongside the development of scale-up expertise, there is a broader cultural shift. There already has been a cultural shift in Europe and Canada around start-ups. However, up until recently there has been limited awareness about the importance of scale-up, particularly in Europe. An important step to changing the institutional setting is the cultural awareness that entrepreneurial success is not possible without growth and exit, and that scale-up is an essential aspect of completing the entrepreneurial value creation cycle. The situation is changing most notably in Canada where the new government has made scale-ups one of the primary focus of its new innovation and growth agenda. The recent launch of the 'Scale-Up Institute' in the UK another sign of this cultural change.

5. Public policies for the financing of scale-ups

5.1. The role of government in scale-up

Scale-up poses some challenges not only for the private sector but also for policy makers. In this section we take a closer look at the tools available to public policy makers, and the trade-offs involved in applying them to the challenge of financing scale-ups. We describe the main policies currently used by governments to address financing gaps, focusing on supply side interventions and selected regulatory framework policies. We explore the underlying rationales for government intervention in this market, and discuss the potential strengths and weaknesses of different policy approaches to help provide a framework for countries seeking ideas regarding policies for financing scale ups.

To address the challenge of financing scale-ups, policy makers must look at the entire entrepreneurial ecosystem, from start-up to scale-up. It can be misguided to expect one policy to provide the solution. Instead the main challenge is to identify what the main forces are, and how they interact with each other.

Our analysis therefore looks at the main policy tools available, but refrains from picking specific solutions. Instead it tries to explain the advantages and disadvantages of the main policies, and elucidate how they can play complementary roles for solving the scale-up financing challenge.

Any policy analysis should lay out its objectives: what market failures justify a role for government, and what goals should the government pursue? A large prior economics literature explores the various types of market failures in entrepreneurial finance, related to informational imperfections, innovation externalities, and coordination failures - Lerner (2008) provides a useful summary. However, the overarching goal of government action is often to stimulate economic growth, especially job creation. This may lead policy makers to stimulate innovation, augment risk capital, provide investment incentives, and/or create new market institutions.

Building on the work of Wilson and Silva (2013), governments have three broad approaches for stimulating an entrepreneurial environment. First, they set the regulatory framework that defines broad parameters of economic activity: rule of law, macro-economic stability, regulation, taxation, and so on. Second, governments can use public policies to stimulate the 'demand-side', promoting entrepreneurship and encouraging innovation. This may involve infrastructure investments in science and technology, investments in human capital, entrepreneurship education, and so on. Finally, governments can use public policies to stimulate the supply-side, fostering investments into entrepreneurial companies. In this paper we recognise the importance of all three types of public policies. However, given our aim of understanding the financing of scale-up, we focus our analysis mainly on supply-side financial policies, although we also consider a subset of regulatory policies that directly affect the financing of scale-ups. Finally we note that policies for scale-ups should not be confused with policies for small- and medium-sized enterprises, where the typical targets are not high growth companies. Nor should they be confused with R&D policies, which typically target a much wider set of companies, including large established corporations.

5.2. Funding policies for scale-ups

The vast majority of government support for entrepreneurial companies has come on the supply side, and has been focused on the very early financing stages. We argue here that scale-up deserves more focus from policy makers. We now ask how some of the existing supply-side policies that are commonly used at the early stages can be used at the scale-up stage. We relate this discussion to our six empirical challenges from section 4.1. Supply side policies address the issues of funding gap (1st challenge), and the challenge of large funds (2nd challenge). Several aspects also relate to the role of acquisitions (3rd challenge) and venture debt (4th challenge).

There are three main ways that governments support funding of entrepreneurial companies. First, there is the direct provision of funds to companies via development banks, dedicated government-owned venture capital funds, or matched co-investment funds. Second, governments can provide funding as limited partners, co-investing with other institutional partners in venture capital funds. Third, governments can invest in fund-of-funds that then invest in venture capital fund. Under this approach the government is removed one more level: it doesn't pick venture capital teams, it only picks a fund-of-funds. One argument is that picking successful venture capital teams is a challenge for governments, whereas picking fund-of-fund managers is relatively easier. The cost of this approach is obviously a second layer of management fees and carried interest.

