

The Booms and Busts of Private Equity

A study of the drivers and components of private equity cycles

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ABSTRACT

In this paper we study the drivers behind private equity cycles. The data consists of 107 282 deals made by 7 296 firms. We hypothesize that activity in the private equity industry is driven by economic shocks, capital supply and demand, as well as market timing, information asymmetries, and agency conflicts. As the drivers cannot be measured directly we use several proxies to regress against deal activity. Results indicate that aggregate activity in the private equity industry is mainly driven by economic shocks and previous performance/agency factors. Increases in activity are primarily made up of larger deals, and more frequent deals by already established private equity firms. New entrants explain less, but comparatively more for venture capital than for buyout.

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Contents

1	Introduction	8
1.1	Motivation of research	8
1.2	Problem statement & research gap	8
1.3	Purpose of study	9
1.4	Background	10
1.4.1	Definitions	10
1.4.2	History and patterns in private equity.....	11
2	Literature	13
2.1	Neoclassical theory of private equity	14
2.1.1	Economic shock.....	14
2.1.2	Capital demand.....	14
2.1.3	Capital supply	15
2.2	Information asymmetry	16
2.3	Market Timing.....	17
2.4	Agency Theory.....	18
3	Methodology.....	20
3.1	Data collection.....	20
3.1.1	Proxies	20
3.1.2	Activity	23
3.2	Hypotheses	26
3.3	Research design.....	29
4	Data	31
4.1.1	Industry trends	34
4.1.2	Cross border deals	37
4.1.3	Activity and firm experience.....	40
5	Results.....	41

5.1	Univariate analysis	41
5.1.1	Addressing non-stationarity	41
5.1.2	Univariate regressions on BO deal volume with normal standard errors	42
5.1.3	Univariate regressions on VC deal volume with normal standard errors	43
5.1.4	Addressing heteroscedasticity and serial correlation in error terms	43
5.1.5	Univariate Newey-West	44
5.1.6	Multivariate	50
5.2	Components of activity	58
6	Conclusions	61
6.1	Summary of Results	61
6.2	Discussion and limitations	62
	Appendices	69

List of tables

Table 1: Proxies for theoretical drivers of BO/VC activity	21
Table 2: Direction of influence of each driver	28
Table 3: Descriptive statistics	32
Table 4: Target industry descriptives by private equity segment (BO/VC).....	36
Table 5: Aggregate international deal ranking	39
Table 6: International deal ranking by industry.....	39
Table 7: Univariate Newey-West on BO	46
Table 8: Univariate Newey-West on VC	48
Table 9: Multivariate regression on BO within frameworks (1)	51
Table 10: Multivariate regressions on BO within frameworks (2)	52
Table 11: Multivariate regressions on VC within frameworks (1).....	54
Table 12: Multivariate regressions on VC within frameworks (2).....	55
Table 13: Multivariate regressions on BO across frameworks	56
Table 14: Multivariate regressions on VC across frameworks.....	57
Table 15: Univariate first differenced OLS on components of activity.....	59
Table 16: Multivariate first differenced OLS on components of activity.....	60
Table 17: Dickey-Fuller test for unit roots (1).....	69
Table 18: Dickey-Fuller test for unit roots (2)	70
Table 19: Descriptive Statistics for regression variables	71
Table 20: Ordinary least squares on BO with first differences.....	72
Table 21: Ordinary least squares on VC with first differences.....	73
Table 22: Ordinary least squares on BO with lagged first differences	74
Table 23: Ordinary least squares on VC with lagged first differences.....	75
Table 24: Breusch-Godfrey test for serial correlation in error terms.....	76
Table 25: Aggregate number of unique BO deals per target industry	77
Table 26: Share of unique BO deals per target industry.....	78
Table 27: Share of unique BO deal activity in target industry by year.	79
Table 28: Aggregate number of unique VC deals per target industry	80
Table 29: Share of unique VC deals per target industry.....	80
Table 30: Share of unique VC deal activity in target industry by year.	82
Table 31: Number of unique international BO deals by region per year	83
Table 32: Share of unique international BO deals by region per year.....	84
Table 33: Number of unique international VC deals by region per year	85

Table 34: Share of unique international VC deals by region per year	86
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List of figures

<i>Fig. 1: Total number of deals per year by BO/VC</i>	<i>33</i>
<i>Fig. 2: Average deal size per year by BO/VC</i>	<i>33</i>
<i>Fig. 3: Total deal volume per year by BO/VC</i>	<i>33</i>
<i>Fig. 4: Standard deviation of deal value across industries per quarter by BO/VC</i>	<i>87</i>
<i>Fig. 5: Average number of target industries invested in per firm per quarter by BO/VC</i>	<i>87</i>
<i>Fig. 6: International share of deal value and No. of deals, by industry.....</i>	<i>88</i>
<i>Fig. 7: Active BO firms by experience</i>	<i>89</i>
<i>Fig. 8: Active VC firms by experience</i>	<i>89</i>
<i>Fig. 9: Number of BO deals, by experience.....</i>	<i>90</i>
<i>Fig. 10: Number of VC deals, by experience</i>	<i>90</i>
<i>Fig. 11: Number of BO deals, by year founded</i>	<i>91</i>
<i>Fig. 12: Number of VC deals, by year founded.....</i>	<i>91</i>

Abbreviations

PE	Private Equity
BO	Buyout
VC	Venture Capital
OECD	Organization for Economic Cooperation and Development
IBES	Institutional Brokers' Estimate System
VX	Thomson Reuter's Venture Xpert database
VS	Dow Jones' Venture Source database
MA	Thomson Reuter's Mergers and Acquisitions database
GP	General Partner
LP	Limited Partner
LBO	Leveraged Buyout
IPO	Initial Public Offering

1 Introduction

1.1 Motivation of research

Private equity is often used to refer to a type of asset management that focuses on leverage buyouts, where entire companies are bought with a small portion of equity and a large debt load. Venture capital is a similar asset class that consists of smaller investments into younger, emerging firms. In this paper we distinguish between buyout firms and venture capital firms, and call the whole universe of such investments ‘private equity’. Henceforth, we use the term private equity to describe both venture capital and buyout activities.

The emergence of venture capital and buyout funds date back to the early 1980’s (Wright & Robbie, 1998). Since then, private equity has grown tremendously in size. During 2016, global private equity firms collectively raised \$347 billion which is a more than a tenfold increase from 1996 levels (Preqin, 2016).

Raised capital is not the only important metric. Venture capital is still a comparatively rare form of financing, as less than 0.2% of founded firms each year receives venture capital investments. However, the impact of venture capital is considerable, as over 50% of the “entrepreneurial” IPOs are made by companies that received venture capital funding (Kaplan & Lerner, 2010).

1.2 Problem statement & research gap

Private equity as a subject of academic investigation has grown in popularity during the last decades and sufficient study of the asset class is forthcoming. We hope that adding to this growing body of knowledge will be both gratifying and appreciated. Secondly, the continued investigation into fluctuations, volatility and drivers is of increasing importance to both practitioners and academia, in understanding the underlying mechanisms to optimize behavior, guide investment decisions and add to the total accrued knowledge of markets as a whole. Several theories explaining the boom-and-bust cycles of private equity have been brought forward but continued work on coupling theories and their corresponding effects are necessary.

Much of research in finance is directly or indirectly related or in opposition to the efficient market hypothesis. In this framework the fundamental prerequisites are (i) no transaction costs, (ii) full information, and (iii) agreement on implications of that information. The private equity industry fulfills even fewer of these qualifications than the economy at large with high barriers to entry, massive transaction costs, illiquidity, and a lack of transparency. This leads to an industry

which likely operates very differently compared to public markets. This does not necessarily mean that the industry is inefficient, but points to the potential and possibility of inefficiencies. Many factors explaining fluctuations and activity in the stock market are likely to also affect the private equity market, but there are differences both in the way these affect the industry and the mechanism by which they do so. Explanations for activity and fluctuations in the industry stem from a number of theories which are put forward by their respective champions but a complete study of the theories and their proposed effects on the US private equity industry is amiss.

1.3 Purpose of study

The papers aim to study the questions of fluctuations in private equity, examining diverse areas of activity and performance, both on aggregate and industry-level. Current research has been largely centered on firm-specific research questions and considerations glossing over the potential for overarching aggregate and industry specific insights. The paper is therefore aimed at both practitioners and academia to better understand the inner working of the investment vehicle. Furthermore, we hope that the thesis will provide some insight for practitioners in better understanding the implications of behavior through identifying strategies and industry characteristics. The paper is based upon a study conducted using exclusively Europe data to identify private equity behavior and dynamics in Europe. The referenced paper suffered from a small sample size and lacking data, a problem affecting this paper less due to the choice of sample – the US market. The additional data accessed allows for more far-reaching conclusions and broader insights into the dynamics of private equity, assessing market forces, externalities and the reactionary responses from practitioners in sight of changing environments and outlook. It is our hope that the uncovered insights can be useful in shedding light on practitioners current behavior, both LP and GP, while providing indications of how to improve upon current praxis. To boil it down to two research questions, we aim to answer the following:

Primary research question:

What factors drive the aggregate deal volume in the private equity industry?

Secondary research question:

What is the composition of deal volume activity in the private equity industry?

The secondary research question is more explorative in nature whereas the primary research question is coupled with testable hypotheses. For a specification of the hypotheses connected to the primary research question, refer to chapter 3.2.

1.4 Background

1.4.1 Definitions

Private equity investment are defined as non-public equity investments in either private or public firms. The definition is broadened as to include buyouts, venture capital and mezzanine investments. The industry is often divided into two blocks either venture capital or buyout. There are differences between the two blocks with regard to maturity of the acquired firms, control post transaction and to a lesser extent the preferred target industries. Venture capital typically invests into companies in earlier stages of development, sometimes subdivided into seed, start-up, early stage and later stage. When a company matures past what venture capital deems to be “late stage”, they are typically targeted by buyout firms. Buyout firms generally invest more aggressively into their firms, gaining either full or considerable control of the company, while venture capital feels at ease in a minority role (Kaplan & Strömberg, 2009).

1.4.1.1 Private equity investments

Capital for private equity investment originally came from individuals and corporations, but the sources of capital has increased to include many financial institutions, pension funds and universities. The institutions are either unable or unwilling to they themselves invest in privately held companies due to lacking expertise, resources and scale to monitor the investment. The investments are instead typically made through a fund operated by a private equity firm where the capital from the diverse sources is been pooled. The investors commit capital to the fund which is utilized by the private equity fund when acquiring companies. The fund initially has a period of acquiring companies and a subsequent period of liquidating, selling and exiting the investments. Exits are done through either IPO, trade sale or recapitalization. Most funds invest in companies during a 5 year period after closing of the fund, and in the following 5 to 8 years divest and return the fund. The median holding period for an LBO investment is 8 years (Strömberg, 2007).

1.4.1.2 Private equity firms

The private equity firms takes on an intermediary role, investing capital in non-public companies. The strategy is typically too geared towards investing in companies where the private equity firm

has identified long-term growth prospects. With control and influence of management they are able to make interventions into the firms to refocus operations, inject additional capital and shape processes and much more. The private equity firms are therefore often specialized in certain target industries and employ personnel with specific skill-sets. The differentiation between private equity firms can be extensive. Both with regard to the preferred targets, and the resources brought to bear. One firm can often have several fund as to even out the workload in disparate areas and optimize cash flow, it is therefore not unusual for firms to be raising capital, invest and distributing capital at the same time. The size of the industry as a whole could therefore be measured by either three of the metrics, amount raised, amount invested and total return, where the two former are most usually used.

1.4.1.3 Structure of private equity transactions

Capital is initially committed to the private equity fund. The fund often has restriction both as to the time frame in which capital can be drawn and what type of investments are to be made. The capital of several LPs are pooled and invested in companies. The GP takes a fee, typically a small transaction fee, a yearly management fee on capital under management, and a part of the profits when the company is sold, with terms and conditions. It is common that the GP invest jointly with the LPs to align interests further.

1.4.2 History and patterns in private equity

The asset classes of the buyout and venture capital emerged and evolved during the 20th century. The two sub-industries have both grown and changed through a series of booms and bust, with related but separated growth tracks. The history of private equity is common divided into three four periods. The origins of the industry and asset class after WWII all the way to the eighties, the leverage buyout boom of the eighties, expansion during the nineties, and the relative maturing during the 21st century marked by two booms subsequent bust, the dot-com bubble and the credit crunch.

Private equity started out as a relatively small asset class in the middle of the last century. Few firms were in the vanguard of the development of the new industry, the trend picked up pace and was popularized during the 60s when prominent finance figures started using publicly traded holding companies as investment vehicles to acquire portfolios of investments in corporate assets.

The conglomerate structure in following decades suffered under its own weight. The void came to be filled by leverage buyout firms and private equity firms. Many of these firms garnered

the public's attention in the 1980s for their restructuring activities, being discredited as corporate raiders. The strategies which were ultimately employed in the wake the conglomerate downfall was that of hostile take-overs, asset stripping, lay-offs and extensive restructuring. By the end of the decade the market had grown precipitously as shown by the largest buy-outs (e.g. KKR \$31,1bn takeover of RJR Nabisco). The industry has since then positioned itself in many segments with many different strategies for creating value.

Excessive spending for companies in the 80 were beginning to take its toll and many firms declared bankruptcy in the early 90s. Target firms also developed novel strategies to combat hostile take-over such as the poison pill hindering the continued growth of the industry. After a rocky beginning of the decade the industry started growing again, raising considerable capital in 1992, a growth which continued and reached its peak in 2000. The focus of private equity firms markedly changed in the 90s, and efforts to persuade management and shareholder of the positive aspects of selling and cooperating with private equity firms. Leverage was decrease and long term growth the primary focus.

Venture capital followed a similar yet different trend. During the 80s the industry had helped firms such as FedEx, Apple, Cisco, and Microsoft grow, however returns were still relatively low compared to LBOs. After refocusing on improving operations and laying the ground-work for the industry for over a decade the industry jumpstarted in 1995 and continued growing rapidly lasting through to the bursting of the internet bubble in 2000. (Metrick, 2007)

The bubble bursting saw venture firms forced to make large write-offs and investors sought to decrease their committed capital. However, total capital investments did not fall precipitously but stayed level from 2003 to 2005 despite the turmoil. The levels are modest compared to the peak in 2000, levels which we have not seen since. The buyout segment was also sent reeling from the recession, with large losses sustained from investments in telecommunications and technology.

The combination of decreasing interest rates, loosening lending standards and regulatory changes would set the stage for another imminent boom. With an increased regulatory burden for public companies the allure of private equity ownership increased, with the adverse effect on venture capital. Due to the decreasing attractiveness of IPOs the venture capital markets suffered a minor regulatory setback. The low interest rates of the period spurred investments into more risky asset classes, such as high yield debt and leveraged loans, used to finance private equity deals. The result was, allegedly, larger firms, larger funds, and larger deals. Several so called Mega-deals were pursued and acted upon by private equity firms during 2006 and 2007. The excessive deal-making was to mark yet another peak and subsequent fall for the industry.

However, the industry has continued its long-term trajectory, positioning itself as a permanent addition and institution in capital markets. Though still controversial and somewhat curious.

2 Literature

Cyclicalities in the private equity industry have been sparsely studied. Most previous research has been concerned with the performance of private equity funds, see e.g. Kaplan & Schoar (2005). The growth and prevalence of the industry across countries has also been studied, e.g. Jeng & Wells (2000). Though the cyclicalities of private equity activity within a country have been widely cited, by practitioners and analysts alike, it has not sparked a research effort. Partly due to issues of transparency, data availability and the ability to draw far reaching conclusions. There are however hypotheses and theories put forward to explain the variations in activity.

The most complementary previous work in this line of research has been made by Sommer (2012) who researched the cyclicalities in the European private equity market. She finds that private equity cycles are mostly driven by economic fundamentals and capital demand. Further, she also finds that venture capital cycles on average lead buyout cycles by one quarter. The set of proposed theories range from a fundamentals perspective to a behavioral perspective, wherein diverse sets of ideas and theories are contained. The theories are represented in the coming sections. Her work suffers from an apparent lack of data, but more importantly the results are muddled by cross country specifics. Sommer's results overtly contradict previous work from Jeng & Wells whom identified the drivers of private equity markets to be the viability and possibility of IPO exits. Problems stemming from immature capital markets are less pronounced in the US and therefore allows for more accurate research into the theoretical drivers of fluctuations. Researchers in the field often combine and mix drivers in explaining the volatility, further complicating the theoretical underpinnings of activity. Sommer's dissertation is nevertheless our main inspiration for this paper.

Kaplan and Strömberg (2009) arrive at a twofold conclusion. First, private equity firms exploit favorable mispricing in capital markets by increasing lending in periods when debt is relatively cheap. The cheap credit then fuels activity in the industry. Second, the authors also find a relationship between liquidity and returns. When returns to private equity funds are high, the inflows of capital from investors increase and the other way around when returns are low. The second point does not take into account the investment levels of private equity firms. The proportion of committed capital to invested capital is not constant – during the 2007 private equity boom the most private equity firms had large amounts of uninvested capital (Axelson, et al., 2007).

2.1 Neoclassical theory of private equity

The neoclassical theory postulates that fluctuations and changes in markets are as a result of economic, technological or regulatory shocks, on the level of the industry, the aggregate or both. The neoclassical framework has largely underpinned and created a grounding of economic thought, and has therefore been much criticized but also widely utilized. The assumption used are that of (1) rational individuals/organizations, (2) whom are utility maximizing, (3) with access to full information. From this framework the theory of efficient markets and, perhaps more interesting for this thesis, the efficient capital markets hypothesis originate. The framework, with regard to the neoclassical theory, hinges on two separate measures, capital supply and capital demand, wherein both have an effect on the activity of the market, and a theorized preceding economic change in outlook connected to an economic shock. The framework has found most adherence in research explaining cross country differences and cross border deal flow. Where capital flows and activity clearly follow economic outlook through postulated mechanisms used extensively in the neoclassical theory, e.g. supply, demand, riskiness and return (Gompers & Lerner, 1998). It is conceded that there exists internal connections between the postulated divisions made to the framework below (Schertler & Tykvová, 2012).

2.1.1 *Economic shock*

The realities of markets have shown that fluctuations and cycles in the economy and industries are a discernible truth, apparently unavoidable. The business cycle opens up for more profitable investments and thereby increased private equity activity. The economic shock leads to revised forecasts and the relationship between risk and supply, affecting both demand and supply (Hirschleifer, 1958). Changing expectation and presently identified technological advances and growth levels are postulated to change the investment decisions of private equity firms, and thereby drive activity (Ueda & Hirukawa, 2011; Armour & Cumming, 2006; Cumming & MacIntosh, 2006) The theory has in some cases been tested with mixed results (Leachman, et al., 2002; Jeng & Wells, 2000).

2.1.2 *Capital demand*

High demand for capital theoretically reflect favorable economic outlook where attractive investment opportunities are more abundant and accessible. Changing market environments with

a growing economy and industry leads to more investment opportunities which in turn necessitates additional capital to successfully pursue such ventures, the investments range from increasing working capital to increases in plants, property and equipment – i.e. if more output is forecasted, inputs have to increase to match. Many studies point to the inability of private firms to access sufficient amount of capital, summarized by Hubbard (1998). Private equity operate as an intermediaries between the capital suppliers, both equity and debt holders, and the firms with demand for capital. A potential identification of spending following increases in activity points to capital demand being present before the transaction. The component of capital demand is used extensively in tandem with other postulated neoclassical drivers to explain activity (Schertler & Tykvová, 2012; Romain & van Pottelsberghe, 2004) The theory of capital demand is further tacitly utilized in considerations of taxation and legislation (Poterba, 1989; Cumming & Walz, 2010).

2.1.3 Capital supply

Given the implied assumption of the theoretical framework, of efficient capital markets, lenders and investors have no preference with regard to private equity. The capital supplied is in the framework invested at a risk adjusted return in the target companies. The allocation across different asset classes remains unchanged regardless of the supply. This indicates that capital supply should have no effect on the activity of private equity. However, in the face of imperfect markets and illiquidity the markets behave differently. Capital supply and increases in accessible liquidity have been empirically connected in the theoretical framework to increases in activity (Harford, 2005). Capital supply is therefore predicted to be connected to activity.

In the literature there is also a hypothesis put forward that private equity firms are constrained in the amount of capital they can invest, and are forced to resort to using leverage to make investments. Favorable credit market conditions loosens this restriction and allows for more activity. The need for external capital acts as a check for private equity in limiting excessive investment sprees. Building on the premise of differing incentives, the GP is incentivized to undertake risky investments, but is curtailed by the availability of external capital. The holders of external capital then acts to limit the investment activity of the GPs. (Axelson, et al., 2007)

There are further changes to capital supply present in the private equity markets. Reputable private equity firms receive loans with narrower spreads, with longer maturities and rely more on institutional loans. There is furthermore evidence of more lax covenants and repayment schemes. However, these measures of capital supply, though highly relevant, are harder to measure and suffer from a lack of data availability. These loan term were shown to change over time, both dependent on the reputation of the firm and the industry at large, as well as according to overall

economic outlook. (Demiroglu & James, 2010). Capital gains tax is also shown to affect supply, and activity, in accordance with the theory (Keuschnigg & Nielsen, 2002; Keuschnigg & Nielsen, 2004).

2.2 Information asymmetry

Informational asymmetries have been studied extensively and acknowledged by academia and practitioners alike. It is the differences in knowledge between stakeholders, in our case primarily incumbent shareholders, management, GPs and LPs. The informational disadvantage can be created in many different ways stemming from changing market characteristics – social, economic, and technological (Leland & Pyle, 1976). Due to fluctuations in the economy the state of information asymmetry can change and stakeholders aim to leverage their newly accrued knowledge to further their interests (McNichols, 1989). The private equity industry prides themselves on superior knowledge and industry insights, which would indicate that their services would be more sought after in times of uncertainty and heightened risks and thereby increase the deal activity within the financial institution as a whole. (Akerlof, 1970)

The issue typically results in incumbents preferring internal sources of financing as the external financing has corrected its pricing to the inherent risk of the information asymmetry. The private equity industry could in such a situation add value to a deal through extensive due diligence mitigating information asymmetry and providing correctly priced capital. (Korajczyk, et al., 1992). The value added is highly relevant in all segments of the private equity industry. Venture capital companies suffer excessively from issues of information asymmetry where the quick-paced environment and changing firms are hard to value correctly, there is also great value in hard-to-measure attributes such as human capital, experience, teamwork, corporate culture etc. (Amit, et al., 1998). Buyouts suffer from a similar problem on the opposite side of the spectrum. Here the companies and deals can be sufficiently large to necessitate extensive research, where a company might be acting in several markets simultaneously, and servicing different segments, through different departments with different products. (Prowse, 1998)

A correct valuation necessitates not only time but also experience, which private equity firms pride themselves on having. These situations could even result in private equity companies preferring companies that need extensive due diligence as it is here that they can add the most value.

Other mechanisms proposed as drivers of private equity activity are connected to incumbent management's access to superior information. Private equity adds value through unlocking the

potential of a company through the use of incentive schemes and close monitoring. These incentive schemes can be attractive for the incumbent management as they will receive the lucrative compensation, they are therefore incentivized to work towards being acquired by a private equity firm. Information asymmetries then work in incumbent management's favor in being able to sway current owners to sell at a discount, driving private equity activity. Some indicators are in stark opposition to this conclusion, (i) actual performance does not exceed the forecasted performance (Kaplan, 1989; Ofek, 1994), (ii) Private equity firms often bring in new management (Achrya & Kehoe, 2013), and (iii) during booms there is evidence of private equity firms having overpaid. However, large profits have been made in the industry, stemming not from increases in operating performance, but from buying low and selling high (Achrya & Kehoe, 2013; Guo, et al., 2011). The drawn conclusion is that information asymmetry is likely not a factor but rather the relative bargaining power of the firms and market timing strategies. (Kaplan & Strömberg, 2009)

2.3 Market Timing

Market timing has become an ever more popular field of finance. In some sense spawned out of behavioral finance, wherein actors can effectively gain excess profit through identification of mispricing. The theory adds to the semi-strong market efficiency as it describes how actors can exploit these temporary effects to their advantage, the market is therefore considered efficient in the medium and long-run. Market frictions invariably segments the debt and equity markets, creating this opportunity. The theory is highly connected to some financial institutions, hedge funds for example, but non-financial institutions also. There is also evidence of firms acting upon mispricing in capital markets.

Due to the presence of mispricing in financial markets firms can be rational to use their own overvalued company stock, utilizing either equity for a swap or a new issuance (Myers, 1984; Marsh, 1982). In trying to shed light on issues of financial structure one also describes, by extension, added value to additional investments and acquisitions. The empirical findings point to the likelihood of equity issuances and debt issuances following stock price fluctuations and runs contrary to both the trade-off theory (Modigliani & Miller, 1958) and the pecking order hypothesis (Myers & Majluf, 1984).

The two theories describe that firms decide their financial structure by balancing the pros and cons of borrowing. Additional debt leads to both additional interest tax shield and costs of financial distress. Up to a point the benefits from the additional interest tax shield outweigh the

costs of financial distress, but as the debt increase the marginal cost increases. An optimal amount of debt can therefore be identified. The pecking order theory instead describes that costs of financing increases as asymmetric information increases. The costs of financing are therefore lowest for internal cash flows, followed by debt issuance and lastly equity issuances. It follows that firms prioritize the least costly financing scheme.

If firm value increases, according to the trade-off theory, the firm should issue additional debt to counterbalance. This is contingent on the fact that nothing except for the firm value has changed, the interest tax shield and costs of financial distress remain unchanged. Pecking order theory describes no mechanism whereby inside information systematically favors any one party when firm value increases – “There is no way firms can *systematically* take advantage of purchasers of new equity in a rational expectations equilibrium” (Myers, 1984). Market timing predicts a divergent effect, if firm value increases it can be a sign of a temporary mispricing, of overvalued equity. By identifying this the firm can use the overvalued equity to finance investment and acquisitions, either through swapping its equity or through equity issuance for additional liquidity.

Additional means of taking advantage of mispricing are put forward by researchers, where the credit spread can offer such opportunities. A decrease in credit spreads leads to a surge of healthy companies pursuing additional debt, these firms are characterized as market timers. Credit spread is therefore theorized to be connected to the framework of market timing (Hui, 2010). Others instead point to the IPO markets as the greatest indicator of market timing behavior (Alti, 2006).

2.4 Agency Theory

The capital allocation mechanism of private equity has been described by a handful of researchers, e.g. Lerner, Schoar & Wongsunwai (2007), Kaplan & Schoar (2005) Robinson & Sensoy (2016), Sommer (2012). The comovement with public markets and general business cycles is identified, and the entire cycle of the asset class is subsequently described. High fund returns leads to an influx of capital as investors search for superior investment vehicles. The influx of capital causes new market entries and increased deal making, sparking competition for deals and a subsequent decline in returns. The decline in returns leads to market exits and decreased activity of PE firms. The subsequent competition for capital leads to increased fund returns and the cycle begins anew. The research is in most cases not a statistical analysis but rather asserted and given credence through visual representations.

The theory is grounded in agency theory in which the GPs are incentivized to undertake unprofitable acquisitions in times of abundant liquidity through the fee structure. The theory's predictions is difficult to prove as the capital raised and invested could be due to economic shock and positive market sentiments. The overvaluation and excessive deal making in such an environment could possibly therefore not be due to agency conflict but rather optimism or hubris. Coupled with measurements of economic outlook and shock the results can be interpreted more effectively.

3 Methodology

3.1 Data collection

The study necessitates the collection of disparate data to answer the question properly. These fall into two main categories. First, proxies hypothesized and theorized to predict activity and second, data of activity.

3.1.1 Proxies

The proxies chosen are each related to a theoretical framework: neoclassical, information asymmetries, market timing and agency conflict. Since the direct effects are not directly visible and immeasurable we have selected a set of proxies. The underlying theories postulate that they are correlated to the proxies, and can indeed be approximately measured by the proxy. The correlation is not expected to be perfect which is why several proxies are used for each theory examined. The multitude of proxies not only allows for higher probability of finding variables that correlate to activity that are connected to a framework, they also add to the total understanding of activity, as we are not interested in explaining if a set of variables is responsible for activity, but rather explain the totality of volatility in activity with the help a theoretical arsenal. Indeed the proposed proxies serve to validate such theories and apply them to the private equity industry.

The proxies have been accessed from several databases, including OECD, Datastream, Compustat - Capital IQ, Yahoo Finance, the Federal Reserve, IBES, Preqin, Bain Capital, Thomson Reuter's VentureXpert and Mergers & Acquisitions. The problem of inconsistency of accessing data from diverse datasets was unavoidable, as for example data on returns was not present in the dataset on activity. All data was converted and tabulated into quarterly data points pending analysis.

Table 1: Proxies for theoretical drivers of BO/VC activity

This table presents our selection of proxies from six different theoretical drivers of private equity and venture capital activity. All proxies are listed under their respective theoretical frameworks.

Proxy	Description	Source
<u>Economic shock</u>		
<i>Real GDP</i>	US GDP at constant prices	OECD
<i>Business Confidence Index</i>	Enterprises' assessment of production, orders and stocks and short-term expectations	OECD
<i>Industrial Production Index</i>	Output of industrial establishment, expresses change in the volume of production output.	OECD
<i>Operating income</i>	Weighted mean of change in operating income in S&P 500 companies	Compustat/Capital IQ
<i>Gross profit</i>	Weighted mean of change in gross profit of S&P 500 companies	Compustat/Capital IQ
<i>Delinquency rate</i>	US Corporate delinquency rates	Datastream
<u>Capital Demand</u>		
<i>Gross Private Domestic Investment</i>	Capital and residential expenditures, and change in inventories in the US	OECD
<i>Sales</i>	Weighted mean of change in sales in S&P 500 companies	Compustat/Capital IQ
<i>Capital expenditure</i>	Weighted mean of change in capex in S&P 500 companies	Compustat/Capital IQ
<i>Total assets</i>	Weighted mean of change in total assets in S&P 500 companies	Compustat/Capital IQ
<u>Capital Supply</u>		
<i>Prime rate</i>	Average majority prime rate charged by banks on short-term loans to business, quoted on an investment basis	Federal Reserve
<i>3-month T-bill rate</i>	Rate of a short-term debt obligation backed by the U.S. government	Federal Reserve
<i>Corporate debt</i>	Outstanding non-governmental and non-share securities	Datastream

Proxy	Description	Source
<u>Information asymmetry</u>		
<i>Dispersion of Analyst Forecast</i>	Equal weighted mean of standard deviation of earnings forecasts across S&P 500 companies	I/B/E/S
<i>VIX</i>	CBOE Volatility Index, implied volatility of S&P 500 index options	Yahoo Finance
<i>Trading volume</i>	Price weighted quarterly trading volume in S&P 500 companies (\$Mn traded / price index)	Yahoo Finance
<u>Market Timing</u>		
<i>Credit spread</i>	Absolute difference between Barclays US indices of Aaa and Caa	Datastream
<i>IPO volume</i>	Aggregate IPO proceeds from Amex, NYSE, and NASDAQ	(Ritter, 2016)
<i>Book to market</i>	M2B-ratio of S&P 500 companies	Compustat/CapitalIQ
<i>Price to Earnings</i>	PE-ratio of S&P 500 companies	Compustat/CapitalIQ
<u>Agency conflict</u>		
<i>New firms</i>	Number of private equity firms founded in the quarter	SDC Platinum
<i>Fund performance</i>	Time-weighted IRRs of liquidated funds per quarter	Preqin/Bain&Company

3.1.2 Activity

A major hindrance and continued issue in problems posed concerning private equity is the availability of data. In the prevailing case most of the data is safeguarded by the stakeholders whom do not wish to share their information as they are entwined with confidential deal information which could prove to have an effect on both future returns and relationships if they became publically accessible. For this reason there is also no legal obligation of the participants to disclose the relevant data.

The problem is accentuated when looking at deal which can be characterized as *private-to-private*. In the case where one participant is public the information has to be readily made available to shareholders, and is thereby rendered public. But the majority of the deals, both in number and in volume, is not in this category.

The databases which contain information on buyouts and venture capital deals have despite this grown over the last few decades. Some of the information can be made available to a limited degree so as to safeguard the confidentiality of deal specifics. However, this leaves the problem largely unsolved for a host of research questions which is commonly lamented by academia. Issues of performance on a firm level are the most effected as they depend on deal specific data as well as firm specific data, more specifically exact data on performance, valuation and other firm inputs such as experience and capital injections.

The problem of data collection has in some instances been solved by having access to a limited number of Limited Partners and/or General Partners. This leads to the possibility of answering more specific questions in the field but causes the achieved results to be less conclusive due to the limited sample size. Other solutions to problem of data availability include collecting data from publically traded private equity firms. However, the sample size is too small to allow for a meaningful analysis.

The case for aggregate activity and performance in the US is in the larger scheme of things less cumbersome due to data availability through a number of databases where a multitude of data is disclosed.

There are two main sources of information on venture capital investments, VentureXpert (VX), a unit of Thomson Reuters, that began collecting data in 1961, and Venture Source, a unit of Dow Jones that began collecting data in 1994. In general VX is more complete with regard to the number of deals while VS has more detailed information per deal. For our purposes the VX database is therefore preferable. Due to inconsistencies and problems of compatibility the VX database is used exclusively for information on venture capital deals.

The database is merged and matched with Thomson Reuter's Mergers and Acquisitions database. Deals that were present in both databases were eliminated. Rounds in which an investment firm bought the same company twice within a six month span were deleted. If the rounds were separated by more than six months they have been left in the dataset – it is not uncommon for investment firms to stagger their investments, investing in the same company several times over time. Duplication is inevitable as there is no clear-cut divide between the two segments, venture and buyout. It is possible that an investment firm initially participated in the early stages of a target company's history and as the company matured it became a suitable candidate for a buyout. The duplications were manually handled on a deal to deal basis, deciding on whether the deal information from one or the other database was to remain. Data-availability largely guided these decisions.

Extensive and time consuming additional manual handling was done to correctly input and check firm names. Due to the complicated nature of private equity firm structuring it is hard to define what is the same firm, and not. This is a problem that is largely ignored and circumvented by contemporaries researching performance and activity on the fund level. However, the problem looms over the data on the firm level. The data is self-reported which means that whichever name that the firm puts in will be registered. Some firms report the most immediate acquirer, the fund or holding company, while other's report either the company responsible for handling the deal and the due diligence, others simply report the group name. This results in a situation where one company group can have a multitude of firm names in the dataset, delineated by geographies, industries, investment type and judicial entity. This was handled by manually, whereby firm names that were not closely related but obviously the same firm were changed. Since the primary research is done on the aggregate level and industry level the problem is not accentuated to its full extent. But it is still important as a means of eliminating duplicates and drawing supporting conclusions from the sample descriptive statistics. Additional errors in the database were also corrected for, misspellings and errors in registration.

To harmonize the databases additional data was needed. This was handled through manual input of relevant company data and through cross-referencing between the databases. For example, if a firm's founded date is registered in one database but not the other, then the data point can be transplanted into the other database. This complimentary aspect of the databases lead to a slight increase in data availability. It is not uncommon that private equity firms enter into syndicated when investing in companies, pooling their funds and together acquiring a company. The round amounts are listed in their totals, and not the individuals firms stake in the company, we therefore only counted each investment round once towards the aggregate. The

problems this posed are negligible as we are not conducting the analysis on the firm level, the individual firms' investments are therefore not of interest. There was an issue of syndication wherein the funds that took part were of differing types. Since the only possible way of delineating between investment types is through their respective fund notations these deals have been taken out of the dataset in favor of deals in which only one fund type was active. This resulted in the dataset decreasing approximately 5% in size, i.e. not detrimental or overly significant decrease. The prevalence of this issue points to the previously mentioned problem of muddled term usage between investment types.

There are databases that more exclusively cater to buyout, Preqin, Capital IQ and Pitchbook. They typically receive their data from disclosures from LPs, filings with the SEC and other public sources. However, the VX database gathers information on buyouts and is this setting utilized exclusively to measure activity. We have identified a deterioration in the database of both VX and VS in the last decade which could adversely affect the results of the paper, this is taken into consideration when assessing the results.

There is additional potential for error in the collected data from the sources reporting on private equity (Kaplan & Lerner, 2016). First, the data is likely incomplete as funds have been known to pressure LPs to not report to data providers. Where LPs have even been dropped due to their inability to make such commitments. (Lerner, et al., 2011). Second, there might be a back-fill of funds, where funds are not captured by the data providers unless the firm successfully raise a second fund and/or gains institutional investor interest.

Additional problems are that of definitions. There is some uncertainty with regard to consistency of defined terms, vintage year is sometimes used as the year the firm was founded, when the firm's first fund was founded, or when the fund made its first investment. The distinction between buyout and venture capital is also muddled where venture capital have increasingly undertaken larger investments in more mature companies, while buyouts have in some cases been done in growth companies taking on a minority stake. The unclear definitions and overlap are made clear by firms that identify as buyout companies making venture capital investments and vice versa.

We collect data from 110.212 investment rounds and buyouts spanning the years 1990-2016. The investments studied are limited to those made by US registered private equity firms, however target companies are spread across 131 different countries.

3.2 Hypotheses

We derive hypotheses about what drives investment activity in the private equity industry based on the theoretical frameworks discussed above. The neoclassical framework states that there is a link between the general business cycles and private equity activity. Private equity firms are according to the framework chasing returns and positive net present value of its investments. In a business cycle where target firms are themselves identifying many such investment opportunities the private equity firms are incentivized to acquire more targets.

Some private equity firms, especially buyout firms, rely heavily on the use of leverage to make acquisitions. In times of ample credit supply, private equity have free reign to pursue investment opportunities, which can be expected to fuel investment activity.

Further, when potential target companies are investing heavily and are in need of capital injections, they might be more willing to open themselves up to buyout or venture capital investments to fund their projects. The framework thereby makes several predictions as to the behavior of rational investors and the drivers of activity. The three hypotheses related to the neoclassical framework are the following:

H1: Economic shocks drive investment activity in the private equity industry

H2: Capital supply drives investment activity in the private equity industry

H3: Capital demand in target companies drives investment activity in the private equity industry

The second theoretical framework that might predict activity in the private equity industry is information asymmetries. In times of high information asymmetries, the private equity industry can be expected to decrease investment activities, as potential investment opportunities are riskier to pursue. On the other hand, it might be that private equity firms have access to better information than other investors which they can leverage in times of great uncertainty. That theory seems more far-fetched, so the main hypothesis derived from the information asymmetry framework is:

H4: Information asymmetries have a negative impact on investment activity in the private equity industry

Within the framework of market timing, private equity firms are theorized to time the market with aims of excess returns. The firms therefore aim to acquire companies when their valuations are favorable and the costs to the private equity firms the lowest. This leads us to our fifth hypothesis:

H5: Mispricing drives investment activity in the private equity industry

Agency theory states that historical returns affect investment decisions of LPs, leading to more activity and new entrants. Due to incentive structures GPs who are flooded with capital will make investment decision that are suboptimal. This leads to overvaluation of potential target firms and consequently mediocre returns. Activity decreases and investment firms exit the market, leading to more favorable valuations and consequently higher returns which starts the cycle anew. The reports on IRRs of investment is made quarterly to LPs but we hypothesize that the internalization of the information by potential investors is longer, where they do not rely on the previous years' data, but rather on historical averages. The formation of new firms and funds is also time consuming, such decisions are not made with data from just one quarter but rather from historical considerations as well - further delaying a resurgence of activity. The effect might therefore not be immediate but delayed. The hypothesis we derive from agency theory is thus:

H6: Previous performance of private equity funds drives investment activity in the private equity industry

Table 2: Direction of influence of each driver

This table presents the expected sign for estimates of each proxies influence on private equity and venture capital activity. The “hypothesis” column presents whether coefficients are expected to be positive, negative or if there are theoretical explanations on each side of the hypothesis.

<u>Proxy</u>	Hypothesis
Economic Shock	
<i>Real GDP</i>	+
<i>Business Confidence Index</i>	+
<i>Industrial Production Index</i>	+
<i>Operating income</i>	+
<i>Gross profit</i>	+
<i>Delinquency rate</i>	-
<u>Capital Demand</u>	
<i>Gross Private Domestic Investment</i>	+
<i>Sales</i>	+
<i>Capital expenditure</i>	+
<i>Total assets</i>	+
<u>Capital Supply</u>	
<i>Prime rate</i>	-
<i>3-month T-bill rate</i>	-
<i>Corporate debt</i>	+
<i>High yield index</i>	-
<u>Information asymmetry</u>	
<i>Dispersion of Analyst Forecast</i>	+/-
<i>VIX</i>	+/-
<i>Trading volume</i>	+/-
<u>Market Timing</u>	
<i>Credit spread</i>	+
<i>IPO volume</i>	+
<i>Book to market</i>	-
<i>Price to Earnings</i>	-
<u>Agency conflict</u>	
<i>New firms</i>	+
<i>Fund performance</i>	+

Additional auxiliary hypotheses deal with the behavior of firms during booms and busts. The behaviors to be identified are primarily that of components of deal activity. The boom and bust cycles in private equity and the associated drivers are divided between BO and VC, but there are other possible and available groupings of interest. In handling the data we hope to find results pertaining to the components of activity. These potential findings include the behavior of firms to pursue deals internationally. The pattern and mechanism whereby private equity firms operate could either be increased international activity in boom times due to an abundance of capital and overzealous investments managers, or that the prevalence of international deals decrease during booms due to increased access to attractive investments domestically.

Private equity firms can be both specialists and generalist when it comes to industries. However, the behavior of firms is likely to change over time, reflecting both changing strategy with regard to the overall dispersion of activity across industries and identification of trends. Booms could lead private equity firms into either casting a wider net, entering into more industries as activity increases, or they could decrease the number of targeted industries, following a similar rationale as to international versus domestic deals.

We try to pinpoint the aggregate drivers of activity, but changes to activity could be driven by sub groups within segments. Increased activity could primarily be driven by new firms identifying the investment opportunities and starting up shop, or established firms increasing their scope, pace and size to make good on the identified opening in markets. The experience of the firms is reasonably a factor in the behavior in view of a changing environment. The firms' founding is related to this question and could also possibly shed light on the composition of activity.

3.3 Research design

The research design is unapologetically quantitative because of the limitations of qualitative studies in the prevailing field. The quantitative approach is unhindered by biases, is unobtrusive and results in a larger sample than using a qualitative method of analysis.

The operationalization of the research question leads to correlations and causations found between theoretical postulations and the corresponding data. Through the use of independent variables listed as proxies and connected to their respective theories the dependent variable of deal activity can be assessed. Most of the drivers and corresponding activity data is measured quarterly. Because of the imperfections of using proxies as a way to measure the underlying theoretical significance a number of proxies have been supplied for each set of theories. The use of control variables is largely forgone as the study hopes to find the answer to the aggregate drivers

and causes for fluctuations and changes in deal activity, rather than specializing on a specific set of drivers while holding all others static.

The dataset has as previously mentioned been limited to data points containing information on disbursements leading to results that are both concerned with the gross number of deals and the total deal volume. As our later analysis will show, both proxies and deal values are time series that are persistent and non-stationary. Such characteristics necessitates certain adjustments to both the data itself and estimation methods, to get efficient and unbiased results. To address non-stationarity we use the first difference of proxies and deal volumes, and to address serial correlation we devise Newey-West estimators to get unbiased standard errors.

4 Data

The private equity industry has changed in both composition and size in recent decades. Both increasing volumes and an influx of new entrants has brought about this change. The dataset spans twenty six years, from 1990 to 2016 and encompasses 206.450 deals, 29.849 and 173.501 for BO and VC respectively. However, there are deals in which several firms pooled their investments to acquire a company, this is especially prevalent in the venture capital industry. To avoid counting deals twice only unique deals are counted resulting in a considerably lower number of total deals. Unique deals are 27.155 and 80.127 for BO and VC respectively. The growth in both number and volume is shown in *Fig. 1* and *Fig. 3*. The number of active firms exhibit similar behavior for both segments. Steady increases preceding a boom, a sharp decline followed by a steady growth again. The only difference is in the global maximums, where the peak in active firms for VC is in 2000, and for BO during 2008.

The venture capital data clearly depicts three periods of increased activity, which correlate to business cycles. Booms can be identified in 2000, 2007/2008 and 2014/2015 where both the volume and the number of deals increases considerably. The BO-industry is less clearly correlated to business cycles but the three periods can also be identified here. Over time both the number of deals and the average deal size has increased, and follow a similar trajectory. Average deal size for BO reaches a global maximum in 2006 and remains relatively steady in the following year. The average deal size then falls precipitously, pointing towards the abandoning of so called mega-deals. The BO industry has increased its volume more aggressively due to an increase in the number of deals which were low compared to the number of deals for VC, the percentage change in number of deals in BO compared to VC is considerably larger.

Table 3: Descriptive statistics

This table presents summary statistics for deal values per quarter (dependent variables), winsorized at the 5% level by quarter, in Panel A. Summary statistics for unadjusted proxies (independent variables) are shown in Panel B.