In principle all three funding mechanisms can be used at all investment stages. However, using them at the scale-up stage poses some special challenges. First, the amount of funding required is more substantial, so that going alone is particularly unattractive for governments. Second, the notion of smart money is subtly different for start-ups than scale-ups. The expertise required at the scale-up stage concerns managing growth, which involves the establishment of efficient organizational practices as well as access to new markets, partners, and networks that play a lesser role at the start-up stage. Different types and combinations of expertise are therefore needed at the scale-up stage. Finally, an international growth perspective is particularly important at the scale-up stage.

Across all three government venture capital financing models, there is a question regarding the terms under which the government should invest relative to the private investors. One approach is that the government invests on exactly the same terms as private investors, this is referred to as 'pari passu'. Another approach is that the government provides some form of financial incentives. This can be structured as a downside protection where private investors can get their money back before the government does. There may even be some additional loss guarantees. In recent years this approach has come out of favour, because of its poor incentive properties. Probably a more sensible approach is for the government to limit its returns on the upside, but to have equal sharing of losses. This has better incentive properties, although it may deprive the government from ever making a good return. More generally, any form of financial incentives imposes some costs on the government. The choice between *pari passu* versus financial incentives therefore depends on how willing the government is to accept lower returns.

One of the major concerns with all government funding programmes is the extent to which they crowd out private markets. Clearly the presence of government funding affects the market equilibrium. The debate is whether these programmes have a large effect on total investment quantities with limited

effect on valuations (the intended market expansion effect), versus a limited effect on total investment quantities with large effects on valuations (the unintended crowding out effect)¹⁵.

There are several important challenges for the design of government funding programmes. We relate these, back to the four investor criteria we identified in Section 2: deep pockets, smart money, networks, and patient money.

The deep pocket requirement runs contrary to the natural instincts of most governments. Politicians typically try to please everyone, spreading their funding as wide as possible. Of particular importance is the regional support of companies, across all parts of the country. This approach may already cause problems at the start-up stage, where economies of agglomeration suggest that investments are more likely to succeed inside than outside the main entrepreneurial hubs. At the scale-up stage, a distributed funding approach becomes even more problematic, because scale-up means backing a relatively small fraction of start-ups that have extraordinary growth potential. Policy makers designing government programmes can often make some choices about the geographic distribution, imposing more or less stringent local requirements. There remains a question about how much geographic dispersion is appropriate when supporting scale-ups.

The requirement to only fund 'smart money' is also a challenge for governments. As noted above, governments are unlikely to have the expertise in house: hence the move towards more indirect investment approaches. However, even when working with private investors, there is relatively little that the government can do to improve the quality of venture capital teams, which is largely based on prior experience. One possible avenue is to attract the best international talent to set up venture capital operations in their jurisdiction. Israel is often considered a successful example of this, historically through the Yozma programme, and more with the Israeli Biotech fund programme. Teralys is also an interesting example of attracting foreign investors to Quebec. However, top venture capital firms have proven to be somewhat reluctant to set up office in locations that are outside of their preferred geographic areas.

The requirement of being well networked points to another challenge in the design of venture capital programmes, namely the appropriate definition of geographic boundary restrictions. The natural instinct of most governments is to create programmes for domestic companies and domestic investors.

¹⁵ This is a difficult question to assess empirically, mainly due to the lack of a counterfactual. The work of Brander *et al* (2015) finds evidence that there appears to be some partial crowding out (both at the level of individual companies and at the aggregate market level), but that the crowding out was far from way full. Note also that their analysis pertains to crowding out at the company investment level. There have been no systematic studies about potential crowding out at the level of institutional investors investing in funds.

However, if scale-up requires international networks, such domestic restrictions may be inappropriate. For example, one practical issue is whether investors that receive government support (whether through direct or indirect channels such as fund-of-funds) are allowed to invest in foreign companies. From a government perspective it can be difficult to justify why government funds might be invested abroad. However, from the perspective of the venture capital firm, a restriction to only invest in domestic companies might preclude it from becoming a global specialist, and force it to become a local generalist. Moreover, it may limit the firm's ability to build stronger international networks which may be important to support its scale-up companies.

Finally, it is unclear to what extent the government can influence the patience and investment horizons of private investors. Being only one among several limited partners means the government has limited influence over the terms of the partnership agreement. In practice most government -supported venture capital funds continue to use the standard model with a 10 year fund life.

It is perhaps for these reasons that while policy makers in many countries provide significant equity capital for the seed and early stage market, few have yet ventured into supporting scale-ups in this manner.