Panel A: Winsorized dependent variables							
	N	Min	Median	Max	Std. dev	Skewness	Kurtosis
BO	108	347.56	9052.04	31620.34	7612.26	0.4530	-0.7484
VC	108	438.51	5120.18	15808.79	10136.81	0.0921	-1.2014
Total	108	953.46	15577.68	38576.95	3430.19	0.7090	0.5701
Panel B: Unadjusted independent variables							
	N	Min	Median	Max	Std. dev	Skewness	Kurtosis
Real GDP	108	5890.80	11497.90	18855.50	3900.46	0.07871	-1.2718
Business Confidence Index	108	96.05	99.81	102.04	1.03	-0.7745	1.4900
Industrial Production Index	108	64.62	101.53	115.77	15.32	-0.0806	-0.7297
Operating income	107	171.50	504.71	904.09	222.98	-0.08354	-1.3258
Gross profit	107	42.05	1139.23	1987.30	549.30	-0.3024	-0.9981
Delinquency rate	108	0.72	2.06	6.41	1.45	1.0999	0.4169
Gross Private Domestic Investment	94	57.59	105.92	133.32	23.47	-0.4713	-1.0846
Sales	107	418.83	3362.47	5615.43	1456.79	-0.26678	-1.0473
Capital expenditure	108	615593	1283894	2246705	445108	0.1304	-0.8952
Total assets	107	11577.71	38967.8	66771.8	18293.86	-0.0959	-1.4854
Prime rate	108	3.25	6.00	10.11	2.32	0.0808	-1.5377
3-month T-bill rate	108	0.02	2.99	7.77	2.31	0.1550	-1.3015
Corporate debt	108	507	1628	5085	1205.70	0.9351	-0.1450
High yield index	104	63.34	95.06	106.53	9.93	-1.0281	0.6262
Dispersion of Analyst Forecast	107	0.005	0.009	0.041	0.005	3.4521	15.944
VIX	108	11.26	17.875	44.14	7.37	1.4206	2.0232
Trading volume	108	26.78	90.63	506.72	89.08	2.0948	5.3846
Credit spread	108	4.19	8.465	27.38	4.81	1.5387	2.3557
IPO volume	100	1	68	248	55.54	0.9062	0.3249
Book to market	107	0.29	0.56	0.93	0.1422	0.8310	0.3199
Price to earnings	108	13.88	20.69	119.85	14.40	4.6318	25.647
New firms	108	12	105.5	377	72.26	1.2468	2.6906
BO fund performance	100	-15.42	3.96	17.80	5.00	-0.5432	2.3341
VC fund performance	103	-19.99	3.05	84.06	11.47	3.5562	23.1926

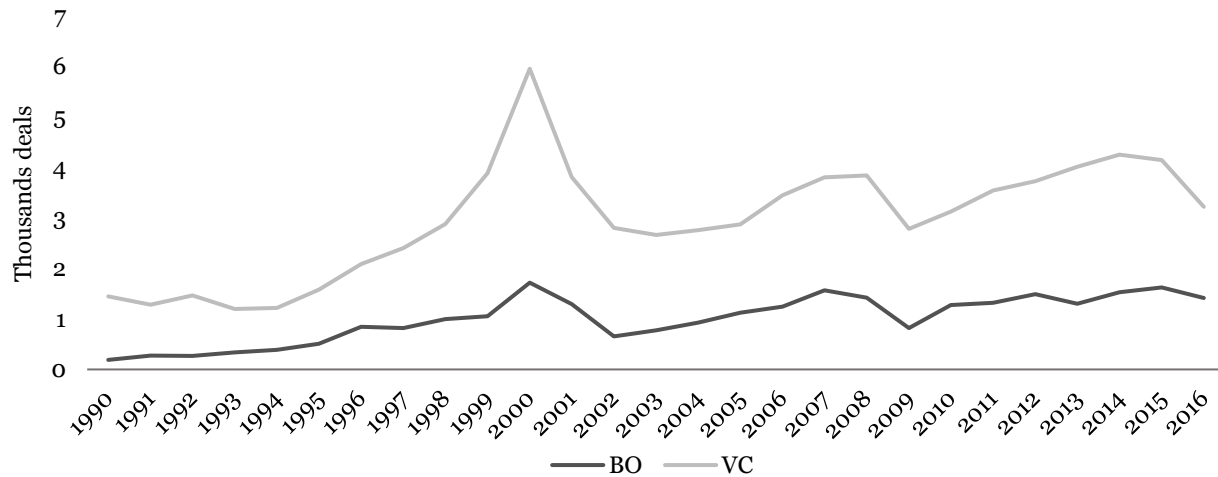


Fig. 1: Total number of deals per year by BO/VC

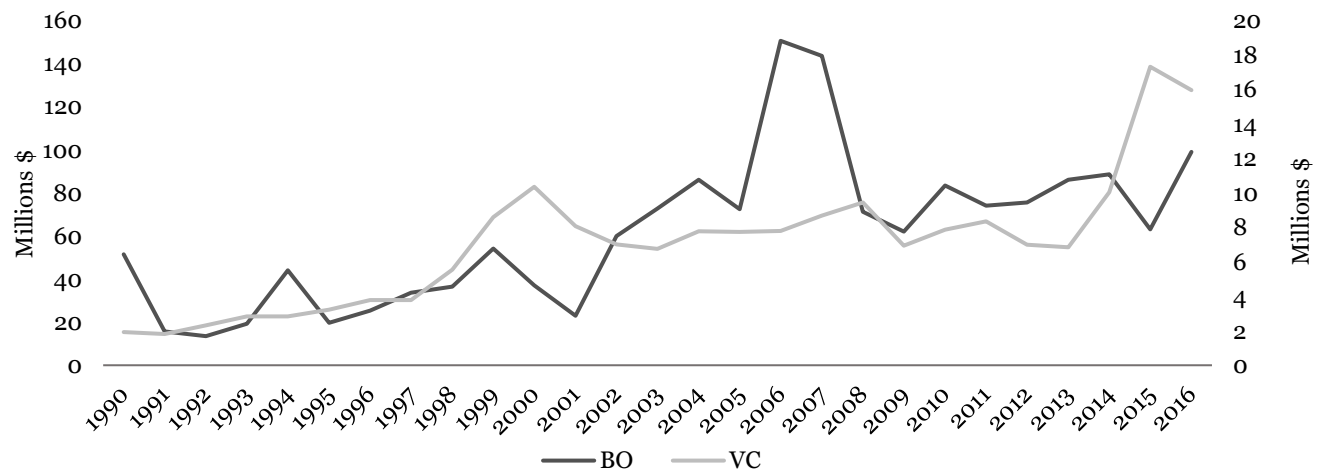


Fig. 2: Average deal size per year by BO/VC

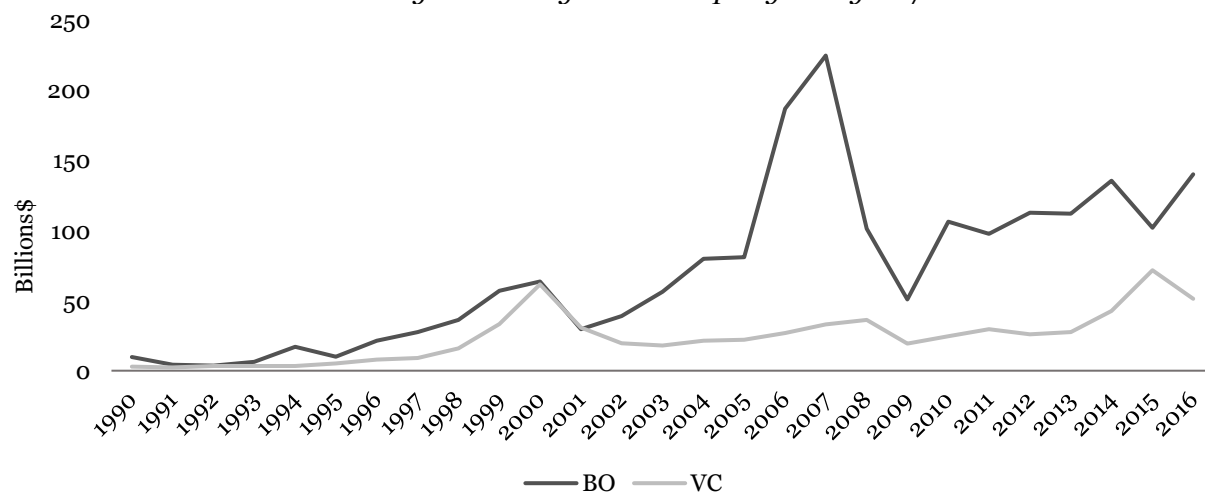


Fig. 3: Total deal volume per year by BO/VC

4.1.1 Industry trends

Business cycles are easily identified as 2000 and 2008 exhibit above average deal activity, followed by a marked drop in activity and subsequently relatively stable increases in activity. On the industry level, including both VC and PE, several things can be identified. See Table 27-Table 30. Many industries experience booms in 2000 and 2007. But the industries which experience the largest booms in 2000 have mediocre or even unchanged deal activity during the boom of 2007/-08, Industries exhibiting this behavior include Communication, Computer software and Internet specific. Deals in communications have decreased during the entire period, this decline has been the most intensive leading up to recessions, 2000 and 2008, when other industries grew and therefore increased their relative share of the activity. The relative share of Internet specifics peaks during 2000, to later decline during the earlier part of the 2000s, the later part of the decade the industry resurges to approx. 20% of deal activity for the remainder the examined period. Internet software has relatively stable deal activity throughout the 1990s and 2000s, grows and subsequently peaks at never before seen levels in 2015 and 2016.

Industries which conversely did not experience the boom of 2000 to the same extent have a larger uptick during 2007, these industries include Industrial/Energy, Biotechnology, Construction, and Medical/Health. The remaining industries experience both booms to about equal extent, these industries include Computer hardware, Consumer related, Manufacturing, Financial services, Business services, and Semiconductors/Electronics. Agriculture, Biotechnology and Industrial/Energy which grew during the boom of 2007, keep their relatively high deal activity, compared to previous levels during the remainder of the examined period. See Table 27-Table 30.

There are also differences with regard to industry activity in private equity and venture capital. Venture capital is more heavily skewed toward investments in Computer hardware, Software, Other, Internet specific and Biotechnology. Medical/Health starts out being a more typical venture capital investment but has in recent times become as common as a private equity investment. Communication is targeted to the same extent by both segments. Industries that are more typically targeted by private equity include consumer related, Financial & Business services, and industrial/energy. The remaining industries are not heavily favored by either fund type, and the least favored by venture capital. These industries include agriculture/fishery/forestry, manufacturing, transportation and utilities. The fluctuations are of differing severity, as evident by the mean weighted standard deviation across industries. The total fluctuations are larger in BO, largely related to the changes in deal size over time. Both VC and BO show similar behavior with regard to industries. VC has lower standard deviation for volume across most industries,

except for Communications, Computer other, Financial services, Industrial/Energy, and Utilities. Many of the differences stem from fluctuations becoming larger due to the incremental nature of deals. In Utilities and Computer other where VC has very few deals, a relatively small absolute change in deals results in large measures standard deviations, however, this is not the case for the other mentioned industries. The differences in standard deviation of deal size is even larger than total volume, this is reasonable as deals in BO are across a wider valuation range while venture capital is focused on one segment of the industry, immature companies with future growth prospects, leading to a narrower range of deal size. It could also be that differences over time is due to overvaluation and hubris in BO, but drivers of the behavior are unable to be determined at this level of analysis.

The industries Consumer Related and Medical/Health are both relatively stable, while investments into Construction, Biotechnology, Computer other, and financial services are more volatile in deal volume. Standard deviation in the volume of Agr/Forestr/Fish, Biotechnology, Computer hardware & other are primarily due to standard deviation in average deals size rather than standard deviation in number of deals. The opposite effect can be identified for Computer software, Internet specifics and Industrial/Energy.

For VC there is a concentration of deal value in industries in the 2000, the concentration declines but resurges after 2009 to seemingly pan out in 2014 at the previously identified high levels of concentration. The BO subsample does not show the same behavior, here the concentration of deal value is relegated to the earlier parts of the 1990s. The data is more erratic and unpredictable but over the long term stable, the short term volatility is due to fluctuations in total activity, rather than reflecting the erratic behavior of changing industry preferences. The data is indicative of BO being less inclined to follow trends, or at least transition between investment strategies and trends in different industries slower and more methodically.

The average VC firm conducts investment in more unique industries compared to BO firms. This is somewhat surprising as BO firms make slightly more investments per quarter. The difference has decline over the years with VC firms in 2016 only being slightly more diverse with regard to industry. See Table 27-Table 30.

Table 4: Target industry descriptives by private equity segment (BO/VC)

	<i>Deal volume</i>			<i>No. Deal</i>			<i>Deal size</i>
	Total	Mean	Mean weighted st.dev	Total	Mean	Mean weighted st.dev	Mean weighted st.dev
BO							
NA	5 394	106	1.09	345	7	0.65	0.92
Agr/Forestr/Fish	8 695	119	1.46	227	3	0.68	1.92
Biotechnology	10 759	118	1.61	454	5	0.60	1.90
Business Serv.	60 794	563	1.08	1 835	17	0.64	0.85
Communications	72 803	680	0.90	1 662	16	0.66	0.94
Computer Hardware	17 077	178	1.30	425	4	0.52	1.30
Computer Other	661	51	1.23	14	1	0.25	1.19
Computer Software	92 826	884	1.17	3 143	30	0.67	0.87
Construction	18 764	191	1.31	550	6	0.67	1.27
Consumer Related	150 012	1 389	0.81	3 884	36	0.44	0.62
Financial Services	149 192	1 381	1.03	2 821	26	0.52	0.77
Industrial/Energy	184 140	1 705	0.95	3 677	34	0.59	0.66
Internet Specific	57 573	606	0.96	2 017	21	0.78	0.79
Manufact.	39 320	367	1.05	1 067	10	0.50	0.86
Medical/Health	64 085	605	1.10	1 945	18	0.56	0.87
Other	36 705	340	1.21	934	9	0.78	0.94
Semiconductor/Electr	23 347	227	1.32	744	7	0.57	1.24
Transportation	57 253	540	1.08	1 201	11	0.55	0.75
Utilities	17 777	254	1.22	210	3	0.55	1.04
BO Total	1 067 176	9 881	0.77	27 155	251	0.46	0.57
VC							
Agr/Forestr/Fish	620	8	1.40	127	2	0.52	1.51
Biotechnology	61 194	567	0.71	7 365	68	0.44	0.48
Business Serv.	6 501	60	1.06	1 173	11	0.59	0.64
Communications	44 477	412	0.99	5 892	55	0.60	0.54
Computer Hardware	18 546	172	0.64	3 039	28	0.25	0.52
Computer Other	479	8	1.32	114	2	0.49	1.13
Computer Software	125 790	1 165	0.82	21 187	196	0.50	0.45
Construction	1 663	18	1.15	237	2	0.64	1.21
Consumer Related	15 482	143	0.62	2 982	28	0.34	0.50
Financial Services	13 498	125	1.26	1 633	15	0.61	0.76
Industrial/Energy	18 984	176	0.86	3 343	31	0.46	0.56
Internet Specific	124 362	1 152	1.09	17 283	160	0.81	0.46
Manufact.	2 188	22	0.92	491	5	0.52	0.79
Medical/Health	61 914	573	0.55	9 408	87	0.26	0.43
Other	1 950	22	1.14	268	3	0.59	1.06
Semiconductor/Electr	35 736	331	0.81	4 962	46	0.49	0.50
Transportation	5 275	49	1.05	577	5	0.52	0.88
Utilities	311	8	1.59	46	1	0.43	1.71
VC Total	538 972	4 990	0.68	80 127	742	0.39	0.43

4.1.2 Cross border deals

There is at first glance a correlation between deal activity and the prevalence of international deals. An increase in deal activity leads to a relative increase in the share of international deals. See *Fig. 6*. The share of international deals in the buyout segment has a local maximum in early 2000 and a noticeable decline in early 2009, followed by a resurgence in 2010. Venture capital does not exhibit the same behavior. It peaks more than a year later than buyouts, in the middle of 2001. The relative share of cross border deals is then relatively stable. The drivers for this behavior are not known. It could be that this is due to other underlying drivers. The data from deal value is harder to interpret due to the volatility in deal size. The pattern emerging from the deal value is instead a clearer indication of the internationalization of both VC and BO, both firms increasingly invest more and more across borders. Globalization could be increasing the prevalence of international deals while other factors connected to the ascension of private equity as an investment vehicle simultaneously increased deal activity. The share of international deals increased during the 90s to reach a peak in early 2001. The share seemingly declines in recessions, both following the IT-crash after 2001, and the credit crunch of 2008. Since 2014 there has been a marked increase in the share of international deals.

The deal value that is connected to international deals is consistently higher than the associated number of deals. See *Fig. 6*. The relationship indicated that international deals are typically larger than their domestic counterparts for both BO and VC. The proposed rationale in previous literature is that of costs of monitoring. Making investments into international firms necessitates both country specific experience and additional resources. In order to justify the accumulation of such experience and the expenditure of additional resources on the investment it need to be somewhat bigger. Small deals are not worth the effort.

The countries with which there was the most deals are presented in Table 5. It is interesting to find that there are irregularities in the markets in which the private equity firms operate, they differ markedly from the list of trading partners. This is most likely due to the maturity of financial markets, prevalence of suitable targets and cultural proximity. These determinants have an extensive corresponding literature (Erel, et al., 2012; Seo & Hill, 2005; Weber, et al., 2011)

A strong trading partner does not necessarily mean that the private equity firm can identify attractive investment opportunities. Great Britain, being the 7th largest trade partner has the most deals and the tiny Nordics garners considerably more interest from private equity firms in relation to their trade connections, so does Israel, Australia, and Bermuda. The data is likely showing that

the vibrancy and maturity of financial markets coupled with a strong trade leads to increased interest by private equity firms. Firms with a big discrepancy in the opposite direction include Mexico and most East/South East Asian countries, China, Japan, South Korea, Taiwan, and Malaysia. This could be explained by either the immaturity of financial markets or cultural differences leading to fewer identified targets. See

Table 32Table 34.

BO and VC differ somewhat in their respective target firm nation investment decisions. VC invest relatively less in countries such as Brazil, Spain, Mexico, Argentina, Poland and Bermuda, while investing relatively more in firms from China, South Korea, Singapore, Taiwan, Israel, Sweden and Finland. The decreased interest for South East Asia is evidently less pronounced in VC, and the favoritism of the Nordics and Israel is even stronger. There is no large discernable difference between activity in the two segments with regard to countries such as Germany, France, Australia, Netherlands, India and Hong Kong. See Table 6.

All regions peak in 2000 and 2007, the relative shares of international deals is of bigger interest. The Nordics, Western and Northern Europe have their relative peaks in BO activity around 2000 while Eastern Asia peaks around 2008, seemingly at the expense of European firms. South Asia grows continuously to rival and surpass European regions in 2009/2010, to reach a peak in 2012 when 20% of US international deals were made in the region. The share of deals consequently declines to levels closer to Eastern Asia with Western regions in Europa and North America once again strengthening their share of deals. South America increases its share during booms, but is relatively weak in the period between 2000 and 2008. The VC subset has some interesting anomalies. The Nordics reach a relative peak in 2008/-09 instead of around 2000. Deals made in the North American region are comparatively weak, due to the large increases in other regions. Eastern Asia also has its largest share of US international investments in 2014/-15, a period in which BO share of deal activity in the region is relatively unchanged and mediocre. See

Table 32Table 34.

Table 5:**Aggregate international deal ranking**

The table presents country rankings of international deal volume contrasted with the volume of general trade rankings from 2016.

Country	Deal Ranking	Trade Ranking	Difference
United Kingdom	1	7	6
Canada	2	2	0
China	3	1	-2
India	4	10	6
France	5	8	3
Israel	6	23	17
Germany	7	5	-2
Japan	8	4	-4
Australia	9	24	15
South Korea	10	6	-4
Netherlands	11	13	2
Brazil	12	12	0
Spain	13	29	16
Sweden	14	36	22
Ireland	15	16	1
Switzerland	16	15	-1
Hong Kong	17	20	3
Singapore	18	18	0
Italy	19	11	-8
Belgium	20	14	-6
Taiwan	21	9	-12
Mexico	22	3	-19
Denmark	23	44	21
Argentina	24	38	14
Bermuda	25	104	79
Finland	26	55	29
Norway	27	46	19
Russia	28	31	3
Poland	29	45	16
Indonesia	30	26	-4
Thailand	31	22	-9
Austria	32	34	2
Malaysia	33	17	-16
Hungary	34	50	16
New Zealand	35	47	12
Luxembourg	36	76	40
Czech Republic	37	53	16
Philippines	38	32	-6
Turkey	39	33	-6
South Africa	40	39	-1

Table 6:**International deal ranking by industry**

The table breaks down international deal volume across the two industries BO and VC, and contrasts them.

Country	BO	VC	Difference
United Kingdom	1	1	0
Canada	2	3	-1
India	4	4	0
China	5	2	3
Germany	6	7	-1
France	7	6	1
Brazil	8	20	-12
Australia	9	10	-1
Spain	10	17	-7
Japan	11	9	2
Netherlands	12	13	-1
Israel	13	5	8
Italy	14	23	-9
Hong Kong	15	16	-1
Mexico	16	29	-13
South Korea	17	8	9
Switzerland	18	14	4
Ireland	19	12	7
Argentina	20	33	-13
Sweden	21	11	10
Singapore	22	15	7
Poland	23	37	-14
Denmark	24	21	3
Bermuda	25	34	-9
Norway	26	27	-1
Belgium	27	19	8
Taiwan	28	18	10
Indonesia	29	31	-2
Thailand	30	28	2
Czech Republic	31	41	-10
Romania	32	56	-24
Russia	33	24	9
Finland	34	22	12
New Zealand	35	30	5
Hungary	36	36	0
Austria	37	25	12
Turkey	38	45	-7
Malaysia	39	26	13
South Africa	40	44	-4
Nigeria	41	55	-14

4.1.3 Activity and firm experience

The experience levels of firms has fluctuated over the last 25 year, more so in VC than in BO. The venture capital industry experienced significant influx of new entrants leading up to, and during the boom of 2000/2001. See *Fig. 7 & Fig. 8*. These firms also kept active during the years following the boom, as shown by the increased share of companies with 2-5 years of experience. Firms with more experience typically make more deals per year, and with higher average deal size, this holds for both BO and VC. See *Fig. 9 Fig. 10*. VC has many more new entrant compared to BO, and the average deal size changes less across all experience levels for VC. The increase in total deal value for the VC subset is made evenly across experience levels, while the increased activity found in BO during boom times is seemingly made to a larger extent by already established firms. The increase in activity is then primarily driven by larger deal sizes. Both deal value and the number of firms increase but not to the same extent for BO and VC. See *Fig. 2 Fig. 3*.

The buyout market firms with experience of 11-20 year make disproportionate amounts of deals. Approximately 25% of active firms are in this age group but they made 40% of the deals. The experience group of 6-11 decrease their deal activity during the same period. The firms founded in the early 1990s are not as many as the firms of the later part of the decade, and the firms are less prone to make deals. The number of new entrants falls somewhat after 2000 to peak again in 2004 with a subsequent slight decline year on year. VC does not seem to have the same steady influx of active firms as BO. It is interesting to point out that there is no large discernable uptick in new entrants during the latter part of the 2000's for VC. Instead the number starts to increase after the credit crunch, growing from 2009 to 2016. See *Fig. 11 Fig. 12*

The buyout market matures during the examined period. In 1990 80% of active firms are 10 years and younger, while the same number for 2016 is 56%. In the venture capital market this is less pronounced, instead we can identify that more experienced firms typically account for a larger share of the deal activity in the bust part of the cycle, the periods before and after the 2000s.

5 Results

In this chapter we aim to find the relationship between theoretical drivers and private equity activity. In the regressions we use the proxies as covariates and deal values winsorized by quarter as independent variables.

The nature of economic time series is such that they often violate the assumptions of ordinary least square regression methods. Violations can yield the results from OLS regressions both biased and inefficient. In time series models, the assumption of independent and identically distributed variables is often violated by non-stationary variables, which can lead to inflated test statistics. Beneath, we check our data and models for inconsistencies with OLS assumptions, and adjust our methods accordingly.

To be able to infer anything about causal relationships we must not only use unbiased estimation methods in our regressions, but also check for confounding relationships by using multivariate models. We begin our analysis with univariate regressions and then extend it by including several covariates in the same regressions.

5.1 Univariate analysis

5.1.1 *Addressing non-stationarity*

A time series is called stationary when its statistical properties such as mean, standard deviation and autocorrelation are constant over time. To estimate relationships between time series data without biases, we need the data to be approximately stationary.

We use the Dickey-Fuller test to identify whether the processes in our variables is non-stationary. If so, the central limit theorem does not hold and using the variables in an OLS regression without adjustments would lead to biased results. In the Dickey-Fuller test, the null hypothesis is that the tested time series has a unit root and is thus non-stationary. To reject the null hypothesis the t-statistic has to be lower than a certain critical value which in turn depends on the number of observation in the tested variable.

Results from the Dickey-Fuller test on unadjusted variables is presented in

Table 17. For a few of the proxy variables, like delinquency rate and price-to-earnings, the test statistics are significant. For most variables however, the null hypothesis of non-stationarity cannot be rejected. We therefore adjust all covariates and both dependent variables with first differencing. For any given value of a variable X at time t , the corresponding first differenced value

is given by $X_t - X_{t-1}$. First differencing is usually an efficient way to remove trends and other non-stationary characteristics from a time series. To confirm that the differencing has had the intended effect, we run a second Dickey-Fuller test on the adjusted variables. Results are reported in Table 18. The null hypothesis that a tested variable possess a unit root can be rejected for all the differenced variables. Descriptive statistics for differences variables are reported in Table 19

5.1.2 Univariate regressions on BO deal volume with normal standard errors

With all variables adjusted to meet the OLS requirement of approximate stationarity, we run the first univariate regressions. Table 20 in appendix I reports the results from univariate regressions with each of the 23 proxies regressed against quarterly buyout deal value.

All economic shock and capital demand variables are significant. Coefficients align with the theoretical expectations that positive economic shocks and increases in capital demand fuel deal volume. Results for capital supply proxies are less conclusive. None of the information asymmetry results are significant, while results on market timing proxies support the notion of buyout funds acting as market timers. The agency theory is supported by the result on the new firms, whereas fund performance is not significant.

For certain proxies it could be argued that the effect on deal volume is expected to be delayed. We run the same regressions, but with up to 4 lags, for the variables that were not significant in the original regressions. The lag from 0 to 4 which yields the highest t-statistic for each model is used. Results from univariate regression with lags are reported in Table 22 in appendix I. Interpretations of results from regressions with lagged variables have to be particularly conservative unless there are specific reasons to believe that the impact of an independent variable will be delayed. Most notably, the buyout fund performance variable is significant at the 1% level when lagged by two quarters. This could be explained by the fact that the process from raising capital to investing it causes a delayed effect.

Before we discuss the regression results at greater length, we will run Breusch-Godfrey tests for serial correlation in error terms in these regression models.

5.1.3 Univariate regressions on VC deal volume with normal standard errors

We run the same type of univariate regressions as we did for the buyout sample, but with differenced venture capital deal volume as dependent variable. The results from the regressions without and with lags are reported in Table 21 and Table 23 respectively, in appendix I.

For the economic shock and capital demand proxies, the results are in line with expectations, similar to the results from the regressions on buyout activity. Results from regressions with capital supply variables is more conclusive however, and indicates that venture capital activity is inversely related to capital supply. For the information asymmetry variables the results are weak and only gain significance by using lagged variables. Results are inconclusive for the market timing theory. The VC fund performance variable gets significant at the 1% level with a lag of 1, similarly to how the BO fund performance variable behaved in the regressions on buyout activity.

Before we can make more extensive interpretations of the results, we test these regression models for serial correlation in error terms.

5.1.4 Addressing heteroscedasticity and serial correlation in error terms

One circumstance which may yield OLS regressions with normal standard errors not to be the best linear unbiased estimator is the presence of serial correlation in error terms. To test for serial correlation in errors we run Breusch-Godfrey tests for each of the regression models with lagged covariates. Breusch-Godfrey tests the null hypothesis that there is no serial correlation in error terms. The results from testing our regressions are reported in Table 24. The tests show that the null hypothesis has to be rejected for all our previous regression specifications.

To address the presence of serial correlation and potential heteroscedasticity in error terms, we use Newey-West estimators to get standard errors that are robust to both serial correlation and heteroscedasticity.

5.1.5 Univariate Newey-West

5.1.5.1 Results of univariate Newey-West on BO

The economic shock framework shows considerable significance for BO. Every proxy except for delinquency rate is highly significant. The relationship between deal activity and the general economic conditions and outlook is strong, in times when target firms identify markets and conditions as favorable BO-firms increase activity. The strongest proxies in the framework are changes in operating income and industrial production. All the identified effects are in line with the proposed hypothesis of economic shock.

The overall strength of the capital demand framework is attested to by the overall strength of the proxies - all exhibit high levels of significance. The proxies were not significant with a lead, as would have been preferable in accordance with the hypothesis, but rather highly significant without any lag or lead. Capital expenditure is the most highly significant in the framework, followed by sales growth. The measures that arguably most closely describe the capital demand of firms.

The coefficient for corporate debt is negative. When the issuance of corporate debt increases then private equity activity decreases. This is not in line with the proposed theory of capital supply where private equity firms increase deal activity when their access to capital for financing deals is abundant. The same effect can be identified in both the 3-month T-bill and the prime rate - Increased rates leads to increased activity. Changes to corporate debt issuance was not significant without a lag, whereby the results from the regression carries less weight. The coefficient for high yield index is positive and significant. Increases to the high yield index leads to increased activity, i.e. decreased costs of borrowing leads to private equity activity. This is in line with the proposed theory of capital supply and the hypothesis. The framework does consequently not support the proposed hypothesis of capital supply, in its entirety.

Two out of three proxies for the BO sample are significant and negative. This indicates that when volatility and uncertainty is elevated private equity firms decrease activity. The behavioral pattern they exhibit is therefore in line with the rest of the economy and one of the proposed hypotheses. With volatility comes increased risks which dissuaded private equity firms from making investments. The effect hypothesized that private equity firms can use a relative advantage information does not find support in the data. The significance in the framework is lower than other frameworks and lags of one and two were necessary to achieve significance.

There are some signs that BO firms time the market. Price to Earnings proxy exhibits negative significance showing that they are more active when the multiple Price to Earnings is low, leading to more favorable valuations. The book to market ratio is also almost significant giving strength

to the identified market timing behavior found in price to earnings. The IPO volume is not significant for the BO segment, unless a lag of two quarters is made. Credit spread is negative in line with the proposed hypothesis of decreases to credit spread leading to increases in activity.

Both proxies for the framework are significant at 5% or at lower levels. New firms is the more significant of the two but fund performance has a higher R-squared, indicating that the variable explains more of the changes in activity, despite not being as significant.

Table 7: Univariate Newey-West on BO

First differenced OLS regressions with Newey-West standard errors. The winsorized aggregate deal volume for BO as independent variable. Where no significance was found a lag of one to four has been added.

Framework & Proxy	Lag	Intercept	Coefficient	t-statistic	R ²
<u>Economic shock</u>					
<i>Real GDP</i>	0	-1305,52	11,72 ***	3,56	0,10
<i>Business Confidence Index</i>	0	102,82	1436,90 ***	2,89	0,09
<i>Industrial Production Index</i>	0	-123,24	592,74 ***	4,76	0,09
<i>Operating income</i>	0	-22,49	24,36 ***	4,46	0,17
<i>Gross profit</i>	0	-72,26	10,72 ***	2,67	0,07
<i>Delinquency rate</i>	0	-2618,07	-4126,20	-1,64	0,04
<u>Capital Demand</u>					
<i>Gross Private Domestic Investment</i>	0	-92,37	344,86 **	2,32	0,06
<i>Sales</i>	0	-93,07	4,33 **	2,58	0,10
<i>Capital expenditure</i>	0	-83,03	0,02 ***	3,02	0,07
<i>Total assets</i>	0	-302,62	0,81 **	2,25	0,08
<u>Capital Supply</u>					
<i>Prime rate</i>	0	173,91	964,91 **	2,24	0,02
<i>3-month T-bill rate</i>	0	215,72	1484,58 ***	2,63	0,04
<i>Corporate debt</i>	3	462,83 *	-9,09 *	-1,66	0,04
<i>High yield index</i>	0	114,94	153,52 **	2,09	0,06
<u>Information asymmetry</u>					
<i>Dispersion of Analyst Forecast</i>	1	107,19	-83408,57 *	-1,74	0,02
<i>VIX</i>	2	108,04	-96,30 *	-1,74	0,04
<i>Trading volume</i>	4	135,82	-21,07	-1,57	0,04
<u>Market Timing</u>					
<i>Credit spread</i>	0	104,39	-214,24 **	-2,06	0,04
<i>IPO volume</i>	2	133,86	16,55 **	2,09	0,03
<i>Market to Book</i>	1	105,51	12843,70	1,57	0,02
<i>Price to Earnings</i>	0	118,77	-56,62 ***	-3,63	0,03
<u>Agency conflict</u>					
<i>New firms</i>	0	67,38	33,69 ***	3,04	0,10
<i>Fund performance</i>	2	138,57	187,48 **	2,13	0,11

*p<0.1; ** p<0.05; *** p<0.01

5.1.5.2 Results of univariate Newey-West on VC

The framework for economic shock is significant across all proxies. VC firms are thereby sensitive to economy-wide indices, profitability measures and rates of delinquency. The two strongest and most significant proxies in the framework prove to be real GDP and Industrial production. Every proxy's effect is in line with the proposed hypothesis of economic shock.

All four proxies in capital demand are significant. The proxy with the highest significance is Gross Private Domestic Investment, while Total assets is the weakest, only barely significant. Capital expenditure and sales growth are less significant compared to Gross Private Domestic Investment but score the same high r-squared indicating that they explain comparatively much of the variance in activity. All the proxies show a direction of the coefficient which is in line with the hypothesis.

All proxies are significant in capital demand, especially the 3 month T-bill rate. Corporate debt required a lag of three for achieving significance. The prime rate and 3-month T-bill have positive coefficients showing that increases to the rates leads to increases in activity, corporate debt follows the same theoretical direction – Improved access to debt leads to less activity. This is not in line with the proposed hypothesis of capital supply. The high yield index is positive which is in line with the hypothesis.

The significance of the proxies in the information asymmetry framework are relatively weak. Both dispersion of analyst forecast and the VIX are only significant on the 5% level, and necessitated lags of 1 and 3 respectively. The sign of the coefficients is in line with one of the associated information asymmetry hypotheses, that information asymmetry leads to VC firms decreasing activity as uncertainty increases the riskiness of deal making.

The framework of agency conflict contains the proxy with the strongest significance in the entire sample, new firms. The proxy is the most significant by a large margin and the r-squared is three times its closest rival, explaining a third of the variance in activity. Fund performance is also highly significant, with the second largest r-squared in the sample. The results are in line with the hypothesis, including the increased significance of fund performance with a lag.

Table 8: Univariate Newey-West on VC

First differenced OLS regressions with Newey-West standard errors. The winsorized aggregate deal volume for VC as independent variable. Where no significance was found a lag of one to four has been added.

Framework & Proxy	Lag	Intercept	Coefficient		t-statistic	R ²
<u>Economic shock</u>						
<i>Real GDP</i>	0	-416,80	3,94 ***		4,22	0,09
<i>Business Confidence Index</i>	0	57,38	371,49 *		1,92	0,05
<i>Industrial Production Index</i>	0	-26,57	216,87 ***		3,48	0,10
<i>Operating income</i>	0	28,96	5,29 ***		2,77	0,06
<i>Gross profit</i>	0	7,91	2,90 ***		2,65	0,04
<i>Delinquency rate</i>	0	34,60	-769,39 **		-2,14	0,03
<u>Capital Demand</u>						
<i>Gross Private Domestic Investment</i>	0	-41,66	153,00 ***		3,87	0,09
<i>Sales</i>	0	-13,92	1,50 ***		2,89	0,09
<i>Capital expenditure</i>	0	-15,59	0,01 ***		2,69	0,09
<i>Total assets</i>	0	-23,21	0,16 *		1,88	0,03
<u>Capital Supply</u>						
<i>Prime rate</i>	0	90,73	491,88 **		2,41	0,04
<i>3-month T-bill rate</i>	0	99,67	575,66 *		1,97	0,05
<i>Corporate debt</i>	1	161,40	-2,45 *		-1,82	0,03
<i>High yield index</i>	3	60,70	29,01 **		2,09	0,02
<u>Information asymmetry</u>						
<i>Dispersion of Analyst Forecast</i>	1	55,62	-28 438,33 **		-2,19	0,02
<i>VIX</i>	3	64,65	37,70 **		2,56	0,05
<i>Trading volume</i>	4	67,91	-5,08		-1,13	0,02
<u>Market Timing</u>						
<i>Credit spread</i>	0	57,27	-66,45		-1,45	0,03
<i>IPO volume</i>	0	90,03	6,52 **		2,22	0,04
<i>Market to Book</i>	0	56,59	4 599,76		1,42	0,02
<i>Price to Earnings</i>	0	61,17	-10,50 *		-1,97	0,01
<u>Agency conflict</u>						
<i>New firms</i>	0	30,94	21,12 ***		4,94	0,31
<i>Fund performance</i>	1	90,23	33,64 ***		2,80	0,10

*p<0.1; **p<0.05; ***p<0.01

5.1.5.3 Comparison of Newey-West regressions on BO and VC

The coefficients for economic shock in BO and VC were strongly significant. BO was relatively stronger in most of these proxies, both economic indices and both measures of profitability. However, delinquency is significant in VC, which it is not in BO. The R-squared is considerably lower for operating income, and slightly lower for the other proxies. The VC subsample seem to correlate more strongly to proxies of investment, Gross Private Domestic Investment and Capital expenditures. BO correlates stronger with sales and total assets covariates.

The framework of information asymmetry is comparatively weak, but the proxy dispersion of analyst forecast is stronger in VC while the VIX was more highly significant in the BO sample. Trading volume was significant in neither. There are significant proxies in both VC and BO in the market timing framework, though they are somewhat different. For the VC industry IPO proved significant coupled with significance on the 10% level for price to earnings. BO had three variables that were significant. IPO volume was almost as strong while Price to earnings proved to have considerable significance compared to VC. The BO industry is also seemingly affected by the credit spread, which VC is not.

New firms are considerable drivers of activity, especially in VC. The r-squared for new forms in VC is three times its counterpart in BO and the t-statistic is also considerably higher. Fund performance is significant at the 5% level for both industries, while the lag is two for BO, and only one for VC.

5.1.6 Multivariate

5.1.6.1 Structure of multivariate regressions.

The multivariate regressions are initially conducted within frameworks to ascertain if variables are mutually exclusive or if any other relationships exists. All variables are first regressed on, and in the next step proxies deemed sufficiently different and with significance are tested again.

The next step is regression on the proxies across frameworks. The most significant variable from each framework within the industry is utilized in the multivariate regression. The least significant variable is after each regression dropped until only two remain.

5.1.6.2 Multivariate regression within frameworks on BO

In economic shock there are initially two variables which exhibit significance, the Business Confidence Index and Operating income. The following regression where real GDP, Gross profit and delinquency is dropped sees all t-statistics increase for the remaining proxies. Industrial production becomes significant at the 5% level and operating income increases its significance from the 10% level to the 1% level.

Sales and Capital expenditures are significant in the first regression within the capital demand framework, these were also the most significant proxies in the univariate regressions. The exclusion of all other proxies in sees the Sales t-statistic increase markedly while the s-statistic for Capital expenditures decreases slightly. No proxy is significant in the information asymmetry framework, however, both dispersion of analyst forecast and trading volume approaches significance when the VIX is excluded.

The initial regression within the market timing framework sees only credit spread and IPO volume becoming significant. The exclusion of Book to market, which more closely related to Price to earnings than the other variables sees Price to earnings becoming significant in the regression. In agency conflict the only significant variable is new firms, though fund performance is close to significant at the 10% level.

Table 9: Multivariate regression on BO within frameworks (1)

Newey-West multivariate regressions presented vertically. The first regression features all proxies for each framework, the second regression drops variables not significant in the univariate regressions and drops proxies which are closely related. The t-statistic is indicated in parenthesis below the coefficient for each respective regression and proxy.

Framework & Proxy	Lag	(1)	(2)	(3)	(4)	(5)	(6)
<u>Economic shock</u>							
<i>Real GDP</i>	0	3.098 (0.843)					
<i>Business Confidence Index</i>	0	756.371 ** (2.292)	711.171 ** (2.014)				
<i>Industrial Production Index</i>	0	208.609 (1.147)	333.712 ** (2.291)				
<i>Operating income</i>	0	19.720 * (1.963)	19.214 *** (3.084)				
<i>Gross profit</i>	0	-2.182 (-0.455)					
<i>Delinquency rate</i>	0	-294.151 (-0.303)					
<u>Capital Demand</u>							
<i>Gross Private Dom. Inv.</i>	0			-8.257 (-0.049)			
<i>Sales</i>	0			2.428 ** 2.058	3.679 *** (3.118)		
<i>Capital expenditure</i>	0			(0.013) * (1.918)	0.011 * (1.727)		
<i>Total assets</i>	0			0.422 (1.039)			
<u>Capital Supply</u>							
<i>Prime rate</i>	0					-1213.70 (-1.482)	
<i>3-month T-bill rate</i>	0					2525.26 *** (3.214)	1473.10 *** (2.922)
<i>Corporate debt</i>	3					-7.052 (-1.222)	-6.711 (-1.176)
<i>High yield index</i>	0					143.117 ** (1.987)	152.289 ** (2.106)
<i>No. Obs.</i>		106	106	92	106	101	101
<i>Adj. R-squared</i>		0.191	0.209	0.138	0.123	0.099	0.101
<i>F-statistic</i>		5.125 ***	10.247 ***	4.649 ***	8.39 ***	3.756 ***	4.765 ***
<i>Intercept</i>		-428.736 (-0.832)	-126.903 (-0.631)	-372.75 * (-1.646)	-217.37 (-0.959)	460.1965 * (1.844)	451.546 * (1.799)

*p<0.1; **p<0.05; ***p<0.01

Table 10: Multivariate regressions on BO within frameworks (2)

Newey-West multivariate regressions presented vertically. The first regression features all proxies for each framework, the second regression drops variables not significant in the univariate regressions and drops proxies which are closely related. The t-statistic is indicated in parenthesis below the coefficient for each respective regression and proxy.

Framework & Proxy	Lag	(1)	(2)	(3)	(4)	(5)
<u>Information asymmetry</u>						
<i>Disp. of Analyst Forecast</i>	1	-56705 (-1.178)	-68233 (-1.640)			
<i>VIX</i>	2	-91.296 (-1.467)				
<i>Trading volume</i>	4	-17.479 (-1.395)	-18.896 (-1.565)			
<u>Market Timing</u>						
<i>Credit spread</i>	0			-174.03 * (-1.845)	-178.287 ** (-2.071)	
<i>IPO volume</i>	2			15.637 ** (2.013)		
<i>Market to Book</i>	1			5194.43 (0.693)		
<i>Price to Earnings</i>	0			-31.479 (-1.502)	-40.554 * (-1.960)	
<u>Agency conflict</u>						
<i>New firms</i>	0					25.129 ** (2.578)
<i>Fund performance</i>	2					137.123 (1.621)
<i>No. Obs.</i>		103	103	99	107	99
<i>Adj. R-squared</i>		0.061	0.031	0.058	0.039	0.143
<i>F-statistic</i>		3.195 **	2.654 *	2.495 **	3.153 **	9.163 ***
<i>Intercept</i>		120.908 (0.524)	133.824 (0.555)	123.704 (0.511)	109.25 (0.473)	104.220 (0.394)

*p<0.1; **p<0.05; ***p<0.01

5.1.6.3 Multivariate regression within frameworks on VC

VC exhibits less significance in the economic shock framework compared to BO in the multivariate analysis as well. There are in the first regression no significant variables. There is significance in Gross Private Domestic Investment and Sales when coupled with other proxies within the same framework. The t-statistics for the two variable increased when all other proxies are excluded. The first regression with all capital supply proxies results in only the high yield index being significant. When the 3-month T-bill is dropped the prime rate becomes the most significant variable, with corporate debt almost becoming significant on the 10% level. The high-yield is still significant on the 5% level.

The Dispersion of Analyst Forecast and the VIX is significant for the information asymmetry regression. The VIX coefficient has a negative sign but is only significant with a lag of 3. The subsequent regression when the VIX is excluded the significance of Dispersion of Analyst Forecasts increases while trading volume remains non-significant. The initial market timing regression shows only IPO volume as being significant, however, when credit spread and Book to Market is excluded Price to earnings also becomes significant at the 5% level. Both the number of new firms and fund performance is significant in the multivariate analysis at the 1% level.