5.3. Taxation policies for scale-ups

Beyond the financial investment programmes described in section 5.2, the other main set of financial supply-side policies concerns the tax system, including a variety of tax credits or tax reliefs. In terms of our six empirical challenges in section 4.1., tax policies address mainly issues of the funding gap (1st challenge). From an economic perspective, tax-based approaches can be thought of as subsidies. The government effectively transfers funds to the investor or company without taking any ownership stake in return. From an administrative perspective, this approach is very different from the funding programmes discussed in section 5.2. Tax benefits are entirely driven by rules, leaving the government with no discretion. This helps to eliminate political favouritism, but it also limits the government's ability to fine-tune its programmes to the most deserving investors and companies. Tax benefits also encourage unscrupulous investors, companies, or fund managers to find ways of abusing the system.

While there are obviously numerous tax policies that companies, including entrepreneurial companies, we focus here on specifically on investor-related taxes. For those it is useful to distinguish taxes based on investment inputs (mainly investment tax credits) versus those based on returns (mainly capital gains relief). Examples of investment tax credits that are based on individual investments in companies include the EIS/SEIS tax credit in the UK, or the angel tax credits in the province of British Columbia,

Canada. Examples of investment tax credits that are based on individual investments in funds include the Canadian Labour-sponsored funds, or the French FCPIs.

The important difference between tax credits and capital gains relief is that under a tax credit, investors are rewarded for making investments, irrespective of their eventual success. Capital gains relief, by contrast, are only valuable in case of success (and their value depends on the prevailing rates). We can thus think of this as a risk-return trade-off. With the former the government helps by sharing risk, with the latter the government helps by increasing investors' upside returns. The relative desirability of these two policies therefore depends on the degree of investor risk-aversion, and the importance of investor incentives on the upside.

Investment tax credits have been mainly used at the start-up stage, but not really at the scale-up stage. One of the reasons is that it is easier to administratively define a start-up than a scale-up. Another reason is that the cost of offering tax benefits can be substantially larger at the scale-up stage. Moreover, the formulaic nature of tax policies makes it difficult to promote those investor characteristics that we identified as vital for scale-up financing. Tax credit cannot be targeted only to smart and networked investors. In some cases, however, they can impose some patience on investors, most notably by only granting certain tax benefits after holding the investment for a minimum length of time. The problem here, however, is that holding period requirements also force investors to hold stock of companies that would actually benefit from a liquidity event, such as an early acquisition.

Overall we note that the extent to which tax policies can be used at the scale-up stage remains an open and delicate question, and that funding policies are more likely to fit the requirements of scale-up financing.

5.4. Financial regulatory policies for scale-ups

We also consider some of the regulatory policies that directly affect the financing of scale-ups. Whereas the funding and tax policies discussed in section 5.2 and 5.3 respond mainly to the 1st and 2nd challenge of our empirical findings (namely that the financing gap is larger at scale-up stage, and that it requires larger equity funds - see section 4.1), regulatory policies affect all the challenges.

Consider the question of securities laws and cross-border investing. In the European context there may be opportunities for the further harmonization of security laws to facilitate venture capital. Regulations can also subtly encourage or discourage foreign investments and acquisitions. For example, the new MiFID regulation might be an impediment to non-European LPs investing in EU funds. These regulations

affect the first three challenges in terms of influencing the amount of capital invested, the size of venture funds, and the interest of foreign acquirers.

The regulation of banks matters for venture debt, which is our 4th empirical challenge. In principle venture debt can be provided by either banks or specialised funds, while banking regulation only affects the former not the latter. Still, banks may have some advantages over funds in providing venture debt, because of complementarities with traditional banking services. Thus the regulation of banks is likely to affect the overall supply of venture debt. Capital requirements are an obvious concern: venture debt is typically classified as a high risk loan, and given a high risk weight.

Our 5th empirical challenge concerns the role of stock markets. As shown in section 3.4, European and Canadian stock markets have not been a sufficient source of funding for tech scale-ups, and therefore have not provided much liquidity to investors. Part of the challenge is to design better listing and disclosure requirements. The JOBS act in the US, for example, defined an 'on-ramp' structure that allows companies to maintain greater confidentiality during the listing process (see Dambra, Field, and Gustafson, 2015). The biggest challenge is the current fragmentation of European stock markets. As noted in Section 2, there are network externalities that make larger stock markets more efficient. There are also economies of scale in analyst coverage that suggest that markets get more liquid when there is a critical mass of listed companies with a common investment theme. It is hard to see how any one European country could achieve such a critical mass on its own. We would therefore argue that the creation of a pan-European stock market, or at least inter-listing or networking mechanisms among European tech stock markets, is highly desirable. The implementation of such an initiative remains challenging, but the economic benefits for the scale-up ecosystem would be substantial (see Wilson and Silva, 2013).