Table 11: Multivariate regressions on VC within frameworks (1)

Newey-West multivariate regressions presented vertically. The first regression features all proxies for each framework, the second regression drops variables not significant in the univariate regressions and drops proxies which are closely related. The t-statistic is indicated in parenthesis below the coefficient for each respective regression and proxy.

<i>Framework & Proxy</i>	<i>Lag</i>	<i>(1)</i>	<i>(2)</i>	<i>(3)</i>	<i>(4)</i>	<i>(5)</i>	<i>(6)</i>
<u><i>Economic shock</i></u>							
<i>Real GDP</i>	<i>0</i>	1.467 (1.368)	2.961 *** (2.866)				
<i>Business Confidence Index</i>	<i>0</i>	141.740 (0.916)					
<i>Industrial Production Index</i>	<i>0</i>	127.569 (1.677)					
<i>Operating income</i>	<i>0</i>	2.788 (1.449)	3.447 (1.651)				
<i>Gross profit</i>	<i>0</i>	0.342 (0.318)					
<i>Delinquency rate</i>	<i>0</i>	98.177 (0.254)	-138.067 (-0.452)				
<u><i>Capital Demand</i></u>							
<i>Gross Private Dom. Inv.</i>	<i>0</i>			102.670 * (1.876)	126.248 *** (3.252)		
<i>Sales</i>	<i>0</i>			1.187 ** (2.413)	1.207 ** (2.558)		
<i>Capital expenditure</i>	<i>0</i>			0.001 (0.651)			
<i>Total assets</i>	<i>0</i>			-0.027 (-0.282)			
<u><i>Capital Supply</i></u>							
<i>Prime rate</i>	<i>0</i>				-81.536 (-0.159)	471.294 ** (1.997)	
<i>3-month T-bill rate</i>	<i>0</i>				651.468 (0.949)		
<i>Corporate debt</i>	<i>1</i>				-1.603 (-1.231)	-1.8501 (-1.554)	
<i>High yield index</i>	<i>3</i>				31.923 ** (2.006)	29.322 ** (1.967)	
<i>No. Obs.</i>		106	106	92	92	103	103
<i>Adj. R-squared</i>		0.09	0.088	0.117	0.13	0.052	0.047
<i>F-statistic</i>		2.728 **	4.372 ***	4.014 ***	7.802 ***	2.396 *	2.659 *
<i>Intercept</i>		-188.240 (-1.191)	-325.094 ** (-2.303)	-84.690 (-0.862)	-90.472 (-0.816)	161.120 (1.144)	167.007 (1.165)

*p<0.1; **p<0.05; ***p<0.01

Table 12: Multivariate regressions on VC within frameworks (2)

Newey-West multivariate regressions presented vertically. The first regression features all proxies for each framework, the second regression drops variables not significant in the univariate regressions and drops proxies which are closely related. The t-statistic is indicated in parenthesis below the coefficient for each respective regression and proxy.

<i>Framework & Proxy</i>	<i>Lag</i>	(1)	(2)	(3)	(4)	(5)
<u><i>Information asymmetry</i></u>						
<i>Disp. of Analyst Forecast</i>	1	-25106 ** (-2.333)	-27729 ** (-2.454)			
<i>VIX</i>	3	36.020 ** (2.210)				
<i>Trading volume</i>	4	-4.022 (-0.986)	-4.194 (-1.057)			
<u><i>Market Timing</i></u>						
<i>Credit spread</i>	0			-40.773 (-0.903)		
<i>IPO volume</i>	0			5.512 ** (1.996)	6.636 ** (2.248)	
<i>Market to Book</i>	0			2807.96 (0.932)		
<i>Price to Earnings</i>	0			-8.413 (-1.484)	-11.645 ** (-2.225)	
<u><i>Agency conflict</i></u>						
<i>New firms</i>	0					21.186 *** (6.633)
<i>Fund performance</i>	1					34.078 *** (4.537)
<i>No. Obs.</i>		103	103	98	99	102
<i>Adj. R-squared</i>		0.056	0.015	0.04	0.035	0.4
<i>F-statistic</i>		2.998 **	1.769	2.015 *	2.752 *	34.677 ***
<i>Intercept</i>		67.533 (0.599)	67.101 (0.607)	86.401 (0.817)	90.390 (0.836)	55.962 (0.798)

*p<0.1; **p<0.05; ***p<0.01

5.1.6.4 Multivariate regression across frameworks on BO

The multivariate regression across theoretical frameworks for BO has sporadic significance for its proxies. The only two frameworks that continuously has significance is information asymmetry and agency conflict. Activity is indicated to be driven by the dispersion of analyst forecast together with the general economic outlook, i.e. GDP growth. The fund performance variable is the most significant two quarters lagged, indicating that information and calibration to information of high returns take half a year to be converted into increased activity. The measure for information asymmetry is also lagged by one. The economic shock variable is initially not significant but with the exclusion of capital expenditures it becomes significant on the 1% level. The frameworks of capital demand, capital supply and market timing show no significance in any of the regressions.

Table 13: Multivariate regressions on BO across frameworks

Newey-West multivariate regressions presented vertically. First regression features the most significant proxy from each framework, every subsequent regression drops the least significant variable. The t-statistic is indicated in parenthesis below the coefficient for each respective regression and proxy.

Framework & Proxy	Lag	(1)	(2)	(3)	(4)	(5)
<u>Economic shock</u>						
<i>Industrial Production Index</i>	0	342.72 * (1.707)	293.32 (1.554)	237.96 (1.160)	431.565 *** (3.262)	558.96 *** (4.226)
<u>Capital Demand</u>						
<i>Capital expenditures</i>	0	0.0112 (1.517)	0.0109 (1.479)	0.0083 (1.142)		
<u>Capital Supply</u>						
<i>Prime rate</i>	0	-422.73 (-1.099)				
<u>Information asymmetry</u>						
<i>Disp. of Analyst Forecast</i>	1	-85936 *** (-3.058)	-82815 *** (-3.014)	-74070 *** (-2.824)	-81302 *** (-3.053)	-46916 * (-1.761)
<u>Market Timing</u>						
<i>Price to Earnings</i>	0	45.462 (1.234)	44.236 (1.170)			
<u>Agency conflict</u>						
<i>Fund performance</i>	2	193.16 ** (2.077)	191.55 ** (2.096)	173.05 ** (1.953)	173.703 * (1.821)	
<i>No. Obs.</i>		99	99	99	99	106
<i>Adj. R-squared</i>		0.171	0.177	0.174	0.17	0.079
<i>F-statistic</i>		4.366 ***	5.215 ***	6.148 ***	7.713 ***	5.515 ***
<i>Intercept</i>		-215.8 (-0.910)	-160.28 (-0.681)	-94.181 (-0.393)	-42.559 (-0.185)	-107.58 (-0.469)

*p<0.1; **p<0.05; ***p<0.01

5.1.6.5 Multivariate regression across frameworks on VC

The multivariate regression across theoretical frameworks for VC is highly significant. Four out of the six tested theoretical frameworks garners a significant results, the two that does not are the Gross Private Domestic Investment and Dispersion of Analyst Forecast. VC firms increase activity in the face of increases to real GDP, prime rates, IPO volume and Fund performance. The two strongest proxies are Fund performance and Real GDP.

Table 14: Multivariate regressions on VC across frameworks

Newey-West multivariate regressions presented vertically. The first regression features the most significant proxy from each framework, each subsequent regression drops the least significant variable. The t-statistic is indicated in parenthesis below the coefficient for each respective regression and proxy.

Framework & Proxy	Lag	(1)	(2)	(3)	(4)	(5)
<u>Economic shock</u>						
<i>Real GDP</i>	0	2.887 (1.480)	3.585 *** (3.388)	3.602 *** (3.528)	3.898 *** (3.958)	4.412 *** (4.480)
<u>Capital Demand</u>						
<i>Gross Private Dom. Inv.</i>	3	21.175 (0.333)				
<u>Capital Supply</u>						
<i>Prime rate</i>	0	307.630 * (1.922)	318.350 ** (2.252)	328.781 ** (2.443)	287.221 ** (2.025)	
<u>Information asymmetry</u>						
<i>Disp. of Analyst Forecast</i>	1	-6348.0 (-0.694)	-4565.5 (-0.514)			
<u>Market Timing</u>						
<i>IPO volume</i>	0	5.062 * (1.827)	5.672 * (1.981)	5.726 * (1.983)		
<u>Agency conflict</u>						
<i>Fund performance</i>	1	35.630 *** (3.027)	35.078 *** (3.017)	35.484 *** (3.130)	35.877 *** (3.225)	35.969 *** (3.233)
<i>No. Obs.</i>		92	98	98	102	102
<i>Adj. R-squared</i>		0.215	0.225	0.233	0.199	0.195
<i>F-statistic</i>		5.154 ***	6.639 ***	8.367 ***	9.369 ***	13.258 ***
<i>Intercept</i>		- 267.242 (-1.460)	-317.085 ** (-2.385)	-317.651 ** (-2.408)	- 358.821 (-2.561)	- 439.590 (-3.137)

*p<0.1; **p<0.05; ***p<0.01

5.2 Components of activity

The regressions breaks down and describes what components drive private equity activity. The largest effect for both BO and VC is the average deal size. As activity increases the largest part in this is due to the fact that the size of deals increases. This is comparatively truer for BO than VC but it is undoubtedly the largest effect for both segments. Activity within BO is also comparatively more driven by activity of already established firms. The number of firms active each quarter for the BO sample is the second biggest contributor. When it comes to new entrants and number of deals per active firm VC takes the upper hand. VC investment are smaller in size and scope which possibly contributes to the identified effect of a comparatively large contribution to activity by new entrants. This possibly also affects the capability and willingness of VC firms to accelerate their deal making more than BO firms.

The total variance of deal value in the BO segment is larger meaning that the comparative analysis is somewhat lacking. Scaled in accordance with the standard deviation of total round amount per segment the story is somewhat different. The standard deviation of BO is twice as large, which means that in dollar amounts the component size of deals has more than twice as large an effect in driving activity in BO compared to VC. The activity of already established firms participating more often drives 50% more activity in BO, the increase in number of deals for BO results in slightly larger fluctuations in activity, and new entrants have approximately the same effect in dollar amounts.

Table 15: Univariate first differenced OLS on components of activity

This table contains a univariate first differenced OLS regression on the components of activity. An increase in activity is captured exhaustively by one of the below components. The components are (1) changes to the average deal size, (2) entry into the market by new firms, (3) changes to the number of already established firms making deals each quarter - inactive firms becoming active, and (4) change to the average number of deals made by firms per quarter. The regression is made once for both BO and VC variables. New entrants are defined as firms with zero or one year of experience.

Univariate					
Component	Intercept	Coefficient		T-statistic	R ²
BO					
(1) <i>dealsize</i>	-32,099	0,16823 ***		15,78	0,7034
(2) <i>activenew</i>	67,61	172,27 ***		5,235	0,207
(3) <i>activeold</i>	0,2074	68,9704 ***		3,932	0,1284
(4) <i>nodeals</i>	114	156,2		0,254	0
VC					
(1) <i>dealsize</i>	-39,748	1,3955 ***		11,541	0,5592
(2) <i>activenew</i>	33,932	24,575 ***		6,702	0,2996
(3) <i>activeold</i>	38,025	10,709 ***		4,906	0,1865
(4) <i>nodeals</i>	64,64	1332,06 ***		5,559	0,2274
*p<0,1; **p<0,05; ***p<0,01					

Table 16: Multivariate first differenced OLS on components of activity

This table contains a multivariate first differenced OLS regression on the components of activity. An increase in activity is captured exhaustively by one of the below components. The components are (1) changes to the average deal size, (2) entry into the market by new firms, (3) changes to the number of already established firms making deals each quarter, inactive firms becoming active, and (4) change to the average number of deals made by firms per quarter. The regression is made once for both BO and VC. New entrants are defined as firms with zero and one years of experience. The standard deviation of components (*Component StdDev*) is taken from descriptive statistics to create a measure of a coefficient's magnitude presented in *Coeff x StdDev*.

Multivariate					
Component	Coefficient		T-statistic	Component StdDev	Coeff x StdDev
BO					
(1) <i>dealsize</i>	0.16403 ***		21.056	39543.97	6486.40
(2) <i>activenew</i>	55.859 ***		3.785	17.05	952.15
(3) <i>activeold</i>	58.6188 ***		8.199	62.21	3646.65
(4) <i>nodeals</i>	1012.17 ***		4.328	0.60	606.01
<i>No. Obs.</i>	108				
<i>Adj. R-squared</i>	0.86				
<i>F-statistic</i>	164.80 ***				
<i>Intercept</i>	-142.29		-1.281		
Component	Coefficient		T-statistic	Component SD	Coeff x SD
VC					
(1) <i>dealsize</i>	1.00009 ***		12.537	2554.1215	2554.35
(2) <i>activenew</i>	13.3652 ***		6.963	61.301043	819.30
(3) <i>activeold</i>	7.4952 ***		7.425	149.4271	1119.99
(4) <i>nodeals</i>	873.433 ***		7.602	0.4739123	413.93
<i>No. Obs.</i>	108				
<i>Adj. R-squared</i>	0.8372				
<i>F-statistic</i>	137.3 ***				
<i>Intercept</i>	-38.556		-0.902		

*p<0,1; **p<0,05; ***p<0,01

6 Conclusions

6.1 Summary of Results

The private equity industry has gone through several booms and bust with considerable volatility, but with a long-term growth trajectory. Prevailing theories in finance can be brought to bear in explaining these fluctuations and describe what drives the activity in the industry.

The results indicate that a host of variables affect the level of activity in BO and VC, each supported by its own theoretical framework. The most significant such theoretical frameworks is shown to consistently be the neoclassical framework, and foremost the economic shock variables. BO exhibited stronger relationships to the framework than VC, probably due to the fact that many of the measures for economic shock are aggregates and mirror effects experienced by large firms. Capital demand had the hypothesized effect but was not able to be completely disentangled from economic shock, and therefore only lends strength to the overarching framework of neoclassical drivers. Capital supply had inconclusive results with three out of four coefficients exhibiting opposite signs from those hypothesized. The framework was stronger in VC in the multivariate regressions while the framework was on approximately the same footing in the univariate regressions.

Other variables affecting the overall activity were return on previous funds, lagged by one or two quarters. Private equity firms are shown to avoid deal-making in volatile markets, showing that they are affected by the information asymmetry negatively to a large extent. The hypotheses that private equity firms could leverage their resources and experience and become a preferred investment vehicle in such periods is disproved. The effect could still exist to a lesser extent in which private equity activity decreases less than comparable investment vehicles that do not have private equities small edge.

VC firms are largely unaffected by market timing considerations, with small significance found in the price earnings ratio. However, BO is able to time the market with regard to the Price to earnings ratio, while also increasing activity during boom times. This is a seemingly counter-intuitive but interesting result, taken together in a multivariate regression both are significant, economic shock more so than market timing. Some evidence is found that BO firms are both able to increase activity in periods of high economic outlook, all the while increasing activity in the face of favorable valuations. However, the proxy was not significant in the multivariate analysis, casting doubt on the ability to draw far-reaching conclusions.

The components of changes to activity are primarily the average deal size and the number of already established firms making deals. The strength of these two variables are also comparatively stronger for BO compared to VC where deal sizes and the number of active established firms fluctuate more. The components which instead have a slightly larger relative share in explaining the change for VC aggregate activity is new entrants and the number of deals made by VC firms per quarter. There is greater aggregate variance in the BO industry due to the industry being bigger, all the components making up the change in activity are therefore stronger than VC when compared dollar to dollar, e.g. increased deal sizes as a driver of activity in BO leads to twice as large an increase in the dollar amounts invested compared to VC, and the new entrants into BO make as big investments as their VC counterparts but are not as important for the totality of the fluctuation in BO activity.

6.2 Discussion and limitations

The strongest proxies for economic shock within BO were operating income and industrial production index, it would seem that the effect is therefore not only related to profitability of firms but also to their general outlook and growth of the economy at large. This is reasonable as BO are active in larger swaths of the economy, more affected by the general economic outlook compared to VC. This is especially true of operating income proxy which is closely related to the viability of BO investments, but less to VC as they are focused on building market share and building market recognition etc. The strongest proxy within the VC framework is instead GDP possibly indicating the relationship between the general economy's growth and the health of the smaller companies in the economy, while the other variables are all more closely related to larger firms. Delinquency rates is the only variable which is significant for VC and never in BO. The riskiness of VC investments is larger - investing in smaller firms with unproven concepts without the resources and platforms of BO targets. Risk of default is therefore a much more important measure for the segment compared to BO where the focus is the possibility of increasing effectiveness and efficiency resulting in higher gross profit and operating income.

The proposed theory and hypothesis of capital supply is that private equity firms are more inclined to invest when they have cheap and abundant access to capital with which to finance deals. The results contradicted this hypothesis as both the prime rate, 3 month T-bill and corporate debt had opposite signs to their coefficients, compared with what was expected. The effect is likely the result of considerations in the target firms rather than in the private equity firm. Possibly, when credit is restricted, target firms are unable to access capital which is then instead

supplied by private equity firms. It is possible that three surprising results are more closely connected to target firms. High yield bonds are not uncommon in the financing scheme of private equity firms, that this proxy should be in line with the proposed hypothesis while the other were not is understandable.

Current shareholders and management have their own considerations and are also affected by macroeconomic changes. The activity of private equity firms cannot be explained conclusively and exhaustively by how the environment affects them and their appetites, the considerations in target firms have to be examined in tandem to reach a more exhaustive model of activity in the private equity industry. Within the framework we are therefore unable to pinpoint a capital supply mechanism driving activity.

The results from capital demand were somewhat inconclusive. If there is capital demand then we would be able to identify that spending increases after high levels of deal activity. The need for increased capital expenditures and investments would have been present before the surge in activity but was not acted upon due to a lack of capital. The private equity firms would thereby have aided firms in supplying capital to make necessary and profitable investments. However, the proxy utilized is the s&p500, which is necessarily unaffected by transaction taking place in other firms. Had data been available documenting the changed capital expenditures and sales following an activity wave in the acquired companies we could conclude that the firms demanded additional capital to make investments, and indeed had capital demand which drove activity. However, due to lacking data availability, and non-transparent private equity owned companies we are unable to measure this effect. Instead we find correlations between proxies with no lag or lead pointing to either the presence of positive NPV investments for target firms or capital demand from target firms. The results from capital demand is thereby rendered inconclusive, but adds weight to the overarching theoretical framework of fundamental economic drivers, i.e. the neoclassical theory, of activity.

The proxies for investments were stronger for VC, both Gross Domestic Private Investments and Capital expenditure. This is probably due to the more aggressive strategy adopted by these firms in pursuing growth. To achieve high return in the VC industry considerable investments might have to be undertaken. In an environment where this is prevalent VC firms are likely to thrive, while BO is more concerned with the overall health of markets, i.e. sales and total assets of firms.

We found no supporting evidence for the information asymmetry hypothesis that private equity firms increase activity in the face of information asymmetry. The hypothesis is grounded in the on the proposition that private equity firms can succeed in the market due to being private

equity firms, with experience, resources and arduous and becoming a preferred investment vehicle in volatile markets. The effect might still exist, but be drowned out by the decrease in an activity pursuant to uncertainty in recession and volatile markets. A closer comparative analysis of the private equity industry contrasted with other investment vehicles has to be conducted to conclusively verify or disprove the hypothesis.

The findings in with regard to market timing are interesting when coupled with the findings of economic shock. Activity changes together with the general business cycle, but private equity firms simultaneously increase activity when valuations are favorable, which should be during a market downturn, a result that on face value seems counter-intuitive. The Book to market metric supported the interpretation, though it was shy of significant on the 10% level. The metric also has innate problems of being more easily manipulated by accounting standards and subjective accounting decisions. Without the same accounting judgement the book to market ratio can be unreliable.

Interpretations of the findings in credit spread are problematic. The coefficient points in the same direction as the proxies for information asymmetry – decreased uncertainty leads to activity. However, corporate debt issuance, a central aspect of the credit spread market timing theory is negative, generating confounding results as corporate debt is identified in the previous literature to increase in the face of decreases to the credit spread. The interplay between the considerations in the target firms and the private equity firms could be relevant and shine through here as well.

The new firms proxy was stronger for VC than BO. This is possibly due to the scope and size of deals. BO firms typically make larger investments into more mature firms, this necessitates more resources and new firms are therefore not as strong a driver of activity. New firms as components of the increased activity was also found to be larger for VC compared to BO in the associated regressions on component activity.

The mechanism for the proxy Fund performance is not determined. When LPs identify high returns they supply more capital in the subsequent quarters enabling private equity firms to accelerate deal activity, and sub-par returns leads to a drying up of capital, decreasing deal activity. This is in line with the proposed theory of agency conflict, but the underlying mechanism we are unable to determine due to the research design and scope. It could also be a case of GP hubris or be due to increased availability of profitable investment targets following periods of high return capturing aspects of economic shock.

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Appendices

I. Tables

Table 17: Dickey-Fuller test for unit roots (1)

This table presents the results of a Dickey-Fuller test on unadjusted variables. Panel A shows the t-statistics and number of observations for independent variables, Panel B shows the corresponding values for dependent variables. For a Dickey-Fuller test on first differenced variables, refer to Table 18.

Panel A: Independent variables		
Proxy	t-statistic	No. Obs.
<i>Economic shock</i>		
<i>Real GDP</i>	5.0102	108
<i>Business Confidence Index</i>	-0.0162	108
<i>Industrial Production Index</i>	0.8896	108
<i>Operating income</i>	0.6438	107
<i>Gross profit</i>	1.5867	107
<i>Delinquency rate</i>	-1.9606 **	108
<u><i>Capital Demand</i></u>		
<i>Gross Private Domestic Investment</i>	0.9021	94
<i>Sales</i>	1.5547	107
<i>Capital expenditure</i>	1.4559	108
<i>Total assets</i>	2.6131	107
<u><i>Capital Supply</i></u>		
<i>Prime rate</i>	-1.4341	108
<i>3-month T-bill rate</i>	-2.2336 **	108
<i>Corporate debt</i>	5.8774	108
<i>High yield index</i>	-0.2017	103
<u><i>Information asymmetry</i></u>		
<i>Dispersion of Analyst Forecast</i>	-1.6367 *	107
<i>VIX</i>	-1.1854	108
<i>Trading volume</i>	-1.2822	108
<u><i>Market Timing</i></u>		
<i>Credit spread</i>	-1.6175	108
<i>IPO volume</i>	-1.0626	100
<i>Book to market</i>	-0.1996	107
<i>Price to Earnings</i>	-2.731 ***	108
<u><i>Agency conflict</i></u>		
<i>New firms</i>	-0.5757	108
<i>BO Fund performance</i>	-3.3544 ***	100
<i>VC Fund performance</i>	-3.3678 ***	103
Panel B: Dependent variables		
Variable	t-statistic	No. Obs.
<i>BO-activity</i>	-0.8539	108
<i>VC-activity</i>	-0.6308	108

*p<0.1; **p<0.05; ***p<0.01

Table 18: Dickey-Fuller test for unit roots (2)

This table presents the results from the Dickey-Fuller test for unit roots on differenced variables. Panel A shows the t-statistic and number of observations for independent variables and Panel B shows the corresponding values for dependent variables. For the variables which have ≤ 100 observations, the t-statistic must be < -2.6 for the hypothesis to be rejected at the 1% level. For the variables with > 100 observations, the t-statistic has to be < -2.58 for the hypothesis to be rejected at the 1% level.

Panel A: Independent variables			
Proxy	t-statistic		No. Obs.
<u>Economic shock</u>			
<i>Real GDP</i>	-1.9315	*	107
<i>Business Confidence Index</i>	-7.9762	***	107
<i>Industrial Production Index</i>	-4.4593	***	107
<i>Operating income</i>	-7.739	***	106
<i>Gross profit</i>	-7.7314	***	106
<i>Delinquency rate</i>	-2.934	***	107
<u>Capital Demand</u>			
<i>Gross Private Domestic Investment</i>	-2.9713	***	93
<i>Sales</i>	-6.1317	***	107
<i>Capital expenditure</i>	-5.3437	***	107
<i>Total assets</i>	-3.9387	***	106
<u>Capital Supply</u>			
<i>Prime rate</i>	-3.7539	***	107
<i>3-month T-bill rate</i>	-4.0425	***	107
<i>Corporate debt</i>	-3.7153	***	107
<i>High yield index</i>	-6.9272	***	102
<u>Information asymmetry</u>			
<i>Dispersion of Analyst Forecast</i>	-10.2254	***	107
<i>VIX</i>	10.4665	***	107
<i>Trading volume</i>	-7.1583	***	107
<u>Market Timing</u>			
<i>Credit spread</i>	-9.6454	***	107
<i>IPO volume</i>	-7.0627	***	99
<i>Book to market</i>	-6.8699	***	106
<i>Price to Earnings</i>	-11.1968	***	107
<u>Agency conflict</u>			
<i>New firms</i>	-6.821	***	107
<i>BO Fund performance</i>	-9.7246	***	99
<i>VC Fund performance</i>	-8.8729	***	99
Panel B: Dependent variables			
Variable	t-statistic		No. Obs.
<i>BO-activity</i>	-6.5966	***	107
<i>VC-activity</i>	-4.5151	***	107

*p<0.1; **p<0.05; ***p<0.01

Table 19: Descriptive Statistics for regression variables

This table presents descriptive statistics for all variables included in the regressions for drivers of activity. The first two rows show descriptive statistics for dependent variables. Subsequent rows show descriptive statistics for each independent variable grouped by their corresponding theoretical framework. Dependent variables are winsorized by year at the 5% level. Both independent and dependent variables are transformed from original data to absolute first difference series.

	N	min	max	median	std. dev	skewness	kurtosis
BO deal value	107	-9456.05	10461.37	57.58	3057.07	0.25	2.14
VC deal value	107	-4881.92	4144.66	23.33	1086.23	0.03	5.32
<i>Real GDP</i>	107	-293.1	283.8	121.40	82.17	-1.41	5.62
<i>Business Confidence Index</i>	107	-2.15	1.92	-0.05	0.65	0.12	0.78
<i>Industrial Production Index</i>	107	-8.99	3.02	0.55	1.54	-2.73	12.76
<i>Operating income</i>	106	-342.89	159.15	7.05	52.17	-2.72	17.79
<i>Gross profit</i>	106	-355.1	302.99	21.97	73.08	-0.71	7.62
<i>Delinquency rate</i>	107	-0.56	0.81	-0.04	0.25	0.88	1.95
<i>Gross Private Domestic Investment</i>	93	-8.61	4.31	0.84	2.13	-1.66	4.78
<i>Sales</i>	106	-815.76	868.48	69.12	219.01	-0.08	4.41
<i>Capital expenditure</i>	107	-236394	149413	13688.00	55521.30	-0.87	3.24
<i>Total assets</i>	106	-4877.81	4993.06	529.72	1093.38	-0.81	8.75
<i>Prime rate</i>	107	-1.74	0.8	0.00	0.43	-1.40	3.27
<i>3-month T-bill rate</i>	107	-1.46	0.76	-0.01	0.43	-1.15	1.67
<i>Corporate debt</i>	107	-243	288	40.00	77.96	-0.16	2.46
<i>High yield index</i>	103	-21.77	13.68	0.60	4.74	-0.95	4.81
<i>Dispersion of Analyst Forecast</i>	106	-0.02	0.02	0.00	0.01	0.61	7.16
<i>VIX</i>	107	-19.56	26.44	-0.26	6.71	0.67	3.22
<i>Trading volume</i>	107	-96.06	137.35	-0.83	29.38	0.80	6.38
<i>Credit spread</i>	107	-13.08	11.12	-0.29	2.96	-0.29	5.90
<i>IPO volume</i>	99	-111	85	4.00	34.78	-0.32	0.67
<i>Book to market</i>	106	-0.11	0.11	0.00	0.04	-0.09	0.77
<i>Price to Earnings</i>	107	-59.75	48.94	0.28	9.30	-0.36	25.09
<i>New firms</i>	107	-142	86	4.00	28.76	-1.35	5.85
<i>BO fund performance</i>	99	-15.99	14.44	0.08	5.61	0.1	0.66
<i>VC fund performance</i>	102	-54.62	55.07	1.13	10.32	-0.27	14.17

Table 20: Ordinary least squares on BO with first differences

Framework & Proxy	Intercept	Coefficient	t-statistic	R-squared
Economic shock				
<i>Real GDP</i>	-1305.52 **	11.718 ***	3.4	0.099
<i>Business Confidence Index</i>	102.821	1 436.90 ***	3.27	0.092
<i>Industrial Production Index</i>	-123.237	592.739 ***	3.216	0.09
<i>Operating income</i>	11.674	24.359 ***	4.635	0.171
<i>Gross profit</i>	-72.261	10.718 ***	2.69	0.065
<i>Delinquency rate</i>	26.704	-2 618.07 **	-2.215	0.045
Capital Demand				
<i>Gross Private Domestic Investment</i>	-92.37	344.856 **	2.363	0.058
<i>Sales</i>	-93.072	4.333 ***	3.313	0.095
<i>Capital expenditure</i>	-83.03	0.015 ***	2.905	0.074
<i>Total assets</i>	-302.621	0.814 ***	3.087	0.084
Capital Supply				
<i>Prime rate</i>	173.906	964.906	1.397	0.018
<i>3-month T-bill rate</i>	215.722	1 484.58 **	2.195	0.044
<i>Corporate debt</i>	149.559	-0.825	-0.216	0.0004
<i>High yield index</i>	114.935	153.517 **	2.456	0.056
Information asymmetry				
<i>Dispersion of Analyst Forecast</i>	135.418	-71 156.01	-0.584	0.003
<i>VIX</i>	115.687	25.938	0.584	0.003
<i>Trading volume</i>	124.616	-14.249	-1.417	0.019
Market Timing				
<i>Credit spread</i>	104.387	-214.244 **	-2.176	0.043
<i>IPO volume</i>	211.322	11.322	1.295	0.017
<i>Book to market</i>	117.769	2269.583	0.278	0.001
<i>Price to Earnings</i>	118.765	-56.621 *	-1.792	0.03
Agency conflict				
<i>New firms</i>	67.384	33.691 ***	3.424	0.1
<i>Fund performance</i>	214.723	75.24	0.479	0.022

*p<0.1; **p<0.05; ***p<0.01

Table 21: Ordinary least squares on VC with first differences

Framework & Proxy	Intercept	Coefficient	t-statistic	R-squared
<u>Economic shock</u>				
<i>Real GDP</i>	-416.804 ***	3.938 ***	3.198	0.089
<i>Business Confidence Index</i>	57.377	371.489 **	2.324	0.049
<i>Industrial Production Index</i>	-26.567	216.874 ***	3.321	0.095
<i>Operating income</i>	28.960	5.289 ***	2.665	0.064
<i>Gross profit</i>	7.908	2.900 **	2.019	0.038
<i>Delinquency rate</i>	34.602	-769.385 *	-1.818	0.031
<u>Capital Demand</u>				
<i>Gross Private Domestic Investment</i>	-41.663	152.997 ***	3.004	0.090
<i>Sales</i>	-13.921	1.503 ***	3.226	0.091
<i>Capital expenditure</i>	-15.589	0.006 ***	3.168	0.087
<i>Total assets</i>	-23.211	0.160	1.656	0.026
<u>Capital Supply</u>				
<i>Prime rate</i>	90.730	491.881 **	2.025	0.038
<i>3-month T-bill rate</i>	99.672	575.657 **	2.406	0.052
<i>Corporate debt</i>	10.984	1.155	0.853	0.007
<i>High yield index</i>	60.700	29.005	1.259	0.015
<u>Information asymmetry</u>				
<i>Dispersion of Analyst Forecast</i>	70.102	6.934.141	0.349	0.001
<i>VIX</i>	59.801	-10.205	-0.647	0.004
<i>Trading volume</i>	58.607	2.399	0.667	0.004
<u>Market Timing</u>				
<i>Credit spread</i>	57.270	-66.445	-1.890	0.033
<i>IPO volume</i>	90.031	6.524 **	2.101	0.044
<i>Book to market</i>	56.587	4.599.756	1.607	0.024
<i>Price to Earnings</i>	61.172	-10.498	-0.925	0.008
<u>Agency conflict</u>				
<i>New firms</i>	30.937	21.118 ***	6.910	0.313
<i>Fund performance</i>	95.864	3.413	0.322	0.001

*p<0.1; **p<0.05; ***p<0.01

Table 22: Ordinary least squares on BO with lagged first differences

Framework & Proxy	Lag	Intercept	Coefficient	t-statistic	R-squared
<u>Economic shock</u>					
<i>Real GDP</i>	0	-1.305.524 *	11.718 ***	3.400	0.099
<i>Business Confidence Index</i>	0	102.821	1.436.902 ***	3.270	0.092
<i>Industrial Production Index</i>	0	-123.237	592.739 ***	3.216	0.090
<i>Operating income</i>	0	-22.494	24.359 ***	4.635	0.171
<i>Gross profit</i>	0	-72.261	10.718 ***	2.690	0.065
<i>Delinquency rate</i>	0	26.704	-2.618.065 **	-2.215	0.045
<u>Capital Demand</u>					
<i>Gross Private Domestic Investment</i>	0	-92.370	344.856 **	2.363	0.058
<i>Sales</i>	0	-93.072	4.333 ***	3.313	0.095
<i>Capital expenditure</i>	0	-83.030	0.015 ***	2.905	0.074
<i>Total assets</i>	0	-302.621	0.814 ***	3.087	0.084
<u>Capital Supply</u>					
<i>Prime rate</i>	0	173.906	964.906	1.397	0.018
<i>3-month T-bill rate</i>	0	215.722	1.484.577 **	2.195	0.044
<i>Corporate debt</i>	3	462.831	-9.090 **	-2.179	0.044
<i>High yield index</i>	0	114.935	153.517 **	2.456	0.056
<u>Information asymmetry</u>					
<i>Dispersion of Analyst Forecast</i>	1	107.191	-83.408.570	-1.501	0.021
<i>VIX</i>	2	108.036	-96.299 **	-2.195	0.045
<i>Trading volume</i>	4	135.822	-21.071 *	-1.982	0.037
<u>Market Timing</u>					
<i>Credit spread</i>	0	104.387	-214.244 **	-2.176	0.043
<i>IPO volume</i>	2	133.864	16.551 *	1.847	0.034
<i>Book to market</i>	1	105.511	12.843.700	1.585	0.024
<i>Price to Earnings</i>	0	118.760	-56.620 *	-1.792	0.030
<u>Agency conflict</u>					
<i>New firms</i>	0	67.384	33.691 ***	3.424	0.100
<i>Fund performance</i>	2	138.570	187.484 ***	3.523	0.113

*p<0.1; **p<0.05; ***p<0.01

Table 23: Ordinary least squares on VC with lagged first differences

Framework & Proxy	Lag	Intercept	Coefficient	t-statistic	R-squared
<u>Economic shock</u>					
<i>Real GDP</i>	0	-416.804 *	3.938 ***	3.198	0.089
<i>Business Confidence Index</i>	0	57.377	371.489 **	2.324	0.049
<i>Industrial Production Index</i>	0	-26.567	216.874 ***	3.321	0.095
<i>Operating income</i>	0	28.960	5.289 ***	2.665	0.064
<i>Gross profit</i>	0	7.908	2.900 **	2.019	0.038
<i>Delinquency rate</i>	0	34.602	-769.385 *	-1.818	0.031
<u>Capital Demand</u>					
<i>Gross Private Domestic Investment</i>	0	-41.663	152.997 ***	3.004	0.090
<i>Sales</i>	0	-13.921	1.503 ***	3.226	0.091
<i>Capital expenditure</i>	0	-15.589	0.006 ***	3.168	0.087
<i>Total assets</i>	0	-23.211	0.160	1.656	0.026
<u>Capital Supply</u>					
<i>Prime rate</i>	0	90.730	491.881 **	2.025	0.038
<i>3-month T-bill rate</i>	0	99.672	575.657 **	2.406	0.052
<i>Corporate debt</i>	1	161.403	-2.451 *	-1.796	0.030
<i>High yield index</i>	3	60.700	29.005	1.259	0.015
<u>Information asymmetry</u>					
<i>Dispersion of Analyst Forecast</i>	1	55.615	-	-1.439	0.020
<i>VIX</i>	3	64.654	37.695 **	2.417	0.054
<i>Trading volume</i>	4	67.914	-5.079	-1.329	0.017
<u>Market Timing</u>					
<i>Credit spread</i>	0	57.270	-66.445 *	-1.890	0.033
<i>IPO volume</i>	0	90.031	6.524 **	2.101	0.044
<i>Book to market</i>	0	56.587	4.599.756	1.607	0.024
<i>Price to Earnings</i>	0	61.172	-10.498	-0.925	0.008
<u>Agency conflict</u>					
<i>New firms</i>	0	30.937	21.118 ***	6.910	0.313
<i>Fund performance</i>	1	90.230	33.635 ***	3.339	0.100

*p<0.1; **p<0.05; ***p<0.01

Table 24: Breusch-Godfrey test for serial correlation in error terms

This table presents values from a Breusch-Godfrey test for serial correlation in error terms. The test is run for each univariate regression and χ^2 – value is printed in the table below. The null hypothesis is that there is no serial correlation in error terms. For all univariate regressions tested the null hypothesis has to be rejected, at least at the 10% confidence level.

Framework & Proxy	No. Obs.	χ^2			
		BO		VC	
<u>Economic shock</u>					
Real GDP	104	17.73	***	23.06	***
Business Confidence Index	104	14.53	**	28.91	***
Industrial Production Index	104	18.88	***	24.42	***
Operating income	103	24.47	***	29.46	***
Gross profit	103	17.59	***	26.69	***
Delinquency rate	104	16.35	***	26.73	***
<u>Capital Demand</u>					
Gross Private Domestic Investment	90	12.61	**	20.50	***
Sales	103	11.28	**	18.42	***
Capital expenditure	104	17.47	***	20.52	***
Total assets	103	17.01	***	27.74	***
<u>Capital Supply</u>					
Prime rate	104	15.65	***	24.31	***
3-month T-bill rate	104	16.87	***	26.44	***
Corporate debt	104	10.50	*	25.89	***
High yield index	99	14.16	**	25.94	***
<u>Information asymmetry</u>					
Dispersion of Analyst Forecast	103	12.39	**	26.18	***
VIX	104	16.03	***	27.83	***
Trading volume	104	15.14	***	28.08	***
<u>Market Timing</u>					
Credit spread	104	11.87	***	28.36	***
IPO volume	96	11.27	**	21.22	***
Book to market	103	14.18	**	26.40	***
Price to Earnings	104	13.47	**	27.94	***
<u>Agency conflict</u>					
New firms	104	10.53	*	13.48	**
BO Fund performance	96	11.57	**		
VC Fund performance	99			38.51	***
		*p<0.1; **p<0.05; ***p<0.01			

*p<0.1; **p<0.05; ***p<0.01

Table 25: Aggregate number of unique BO deals per target industry

Year	-90	-91	-92	-93	-94	-95	-96	-97	-98	-99	-00	-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11	'-12	-13	-14	-15	-16	Grand Total
NA	17	43	25	33	26	46	44	42	32	18	11	3	1	0	0	1	0	0	1	0	0	0	0	1	1	0	0	345
Agr/Forestr/Fish	1	0	1	1	0	3	3	2	14	0	8	3	6	7	8	6	6	15	13	8	24	9	23	17	20	24	22	244
Biotechnology	1	2	5	3	2	4	13	27	23	11	23	24	5	9	13	28	20	22	33	20	39	21	45	20	36	28	28	505
Business Serv.	22	16	22	14	11	28	32	29	40	75	127	95	44	65	79	93	96	149	143	55	90	98	105	89	116	134	116	1983
Communications	20	22	40	51	53	67	105	93	115	117	232	150	56	79	71	72	55	81	78	43	61	48	37	46	35	33	27	1887
Computer Hardware	4	5	0	4	4	14	19	17	26	17	39	24	19	21	10	16	14	25	19	17	26	22	29	19	23	27	14	474
Computer Other	0	0	0	0	0	0	1	0	0	1	1	1	0	0	1	2	1	1	2	3	0	0	0	0	0	0	0	14
Computer Software	3	6	13	15	24	40	96	96	87	138	218	135	81	85	82	110	140	159	155	106	151	189	189	206	285	318	256	3383
Construction	7	2	0	2	14	10	14	17	15	7	30	17	14	15	25	40	35	51	48	16	33	25	32	19	37	29	47	601
Consumer Related	47	36	44	57	78	93	164	150	204	156	213	200	119	126	182	178	192	251	215	116	178	173	199	189	213	218	232	4223
Financial Services	17	88	58	71	53	62	99	70	86	85	153	185	54	72	79	108	123	160	181	78	152	168	181	177	185	212	136	3093
Industrial/Energy	24	17	21	26	47	65	108	82	110	121	152	125	87	145	149	179	254	271	267	157	198	226	290	226	283	252	214	4096
Internet Specific	1	0	2	1	5	17	42	32	61	160	357	176	65	49	63	62	73	82	96	59	98	115	128	101	139	155	93	2232
Manufact.	15	19	19	20	21	22	47	45	67	60	63	58	36	36	45	50	83	73	53	30	45	38	39	49	42	35	42	1152
Medical/Health	9	6	12	16	26	25	94	83	86	60	69	80	58	61	54	101	88	141	142	74	134	131	130	115	100	114	141	2150
Other	7	11	11	12	8	16	33	32	77	94	94	123	34	38	47	74	51	61	46	40	46	30	32	21	30	13	18	1099
Semiconductor/Electr	11	2	3	5	12	14	33	35	29	40	49	61	37	30	27	38	36	56	42	22	45	41	37	23	28	29	28	813
Transportation	8	7	9	13	14	18	37	48	48	36	76	46	41	55	67	92	67	105	62	41	59	63	85	56	58	65	48	1324
Utilities	1	1	0	3	3	4	1	4	3	6	7	9	2	17	10	11	14	16	15	8	16	20	15	16	4	10	15	231
Grand Total	215	283	285	347	401	548	985	904	1123	1202	1922	1515	759	910	1012	1261	1348	1719	1611	893	1395	1417	1596	1390	1635	1696	1477	29849

Table 26: Share of unique BO deals per target industry

Total number of unique deals per year as denominator. Vertical differences. Industry differences in a given year. Accentuated with color scheme. All numbers are quoted as percentages.