Finally, our 6th empirical challenge concerns the establishment of markets for the secondary sale of private shares. To a large extent, this is a private sector challenge, in terms of establishing new platforms for structuring such transactions. Regulators, however, can play a role by simplifying and harmonizing securities laws. Secondary markets could become much more efficient if they attract a broad class of international buyers.

6. Conclusion

This paper examines the challenges of scale-up financing. It provides a theoretical framing for understanding the challenges conceptually. The paper then provides an overview of data suggesting that Europe and Canada have started to catch up to the US in early stage financing, but continue to lag behind at the scale-up stage. Finally the paper provides an overview of the role of government policy to address the financing scale-up challenge.

In this paper we asked three closely related questions. The first question is conceptual: What are the alternative options of funding scale-ups, and what are underlying challenges associated with each of those options? The second question is empirical: What are the differences in the way that scale-up companies are currently financed in the US, Europe and Canada, and what explains these differences? The third question is normative: What is the possible role of government and public policies in supporting the financing of scale-ups?

To answer these questions, we divide our analysis into three parts. In the first part, we develop some simple conceptual frameworks for analysing the financing choices at the scale-up stage. Using the analogy of a car at a crossroad, we examine companies' choices between scaling-up as a privately-held company, as a publicly-listed company, or being acquired by another company. We argue that scale-up investors need to satisfy four important criteria: 'deep pockets', 'smart money', 'networks', and 'patient money'. We also explain the importance of providing investors a well-defined path to liquidity.

In the second part, we compare data about start-up and scale-up financing in the US, Europe and Canada. We synthesise six challenges that Europe and Canada face in terms of catching up to the US, related to the overall market size of scale-up funding, the creation of larger venture funds, the challenge of avoiding selling companies too early, the creation of a venture debt market, finding ways of reinvigorating tech IPOs, and designing better markets for secondary shares.

In the third part, we provided an overview of selected policy approaches to addressing the scale-up financing issue. However, we refrain from making specific recommendations, which would need to be more country- and situation-specific.

Our objective in this paper is to draw attention to the importance of the scale-up challenge, to provide some initial descriptive evidence that shows its importance, and to suggest some hypotheses about the underlying drivers and policy remedies. We hope that our analysis encourages others to go deeper and empirically investigate these issues in greater detail. Specifically, we see three major research challenges.

First, there remain significant challenges in measuring the scale-up gap, and explaining its geographic variation. Our descriptive data is drawn from a variety of data sources, each with its own strengths and limitations. Moreover, our data remains incomplete in several respects. From an empirical perspective, there is a significant problem with measuring the various symptoms of the scale-up challenges, let alone understanding its temporal and geographic variation.

Second, it would be worthwhile to gain a deeper understanding of underlying causes of the scale-up gap. For example, there is the important question of the relative roles of supply-side (ie finance) versus demand-side (ie entrepreneurial) factors that explain the scale-up gap. We content that the preliminary descriptive data suggests that both are likely to matter, and that the two are actually intertwined. Still, understanding the relative importance of these alternative factors remains a question of great importance.

Third, there is a need to go deeper on the policy analysis. This research falls into two broad categories. One is a need for proper evaluation of existing policies. Few of the entrepreneurship programmes have been properly evaluated, with proper control groups and proper separation of selection versus treatment effects. Overcoming the reluctance of policy managers to openly share data about their programme performance remains an important challenge for research. The other need is for some careful analysis of policy alternative. Policy evaluations inform us about how a particular programme achieves its objectives, but policy makers also have to choose among alternative policy approaches. Understanding the differences between alternative policies requires a better theoretical understanding of the economy-wide equilibrium effect. Proper policy design ultimately also requires an empirical evaluation of the social benefits and cost of alternative policy approaches. We believe that significant work remains to be done in this respect.

In conclusion, we consider the scale-up challenge as the second act of a drama, where the first act was the start-up revolution. Policy makers need to be aware that if their intention is to support high growth firms, they need to look beyond just the seed and early stage taking a more long-term and comprehensive approach.