Year	-90	-91	-92	-93	-94	-95	-96	-97	-98	-99	-00	-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11	'-12	-13	-14	-15	-16	Total
NA	7.9	15.2	8.8	9.5	6.5	8.4	4.5	4.6	2.8	1.5	0.6	0.2	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	1.2	
Agr/Forestr/Fish	0.5	0.0	0.4	0.3	0.0	0.5	0.3	0.2	1.2	0.0	0.4	0.2	0.8	0.8	0.8	0.5	0.4	0.9	0.8	0.9	1.7	0.6	1.4	1.2	1.2	1.4	1.5	0.8
Biotechnology	0.5	0.7	1.8	0.9	0.5	0.7	1.3	3.0	2.0	0.9	1.2	1.6	0.7	1.0	1.3	2.2	1.5	1.3	2.0	2.2	2.8	1.5	2.8	1.4	2.2	1.7	1.9	1.7
Business Serv.	10.2	5.7	7.7	4.0	2.7	5.1	3.2	3.2	3.6	6.2	6.6	6.3	5.8	7.1	7.8	7.4	7.1	8.7	8.9	6.2	6.5	6.9	6.6	6.4	7.1	7.9	7.9	6.6
Communications	9.3	7.8	14.0	14.7	13.2	12.2	10.7	10.3	10.2	9.7	12.1	9.9	7.4	8.7	7.0	5.7	4.1	4.7	4.8	4.8	4.4	3.4	2.3	3.3	2.1	1.9	1.8	6.3
Computer Hardware	1.9	1.8	0.0	1.2	1.0	2.6	1.9	1.9	2.3	1.4	2.0	1.6	2.5	2.3	1.0	1.3	1.0	1.5	1.2	1.9	1.9	1.6	1.8	1.4	1.4	1.6	0.9	1.6
Computer Other	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.2	0.1	0.1	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Computer Software	1.4	2.1	4.6	4.3	6.0	7.3	9.7	10.6	7.7	11.5	11.3	8.9	10.7	9.3	8.1	8.7	10.4	9.2	9.6	11.9	10.8	13.3	11.8	14.8	17.4	18.8	17.3	11.3
Construction	3.3	0.7	0.0	0.6	3.5	1.8	1.4	1.9	1.3	0.6	1.6	1.1	1.8	1.6	2.5	3.2	2.6	3.0	3.0	1.8	2.4	1.8	2.0	1.4	2.3	1.7	3.2	2.0
Consumer Related	21.9	12.7	15.4	16.4	19.5	17.0	16.6	16.6	18.2	13.0	11.1	13.2	15.7	13.8	18.0	14.1	14.2	14.6	13.3	13.0	12.8	12.2	12.5	13.6	13.0	12.9	15.7	14.1
Financial Services	7.9	31.1	20.4	20.5	13.2	11.3	10.1	7.7	7.7	7.1	8.0	12.2	7.1	7.9	7.8	8.6	9.1	9.3	11.2	8.7	10.9	11.9	11.3	12.7	11.3	12.5	9.2	10.4
Industrial/Energy	11.2	6.0	7.4	7.5	11.7	11.9	11.0	9.1	9.8	10.1	7.9	8.3	11.5	15.9	14.7	14.2	18.8	15.8	16.6	17.6	14.2	15.9	18.2	16.3	17.3	14.9	14.5	13.7
Internet Specific	0.5	0.0	0.7	0.3	1.2	3.1	4.3	3.5	5.4	13.3	18.6	11.6	8.6	5.4	6.2	4.9	5.4	4.8	6.0	6.6	7.0	8.1	8.0	7.3	8.5	9.1	6.3	7.5
Manufact.	7.0	6.7	6.7	5.8	5.2	4.0	4.8	5.0	6.0	5.0	3.3	3.8	4.7	4.0	4.4	4.0	6.2	4.2	3.3	3.4	3.2	2.7	2.4	3.5	2.6	2.1	2.8	3.9
Medical/Health	4.2	2.1	4.2	4.6	6.5	4.6	9.5	9.2	7.7	5.0	3.6	5.3	7.6	6.7	5.3	8.0	6.5	8.2	8.8	8.3	9.6	9.2	8.1	8.3	6.1	6.7	9.5	7.2
Other	3.3	3.9	3.9	3.5	2.0	2.9	3.4	3.5	6.9	7.8	4.9	8.1	4.5	4.2	4.6	5.9	3.8	3.5	2.9	4.5	3.3	2.1	2.0	1.5	1.8	0.8	1.2	3.7
Semiconductor/Electr	5.1	0.7	1.1	1.4	3.0	2.6	3.4	3.9	2.6	3.3	2.5	4.0	4.9	3.3	2.7	3.0	2.7	3.3	2.6	2.5	3.2	2.9	2.3	1.7	1.7	1.7	1.9	2.7
Transportation	3.7	2.5	3.2	3.7	3.5	3.3	3.8	5.3	4.3	3.0	4.0	3.0	5.4	6.0	6.6	7.3	5.0	6.1	3.8	4.6	4.2	4.4	5.3	4.0	3.5	3.8	3.2	4.4
Utilities	0.5	0.4	0.0	0.9	0.7	0.7	0.1	0.4	0.3	0.5	0.4	0.6	0.3	1.9	1.0	0.9	1.0	0.9	0.9	0.9	1.1	1.4	0.9	1.2	0.2	0.6	1.0	0.8
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 27: Share of unique BO deal activity in target industry by year.

Total number of unique deals per industry as denominator. Horizontal differences. Differences in share of deal activity over time. Accentuated with color scheme. All numbers are quoted as percentages.

Year	-90	-91	-92	-93	-94	-95	-96	-97	-98	-99	-00	-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11	-12	-13	-14	-15	-16	Total
NA	4.9	12.5	7.2	9.6	7.5	13.3	12.8	12.2	9.3	5.2	3.2	0.9	0.3	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	100
Agr/Forestr/Fish	0.4	0.0	0.4	0.4	0.0	1.2	1.2	0.8	5.7	0.0	3.3	1.2	2.5	2.9	3.3	2.5	2.5	6.1	5.3	3.3	9.8	3.7	9.4	7.0	8.2	9.8	9.0	100
Biotechnology	0.2	0.4	1.0	0.6	0.4	0.8	2.6	5.3	4.6	2.2	4.6	4.8	1.0	1.8	2.6	5.5	4.0	4.4	6.5	4.0	7.7	4.2	8.9	4.0	7.1	5.5	5.5	100
Business Serv.	1.1	0.8	1.1	0.7	0.6	1.4	1.6	1.5	2.0	3.8	6.4	4.8	2.2	3.3	4.0	4.7	4.8	7.5	7.2	2.8	4.5	4.9	5.3	4.5	5.8	6.8	5.8	100
Communications	1.1	1.2	2.1	2.7	2.8	3.6	5.6	4.9	6.1	6.2	12.3	7.9	3.0	4.2	3.8	3.8	2.9	4.3	4.1	2.3	3.2	2.5	2.0	2.4	1.9	1.7	1.4	100
Computer Hardware	0.8	1.1	0.0	0.8	0.8	3.0	4.0	3.6	5.5	3.6	8.2	5.1	4.0	4.4	2.1	3.4	3.0	5.3	4.0	3.6	5.5	4.6	6.1	4.0	4.9	5.7	3.0	100
Computer Other	0.0	0.0	0.0	0.0	0.0	0.0	7.1	0.0	0.0	7.1	7.1	7.1	0.0	0.0	7.1	14.3	7.1	7.1	14.3	21.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
Computer Software	0.1	0.2	0.4	0.4	0.7	1.2	2.8	2.8	2.6	4.1	6.4	4.0	2.4	2.5	2.4	3.3	4.1	4.7	4.6	3.1	4.5	5.6	5.6	6.1	8.4	9.4	7.6	100
Construction	1.2	0.3	0.0	0.3	2.3	1.7	2.3	2.8	2.5	1.2	5.0	2.8	2.3	2.5	4.2	6.7	5.8	8.5	8.0	2.7	5.5	4.2	5.3	3.2	6.2	4.8	7.8	100
Consumer Related	1.1	0.9	1.0	1.3	1.8	2.2	3.9	3.6	4.8	3.7	5.0	4.7	2.8	3.0	4.3	4.2	4.5	5.9	5.1	2.7	4.2	4.1	4.7	4.5	5.0	5.2	5.5	100
Financial Services	0.5	2.8	1.9	2.3	1.7	2.0	3.2	2.3	2.8	2.7	4.9	6.0	1.7	2.3	2.6	3.5	4.0	5.2	5.9	2.5	4.9	5.4	5.9	5.7	6.0	6.9	4.4	100
Industrial/Energy	0.6	0.4	0.5	0.6	1.1	1.6	2.6	2.0	2.7	3.0	3.7	3.1	2.1	3.5	3.6	4.4	6.2	6.6	6.5	3.8	4.8	5.5	7.1	5.5	6.9	6.2	5.2	100
Internet Specific	0.0	0.0	0.1	0.0	0.2	0.8	1.9	1.4	2.7	7.2	16.0	7.9	2.9	2.2	2.8	2.8	3.3	3.7	4.3	2.6	4.4	5.2	5.7	4.5	6.2	6.9	4.2	100
Manufact.	1.3	1.6	1.6	1.7	1.8	1.9	4.1	3.9	5.8	5.2	5.5	5.0	3.1	3.1	3.9	4.3	7.2	6.3	4.6	2.6	3.9	3.3	3.4	4.3	3.6	3.0	3.6	100
Medical/Health	0.4	0.3	0.6	0.7	1.2	1.2	4.4	3.9	4.0	2.8	3.2	3.7	2.7	2.8	2.5	4.7	4.1	6.6	6.6	3.4	6.2	6.1	6.0	5.3	4.7	5.3	6.6	100
Other	0.6	1.0	1.0	1.1	0.7	1.5	3.0	2.9	7.0	8.6	8.6	11.2	3.1	3.5	4.3	6.7	4.6	5.6	4.2	3.6	4.2	2.7	2.9	1.9	2.7	1.2	1.6	100
Semiconductor/Electr	1.4	0.2	0.4	0.6	1.5	1.7	4.1	4.3	3.6	4.9	6.0	7.5	4.6	3.7	3.3	4.7	4.4	6.9	5.2	2.7	5.5	5.0	4.6	2.8	3.4	3.6	3.4	100
Transportation	0.6	0.5	0.7	1.0	1.1	1.4	2.8	3.6	3.6	2.7	5.7	3.5	3.1	4.2	5.1	6.9	5.1	7.9	4.7	3.1	4.5	4.8	6.4	4.2	4.4	4.9	3.6	100
Utilities	0.4	0.4	0.0	1.3	1.3	1.7	0.4	1.7	1.3	2.6	3.0	3.9	0.9	7.4	4.3	4.8	6.1	6.9	6.5	3.5	6.9	8.7	6.5	6.9	1.7	4.3	6.5	100
Total	0.7	0.9	1.0	1.2	1.3	1.8	3.3	3.0	3.8	4.0	6.4	5.1	2.5	3.0	3.4	4.2	4.5	5.8	5.4	3.0	4.7	4.7	5.3	4.7	5.5	5.7	4.9	100

Table 28: Aggregate number of unique VC deals per target industry

Year	-90	-91	-92	-93	-94	-95	-96	-97	-98	-99	-00	-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11	-12	-13	-14	-15	-16	Grand Total
Agr/Forestr/Fish	8	8	6	4	6	6	5	9	11	5	11	5	14	2	3	8	4	11	6	1	9	6	8	12	8	9	8	0.2k
Biotechnology	284	227	327	274	308	297	312	296	382	367	561	632	559	732	704	844	885	1203	1197	889	977	918	976	965	779	857	614	17.4k
Business Serv.	38	22	19	30	25	42	72	71	92	150	239	117	75	64	71	64	81	105	141	71	76	57	41	64	50	62	28	2.0k
Communications	383	361	465	318	309	347	470	555	687	838	1419	1085	724	701	745	785	856	742	560	301	223	224	211	126	134	125	89	13.8k
Computer Hardware	313	225	236	167	149	182	173	165	200	239	394	273	213	239	270	257	312	348	339	190	244	271	251	243	290	239	206	6.6k
Computer Other	11	13	15	7	0	10	2	15	8	11	17	25	8	13	7	16	14	7	5	1	0	1	0	2	0	0	3	0.2k
Computer Software	575	578	687	579	564	642	965	1092	1429	1835	2870	2141	1687	1610	1676	1690	1809	1921	2049	1209	1605	2219	2552	3125	3520	3326	2709	46.7k
Construction	6	9	5	7	4	8	16	20	26	17	18	15	6	2	10	5	8	14	30	8	20	17	20	22	14	17	3	0.3k
Consumer Related	237	147	167	169	157	215	197	239	229	229	257	132	122	81	114	186	173	240	233	139	108	142	159	126	223	292	226	4.9k
Financial Services	56	43	47	43	50	50	97	93	152	182	253	175	81	95	106	89	135	116	91	54	56	57	49	73	79	72	64	2.5k
Industrial/Energy	267	178	146	145	113	109	115	143	163	91	122	106	143	124	176	182	272	397	475	316	371	425	332	310	257	242	158	5.9k
Internet Specific	50	36	68	44	102	198	536	693	1010	3241	4814	2113	1111	766	861	1040	1522	1736	1842	1164	1572	2173	2274	2368	2467	2346	1771	37.9k
Manufact.	41	47	39	39	22	45	30	42	29	39	47	27	31	27	19	27	25	25	40	11	14	6	4	13	16	21	12	0.7k
Medical/Health	501	399	556	425	449	499	554	675	806	825	878	776	899	870	984	1112	1250	1369	1241	902	809	893	842	735	751	720	554	21.3k
Other	2	2	3	4	0	9	19	12	17	23	23	22	11	26	19	14	14	26	13	3	15	10	12	8	9	19	11	0.3k
Semiconductor/Electr	286	255	206	167	219	238	145	235	269	377	848	679	585	668	879	846	936	867	736	411	410	328	237	248	253	260	206	11.8k
Transportation	32	34	34	18	14	18	10	25	27	27	30	26	10	23	11	14	27	54	65	48	49	60	43	54	58	79	55	0.9k
Utilities	6	5	4	1	0	1	1	3	0	2	5	4	3	0	1	2	0	1	2	0	2	5	3	0	0	0	1	0.1k
Total	3.1k	2.6k	3.0k	2.4k	2.5k	2.9k	3.7k	4.4k	5.5k	8.5k	12.8k	8.4k	6.3k	6.0k	6.7k	7.2k	8.3k	9.2k	9.1k	5.7k	6.6k	7.8k	8.0k	8.5k	8.9k	8.7k	6.7k	0.2k

Table 29: Share of unique VC deals per target industry

Total number of unique deals per year as denominator. Vertical differences. Industry differences in a given year. Accentuated with color scheme. All numbers are quoted as percentages.

Year	-90	-91	-92	-93	-94	-95	-96	-97	-98	-99	-00	-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11	-12	-13	-14	-15	-16	Total
Agr/Forestr/Fish	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.2	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Biotechnology	9.2	8.8	10.8	11.2	12.4	10.2	8.4	6.8	6.9	4.3	4.4	7.6	8.9	12.1	10.6	11.8	10.6	13.1	13.2	15.5	14.9	11.8	12.2	11.4	8.7	9.9	9.1	10.0
Business Serv.	1.2	0.8	0.6	1.2	1.0	1.4	1.9	1.6	1.7	1.8	1.9	1.4	1.2	1.1	1.1	0.9	1.0	1.1	1.6	1.2	1.2	0.7	0.5	0.8	0.6	0.7	0.4	1.1
Communications	12.4	13.9	15.3	13.0	12.4	11.9	12.6	12.7	12.4	9.9	11.1	13.0	11.5	11.6	11.2	10.9	10.3	8.1	6.2	5.3	3.4	2.9	2.6	1.5	1.5	1.4	1.3	7.9
Computer Hardware	10.1	8.7	7.8	6.8	6.0	6.2	4.7	3.8	3.6	2.8	3.1	3.3	3.4	4.0	4.1	3.6	3.7	3.8	3.7	3.3	3.7	3.5	3.1	2.9	3.3	2.8	3.1	3.8
Computer Other	0.4	0.5	0.5	0.3	0.0	0.3	0.1	0.3	0.1	0.1	0.1	0.3	0.1	0.2	0.1	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Computer Software	18.6	22.3	22.7	23.7	22.6	22.0	25.9	24.9	25.8	21.6	22.4	25.6	26.9	26.6	25.2	23.5	21.7	20.9	22.6	21.1	24.5	28.4	31.8	36.8	39.5	38.3	40.3	26.9
Construction	0.2	0.3	0.2	0.3	0.2	0.3	0.4	0.5	0.5	0.2	0.1	0.2	0.1	0.0	0.2	0.1	0.1	0.2	0.3	0.1	0.3	0.2	0.2	0.3	0.2	0.2	0.0	0.2
Consumer Related	7.7	5.7	5.5	6.9	6.3	7.4	5.3	5.5	4.1	2.7	2.0	1.6	1.9	1.3	1.7	2.6	2.1	2.6	2.6	2.4	1.6	1.8	2.0	1.5	2.5	3.4	3.4	2.8
Financial Services	1.8	1.7	1.6	1.8	2.0	1.7	2.6	2.1	2.7	2.1	2.0	2.1	1.3	1.6	1.6	1.2	1.6	1.3	1.0	0.9	0.9	0.7	0.6	0.9	0.9	0.8	1.0	1.4
Industrial/Energy	8.6	6.9	4.8	5.9	4.5	3.7	3.1	3.3	2.9	1.1	1.0	1.3	2.3	2.1	2.6	2.5	3.3	4.3	5.2	5.5	5.7	5.4	4.1	3.6	2.9	2.8	2.4	3.4
Internet Specific	1.6	1.4	2.2	1.8	4.1	6.8	14.4	15.8	18.2	38.1	37.6	25.3	17.7	12.7	12.9	14.5	18.3	18.9	20.3	20.4	24.0	27.8	28.4	27.9	27.7	27.0	26.4	21.9
Manufact.	1.3	1.8	1.3	1.6	0.9	1.5	0.8	1.0	0.5	0.5	0.4	0.3	0.5	0.4	0.3	0.4	0.3	0.3	0.4	0.2	0.2	0.1	0.0	0.2	0.2	0.2	0.2	0.4
Medical/Health	16.2	15.4	18.3	17.4	18.0	17.1	14.9	15.4	14.6	9.7	6.9	9.3	14.3	14.4	14.8	15.5	15.0	14.9	13.7	15.8	12.3	11.4	10.5	8.7	8.4	8.3	8.2	12.3
Other	0.1	0.1	0.1	0.2	0.0	0.3	0.5	0.3	0.3	0.3	0.2	0.3	0.2	0.4	0.3	0.2	0.2	0.3	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Semiconductor/Electr	9.2	9.8	6.8	6.8	8.8	8.2	3.9	5.4	4.9	4.4	6.6	8.1	9.3	11.1	13.2	11.8	11.2	9.4	8.1	7.2	6.3	4.2	3.0	2.9	2.8	3.0	3.1	6.8
Transportation	1.0	1.3	1.1	0.7	0.6	0.6	0.3	0.6	0.5	0.3	0.2	0.3	0.2	0.4	0.2	0.2	0.3	0.6	0.7	0.8	0.7	0.8	0.5	0.6	0.7	0.9	0.8	0.5
Utilities	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 30: Share of unique VC deal activity in target industry by year.

Total number of unique deals per industry as denominator. Horizontal differences. Differences in share of deal activity over time. Accentuated with color scheme. All numbers are quoted as percentages.

Year	-90	-91	-92	-93	-94	-95	-96	-97	-98	-99	-00	-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11	-12	-13	-14	-15	-16	Total
Agr/Forestr/Fish	4.1	4.1	3.1	2.1	3.1	3.1	2.6	4.7	5.7	2.6	5.7	2.6	7.3	1.0	1.6	4.1	2.1	5.7	3.1	0.5	4.7	3.1	4.1	6.2	4.1	4.7	4.1	100
Biotechnology	1.6	1.3	1.9	1.6	1.8	1.7	1.8	1.7	2.2	2.1	3.2	3.6	3.2	4.2	4.1	4.9	5.1	6.9	6.9	5.1	5.6	5.3	5.6	5.6	4.5	4.9	3.5	100
Business Serv.	1.9	1.1	1.0	1.5	1.3	2.1	3.7	3.6	4.7	7.6	12.2	5.9	3.8	3.3	3.6	3.3	4.1	5.3	7.2	3.6	3.9	2.9	2.1	3.3	2.5	3.2	1.4	100
Communications	2.8	2.6	3.4	2.3	2.2	2.5	3.4	4.0	5.0	6.1	10.3	7.9	5.3	5.1	5.4	5.7	6.2	5.4	4.1	2.2	1.6	1.6	1.5	0.9	1.0	0.9	0.6	100
Computer Hardware	4.7	3.4	3.6	2.5	2.2	2.7	2.6	2.5	3.0	3.6	5.9	4.1	3.2	3.6	4.1	3.9	4.7	5.3	5.1	2.9	3.7	4.1	3.8	3.7	4.4	3.6	3.1	100
Computer Other	5.2	6.2	7.1	3.3	0.0	4.7	0.9	7.1	3.8	5.2	8.1	11.8	3.8	6.2	3.3	7.6	6.6	3.3	2.4	0.5	0.0	0.5	0.0	0.9	0.0	0.0	1.4	100
Computer Software	1.2	1.2	1.5	1.2	1.2	1.4	2.1	2.3	3.1	3.9	6.2	4.6	3.6	3.5	3.6	3.6	3.9	4.1	4.4	2.6	3.4	4.8	5.5	6.7	7.5	7.1	5.8	100
Construction	1.7	2.6	1.4	2.0	1.2	2.3	4.6	5.8	7.5	4.9	5.2	4.3	1.7	0.6	2.9	1.4	2.3	4.0	8.6	2.3	5.8	4.9	5.8	6.3	4.0	4.9	0.9	100
Consumer Related	4.8	3.0	3.4	3.4	3.2	4.4	4.0	4.8	4.6	4.6	5.2	2.7	2.5	1.6	2.3	3.8	3.5	4.9	4.7	2.8	2.2	2.9	3.2	2.6	4.5	5.9	4.6	100
Financial Services	2.3	1.7	1.9	1.7	2.0	2.0	3.9	3.8	6.2	7.4	10.3	7.1	3.3	3.9	4.3	3.6	5.5	4.7	3.7	2.2	2.3	2.3	2.0	3.0	3.2	2.9	2.6	100
Industrial/Energy	4.5	3.0	2.5	2.5	1.9	1.9	2.0	2.4	2.8	1.5	2.1	1.8	2.4	2.1	3.0	3.1	4.6	6.8	8.1	5.4	6.3	7.2	5.6	5.3	4.4	4.1	2.7	100
Internet Specific	0.1	0.1	0.2	0.1	0.3	0.5	1.4	1.8	2.7	8.5	12.7	5.6	2.9	2.0	2.3	2.7	4.0	4.6	4.9	3.1	4.1	5.7	6.0	6.2	6.5	6.2	4.7	100
Manufact.	5.6	6.4	5.3	5.3	3.0	6.1	4.1	5.7	3.9	5.3	6.4	3.7	4.2	3.7	2.6	3.7	3.4	3.4	5.4	1.5	1.9	0.8	0.5	1.8	2.2	2.8	1.6	100
Medical/Health	2.4	1.9	2.6	2.0	2.1	2.3	2.6	3.2	3.8	3.9	4.1	3.6	4.2	4.1	4.6	5.2	5.9	6.4	5.8	4.2	3.8	4.2	4.0	3.5	3.5	3.4	2.6	100
Other	0.6	0.6	0.9	1.2	0.0	2.6	5.5	3.5	4.9	6.6	6.6	6.4	3.2	7.5	5.5	4.0	4.0	7.5	3.8	0.9	4.3	2.9	3.5	2.3	2.6	5.5	3.2	100
Semiconductor/Electr	2.4	2.2	1.7	1.4	1.9	2.0	1.2	2.0	2.3	3.2	7.2	5.8	5.0	5.7	7.5	7.2	7.9	7.4	6.2	3.5	3.5	2.8	2.0	2.1	2.1	2.2	1.7	100
Transportation	3.4	3.6	3.6	1.9	1.5	1.9	1.1	2.6	2.9	2.9	3.2	2.8	1.1	2.4	1.2	1.5	2.9	5.7	6.9	5.1	5.2	6.3	4.6	5.7	6.1	8.4	5.8	100
Utilities	11.5	9.6	7.7	1.9	0.0	1.9	1.9	5.8	0.0	3.8	9.6	7.7	5.8	0.0	1.9	3.8	0.0	1.9	3.8	0.0	3.8	9.6	5.8	0.0	0.0	0.0	1.9	100
Total	1.8	1.5	1.7	1.4	1.4	1.7	2.1	2.5	3.2	4.9	7.4	4.8	3.6	3.5	3.8	4.1	4.8	5.3	5.2	3.3	3.8	4.5	4.6	4.9	5.1	5.0	3.9	100

Table 31: Number of unique international BO deals by region per year

Year	-90	-91	-92	-93	-94	-95	-96	-97	-98	-99	-00	-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11	-12	-13	-14	-15	-16	Total
Western Europe	2	1		1	4	10	14	16	21	39	92	75	37	47	50	55	56	59	43	37	54	51	37	52	46	59	57	1.02k
Northern Europe	1	2	2	2	5	4	17	14	23	41	72	62	25	31	32	34	31	56	56	30	41	47	56	51	74	78	56	0.94k
Eastern Asia			4	3	5	6	8	3	12	29	55	50	19	33	33	38	65	81	68	36	54	49	44	34	58	65	32	0.88k
Northern America	3	4	2	7	5	15	20	10	18	25	40	25	16	20	31	26	36	57	37	29	35	49	51	64	66	66	57	0.81k
Southern Asia					2	1		4	1	7	14	7	7	6	9	24	31	66	57	28	55	66	77	57	56	68	37	0.68k
Southern Europe		6	2	1	2	1	4	4	5	8	20	9	12	8	5	11	17	12	9	3	19	20	13	29	48	61	19	0.35k
South America				3	1	7	11	12	32	18	24	23	10	1	12	1	4	13	16	9	21	17	28	17	22	17	28	0.35k
Australia & NZ		2	2	2	1		6	1	5	6	11	17	7	5	5	7	10	10	10	6	22	16	13	12	16	16	15	0.22k
South-Eastern Asia		1	2	3	8	10	14	6	8	7	19	7	2	4	4	6	9	10	4	2	4	9	12	16	10	13	14	0.20k
Eastern Europe					8	4	4	7	12	15	22	10	6	4	4	15	6	16	9	9	12	9	9	5	3	7	1	0.20k
Nordics				1			2		3	8	17	23	12	10	7	5	8	3	18	3	7	11	12	6	15	13	10	0.19k
Western Asia		2				5	4	12	9	9	16	2	1	3	5	8	16	8	8	3	8	18	8	6	8	12	5	0.18k
Central America				1		2	7	4	8	8	7	4	4	3	3	2	6	5	1	1	3	1	10	4	7	6	6	0.10k
Caribbean					1					2	1	1			3	2	3	1	1	1	2	3	4	3	2	2		0.03k
Western Africa															1	2			3	3	1	4	1	3	8	2	1	0.03k
Southern Africa										1						1		2	5		2	2	3		2	2	2	0.02k
Eastern Africa														2			1			2		2	1	3	3		2	0.02k
Northern Africa							1							1		2	1	1	2	2			2		1	2	1	0.02k
Middle Africa																2												0.00k
Central Asia										1									1									0.00k
Total	6	18	14	23	43	65	112	93	157	224	410	315	158	178	204	241	300	400	348	204	340	374	381	362	445	489	343	6.25k

Table 32: Share of unique international BO deals by region per year

Total number of unique international deals per year as denominator. Horizontal differences. Differences in share of deal activity over time. Accentuated with color scheme. All numbers are quoted as percentages.