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Appendix on Data Sources

OECD:

VC investment data is taken from the OECD 'Entrepreneurship at a Glance 2015' report. Data on Gross Domestic Product (GDP) was obtained from the Organisation for Economic Co-operation and Development (OECD) database. Data used in Figures 2 and 3.

PREQIN

All data for Fund- and Funding-level analyses are taken from the PREQIN Venture Capital data base. The full data set covers about 30,000 funding rounds in 10,000 deals in the period 2010-2015 for Western and Eastern Europe, the Nordics, and North America.

The analysis focuses on Funds and VC deals in the EU27 region, as well as the United States and Canada. Specifically, the observed countries are (countries listed in alphabetical order): Austria, Belgium, Canada, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, Norway, Poland, Portugal, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and United States. The data includes all Nordics to cover the Scandinavian VC market comprehensively, as well as Switzerland in order to have full coverage of continental Europe.

Several filters are applied to the data, such as the availability of funding volume per investment round, or the location information for VC funds. The data is merged across different PREQIN data sets, resulting in further losses of observations. The final data set therefore covers 23,537 funding rounds in 7,957 VC deals made by 1,995 funds of 1,198 different fund managers. Data used in Figure 4-6, 9-14, and 16-17.

VentureSource

Data taken from VentureSource is for the period 2007-2013. Data used in Figure 7.

CrunchBase:

Data on unicorns was sourced from CrunchBase (<http://www.crunchbase.com>). CrunchBase is a crowd sourced database which captures contributions from users, investment firms, and their network of global partners.

Unicorn data was first selected according to a list of unicorns reported by CrunchBase (<http://techcrunch.com/unicorn-leaderboard/>) and CB Insights as of 17 March 2016. The CrunchBase and CB Insight lists contained 161 and 155 companies, respectively. The CrunchBase list was used as the basis for this research, with some adjustments made for companies with known additional information. While a thorough review of each unicorn was not completed, additional information on three companies was used. One company, POWA Technologies, was removed due to confirmation of entering 'administration' (bankruptcy). Two companies, Transferwise (UK) and Hootsuite (Canada), were added due to inclusion on many other unicorn lists. Some countries of origin were adjusted to align with other sources of information.

871 unicorn rounds were pulled from a total of 125,478 deals reported in the CrunchBase dataset between 1960 and 2016. For the unicorn companies, the relevant period of deals is 01 May 2001 to 16 March 2016. Of the 871 unicorn rounds, 793 include the amount raised and 791 identify the round in which the funding event took place. Combined, this left 728 unicorn funding rounds for analysis.

Geographic distribution of unicorns was determined using the adjusted CrunchBase data set. Companies were categorised into four areas, Canada, US, Europe (Czech Republic, France, Germany, Luxembourg Netherlands, Russia, Sweden, Switzerland, UK), and Rest of World (Argentina, China, India, Israel, Japan, Korea, Malaysia, Nigeria, Singapore, South Korea, Thailand, UAE). Data used in Figure 8 and 21.

Invest Europe (f.k.a. EVCA):

Data for Fundraising activities and Venture Capital Divestments (e.g. IPOs) in Europe are taken from the Invest Europe Annual Activity Statistics. The data captures activities from more than 1,800 private equity firms, which are representing Invest Europe's members. The full data set covers approximately €39b in Funds raised for the period 2007-2014 for the following countries in Europe (countries listed in alphabetical order): Austria, Baltic countries, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Other CEE (Ex-Yugoslavia & Slovakia), Poland, Portugal, Romania, Spain, Sweden, Switzerland, Ukraine, and the United Kingdom. Data used in Figure 18.

National Venture Capital Association (NVCA):

Data for Venture Capital activities (Investments and Divestments) in the United States are taken from the PricewaterhouseCoopers/National Venture Capital Association MoneyTree™ Report, which comprises

data from Thomson Reuters. The full data set covers 24,829 investment deals for the period 2010-2015 for the United States. Data used in Figure 18.

Canadian Venture Capital and Private Equity Association (CVCA):

Data for Venture Capital activities (Investments and Divestments) in Canada are taken from the CVCA Industry Statistics Infobase databases. Data used in Figure 18.

Capital IQ

Data for US and European tech IPOs are taken from S&P Capital IQ for the period January 2002 – May 2015. The data comprises IPOs across the US and Europe within the life sciences, software, and hardware industries. Data used in Figures 19, 20, 22 and 23.