Year	-90	-91	-92	-93	-94	-95	-96	-97	-98	-99	-00	-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11	-12	-13	-14	-15	-16	Total
Western Europe	33.3	5.6	0.0	4.3	9.3	15.4	12.5	17.2	13.4	17.4	22.4	23.8	23.4	26.4	24.5	22.8	18.7	14.8	12.4	18.1	15.9	13.6	9.7	14.4	10.3	12.1	16.6	16.25
Northern Europe	16.7	11.1	14.3	8.7	11.6	6.2	15.2	15.1	14.6	18.3	17.6	19.7	15.8	17.4	15.7	14.1	10.3	14.0	16.1	14.7	12.1	12.6	14.7	14.1	16.6	16.0	16.3	15.10
Eastern Asia	0.0	0.0	28.6	13.0	11.6	9.2	7.1	3.2	7.6	12.9	13.4	15.9	12.0	18.5	16.2	15.8	21.7	20.3	19.5	17.6	15.9	13.1	11.5	9.4	13.0	13.3	9.3	14.15
Northern America	50.0	22.2	14.3	30.4	11.6	23.1	17.9	10.8	11.5	11.2	9.8	7.9	10.1	11.2	15.2	10.8	12.0	14.3	10.6	14.2	10.3	13.1	13.4	17.7	14.8	13.5	16.6	13.03
Southern Asia	0.0	0.0	0.0	0.0	4.7	1.5	0.0	4.3	0.6	3.1	3.4	2.2	4.4	3.4	4.4	10.0	10.3	16.5	16.4	13.7	16.2	17.6	20.2	15.7	12.6	13.9	10.8	10.89
Southern Europe	0.0	33.3	14.3	4.3	4.7	1.5	3.6	4.3	3.2	3.6	4.9	2.9	7.6	4.5	2.5	4.6	5.7	3.0	2.6	1.5	5.6	5.3	3.4	8.0	10.8	12.5	5.5	5.57
South America	0.0	0.0	0.0	13.0	2.3	10.8	9.8	12.9	20.4	8.0	5.9	7.3	6.3	0.6	5.9	0.4	1.3	3.3	4.6	4.4	6.2	4.5	7.3	4.7	4.9	3.5	8.2	5.55
Australia & NZ	0.0	11.1	14.3	8.7	2.3	0.0	5.4	1.1	3.2	2.7	2.7	5.4	4.4	2.8	2.5	2.9	3.3	2.5	2.9	2.9	6.5	4.3	3.4	3.3	3.6	3.3	4.4	3.57
South-Eastern Asia	0.0	5.6	14.3	13.0	18.6	15.4	12.5	6.5	5.1	3.1	4.6	2.2	1.3	2.2	2.0	2.5	3.0	2.5	1.1	1.0	1.2	2.4	3.1	4.4	2.2	2.7	4.1	3.27
Eastern Europe	0.0	0.0	0.0	0.0	18.6	6.2	3.6	7.5	7.6	6.7	5.4	3.2	3.8	2.2	2.0	6.2	2.0	4.0	2.6	4.4	3.5	2.4	2.4	1.4	0.7	1.4	0.3	3.15
Nordics	0.0	0.0	0.0	0.0	2.3	0.0	1.8	0.0	1.9	3.6	4.1	7.3	7.6	5.6	3.4	2.1	2.7	0.8	5.2	1.5	2.1	2.9	3.1	1.7	3.4	2.7	2.9	3.11
Western Asia	0.0	11.1	0.0	0.0	0.0	7.7	3.6	12.9	5.7	4.0	3.9	0.6	0.6	1.7	2.5	3.3	5.3	2.0	2.3	1.5	2.4	4.8	2.1	1.7	1.8	2.5	1.5	2.82
Central America	0.0	0.0	0.0	4.3	0.0	3.1	6.3	4.3	5.1	3.6	1.7	1.3	2.5	1.7	1.5	0.8	2.0	1.3	0.3	0.5	0.9	0.3	2.6	1.1	1.6	1.2	1.7	1.65
Caribbean	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.9	0.2	0.3	0.0	0.0	1.5	0.8	1.0	0.3	0.3	0.5	0.6	0.8	1.0	0.8	0.4	0.4	0.0	0.51
Western Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.8	0.0	0.0	0.9	1.5	0.3	1.1	0.3	0.8	1.8	0.4	0.3	0.46
Southern Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.5	1.4	0.0	0.6	0.5	0.8	0.0	0.4	0.4	0.6	0.35
Eastern Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.3	0.0	0.0	1.0	0.0	0.5	0.3	0.8	0.7	0.0	0.6	0.26
Northern Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.8	0.3	0.3	0.6	1.0	0.0	0.0	0.5	0.0	0.2	0.4	0.3	0.26
Middle Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03
Central Asia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 33: Number of unique international VC deals by region per year

Year	-90	-91	-92	-93	-94	-95	-96	-97	-98	-99	-00	-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11	-12	-13	-14	-15	-16	Total
Eastern Asia	19	2		1	4	7	40	40	33	44	225	84	49	55	58	72	118	142	111	75	94	111	69	75	178	196	124	2.03k
Northern Europe	16	16	18	14	9	9	26	27	35	84	209	147	89	68	56	55	68	89	63	56	69	60	97	76	98	104	100	1.76k
Western Europe	11	3	9	9	13	15	23	22	48	93	224	164	85	43	61	52	47	59	44	47	35	39	43	49	53	104	96	1.49k
Northern America	4	15	15	16	12	20	25	25	36	51	99	84	57	43	43	30	43	46	36	18	50	75	71	72	92	107	97	1.28k
Southern Asia	1					1	2	8	8	18	55	25	16	17	7	14	36	34	54	32	50	54	66	57	59	94	57	0.77k
Western Asia	4	4	9	3	2	3	4	7	15	16	67	50	26	26	20	21	29	46	44	23	34	43	42	53	45	52	68	0.76k
Nordics	2	5	3	4	1	1	2	2	8	14	45	34	21	16	12	13	21	23	14	18	14	14	12	14	21	20	15	0.37k
South-Eastern Asia	3	1		2	1	8	17	20	10	13	32	18	13	10	6	2	3	2		4	4	4	7	15	15	25	19	0.25k
Australia & NZ						2	3	9	1	14	22	30	24	24	4	9	2	8	2	4	4	6	13	12	13	14	14	0.23k
Southern Europe		2	4	2	1	1	1	1		6	36	12	8	7	7	5	4	1	3	2	5	3	18	10	16	13	16	0.18k
South America					1	2	5	3	3	8	11	5	4	3		2		4	2	3	2	4	13	10	10	18	13	0.13k
Eastern Europe							1	1	8	8	19	8	8	2		4	1	2	3	1	3	3	4	6	7	5	2	0.10k
Central America			1	1				1			3	2	1	2					2				7	3	1	2	2	0.03k
Caribbean	1										1				1	1	2		1			2	2	3	2	2		0.02k
Eastern Africa																				1	3	3	1	1		3		0.01k
Southern Africa						1	3			1	1				1	1	1		1		1							0.01k
Western Africa																1	1			1							2	0.01k
Northern Africa														1												1	1	0.00k
Middle Africa													1			1												0.00k
Central Asia											1																	0.00k
Total	61	48	59	52	44	70	152	166	205	370	1050	663	402	317	276	283	376	456	380	285	368	421	465	456	610	760	626	9.42k

Table 34: Share of unique international VC deals by region per year

Total number of unique international deals per year as denominator. Horizontal differences. Differences in share of deal activity over time. Accentuated with color scheme. All numbers are quoted as percentages.

Year	-90	-91	-92	-93	-94	-95	-96	-97	-98	-99	-00	-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11	-12	-13	-14	-15	-16	Total
Eastern Asia	31.1	4.2	0.0	1.9	9.1	10.0	26.3	24.1	16.1	11.9	21.4	12.7	12.2	17.4	21.0	25.4	31.4	31.1	29.2	26.3	25.5	26.4	14.8	16.4	29.2	25.8	19.8	21.51
Northern Europe	26.2	33.3	30.5	26.9	20.5	12.9	17.1	16.3	17.1	22.7	19.9	22.2	22.1	21.5	20.3	19.4	18.1	19.5	16.6	19.6	18.8	14.3	20.9	16.7	16.1	13.7	16.0	18.66
Western Europe	18.0	6.3	15.3	17.3	29.5	21.4	15.1	13.3	23.4	25.1	21.3	24.7	21.1	13.6	22.1	18.4	12.5	12.9	11.6	16.5	9.5	9.3	9.2	10.7	8.7	13.7	15.3	15.83
Northern America	6.6	31.3	25.4	30.8	27.3	28.6	16.4	15.1	17.6	13.8	9.4	12.7	14.2	13.6	15.6	10.6	11.4	10.1	9.5	6.3	13.6	17.8	15.3	15.8	15.1	14.1	15.5	13.61
Southern Asia	1.6	0.0	0.0	0.0	0.0	1.4	1.3	4.8	3.9	4.9	5.2	3.8	4.0	5.4	2.5	4.9	9.6	7.5	14.2	11.2	13.6	12.8	14.2	12.5	9.7	12.4	9.1	8.12
Western Asia	6.6	8.3	15.3	5.8	4.5	4.3	2.6	4.2	7.3	4.3	6.4	7.5	6.5	8.2	7.2	7.4	7.7	10.1	11.6	8.1	9.2	10.2	9.0	11.6	7.4	6.8	10.9	8.02
Nordics	3.3	10.4	5.1	7.7	2.3	1.4	1.3	1.2	3.9	3.8	4.3	5.1	5.2	5.0	4.3	4.6	5.6	5.0	3.7	6.3	3.8	3.3	2.6	3.1	3.4	2.6	2.4	3.92
South-Eastern Asia	4.9	2.1	0.0	3.8	2.3	11.4	11.2	12.0	4.9	3.5	3.0	2.7	3.2	3.2	2.2	0.7	0.8	0.4	0.0	1.4	1.1	1.0	1.5	3.3	2.5	3.3	3.0	2.70
Australia & NZ	0.0	0.0	0.0	0.0	0.0	2.9	2.0	5.4	0.5	3.8	2.1	4.5	6.0	7.6	1.4	3.2	0.5	1.8	0.5	1.4	1.1	1.4	2.8	2.6	2.1	1.8	2.2	2.48
Southern Europe	0.0	4.2	6.8	3.8	2.3	1.4	0.7	0.6	0.0	1.6	3.4	1.8	2.0	2.2	2.5	1.8	1.1	0.2	0.8	0.7	1.4	0.7	3.9	2.2	2.6	1.7	2.6	1.95
South America	0.0	0.0	0.0	0.0	2.3	2.9	3.3	1.8	1.5	2.2	1.0	0.8	1.0	0.9	0.0	0.7	0.0	0.9	0.5	1.1	0.5	1.0	2.8	2.2	1.6	2.4	2.1	1.34
Eastern Europe	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.6	3.9	2.2	1.8	1.2	2.0	0.6	0.0	1.4	0.3	0.4	0.8	0.4	0.8	0.7	0.9	1.3	1.1	0.7	0.3	1.02
Central America	0.0	0.0	1.7	1.9	0.0	0.0	0.0	0.6	0.0	0.0	0.3	0.3	0.2	0.6	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	1.5	0.7	0.2	0.3	0.3	0.30
Caribbean	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.4	0.4	0.5	0.0	0.3	0.0	0.0	0.5	0.4	0.7	0.3	0.3	0.0	0.19
Eastern Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.8	0.7	0.2	0.2	0.0	0.4	0.0	0.13
Southern Africa	0.0	0.0	0.0	0.0	0.0	1.4	2.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.4	0.4	0.3	0.0	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.12
Western Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.05
Northern Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.03
Middle Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02
Central Asia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

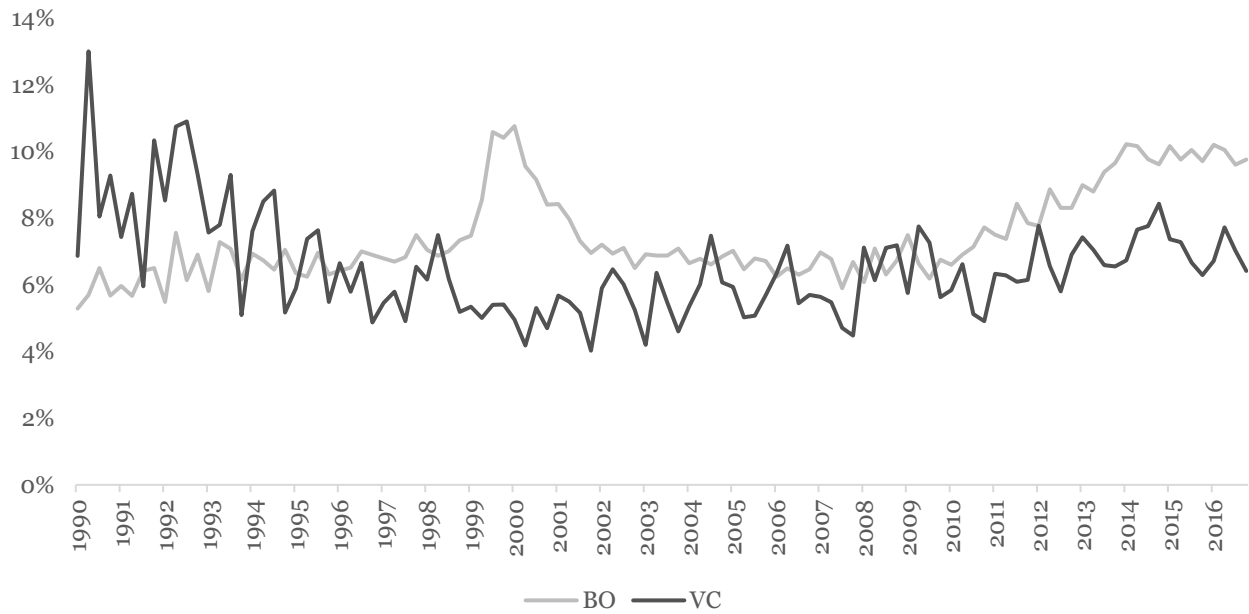


Fig. 4: Standard deviation of deal value across industries per quarter by BO/VC



Fig. 5: Average number of target industries invested in per firm per quarter by BO/VC

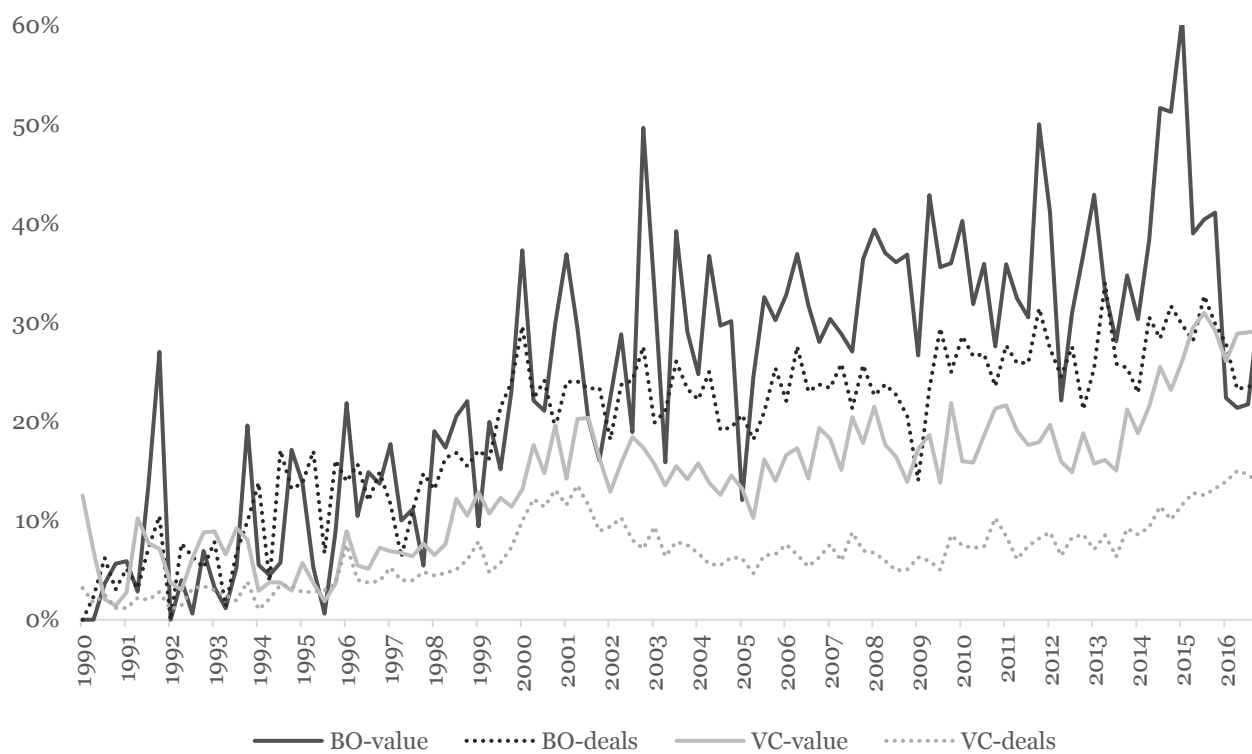


Fig. 6: International share of deal value and No. of deals, by industry

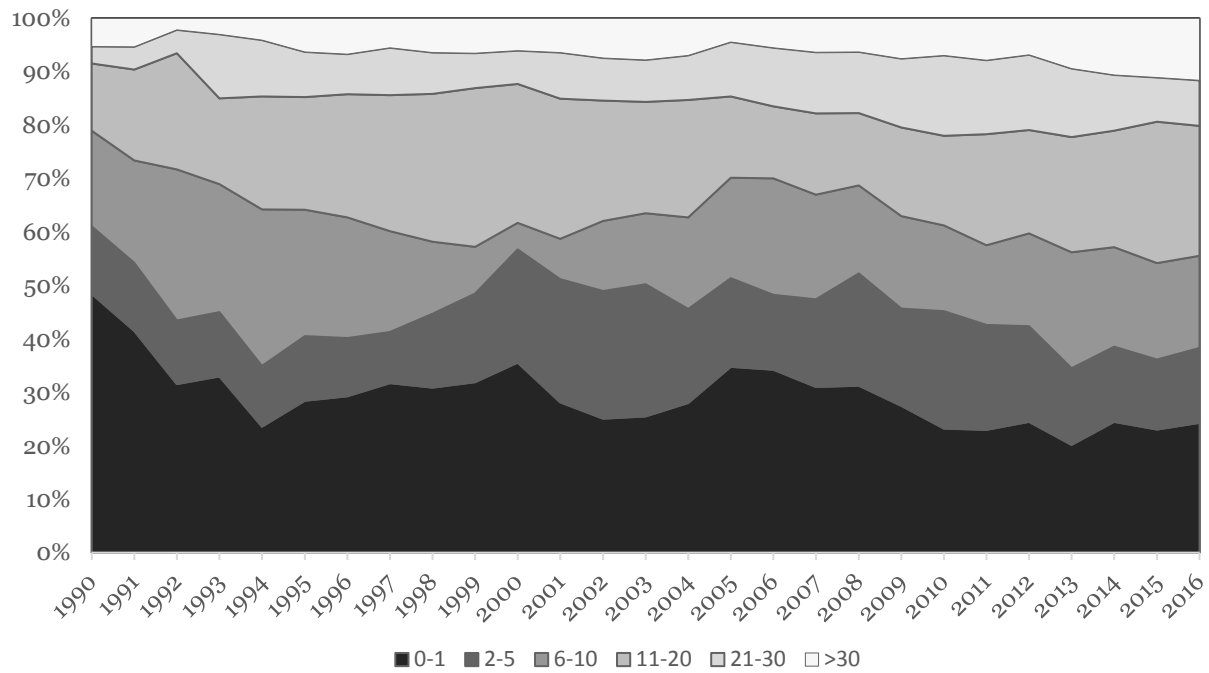


Fig. 7: Active BO firms by experience

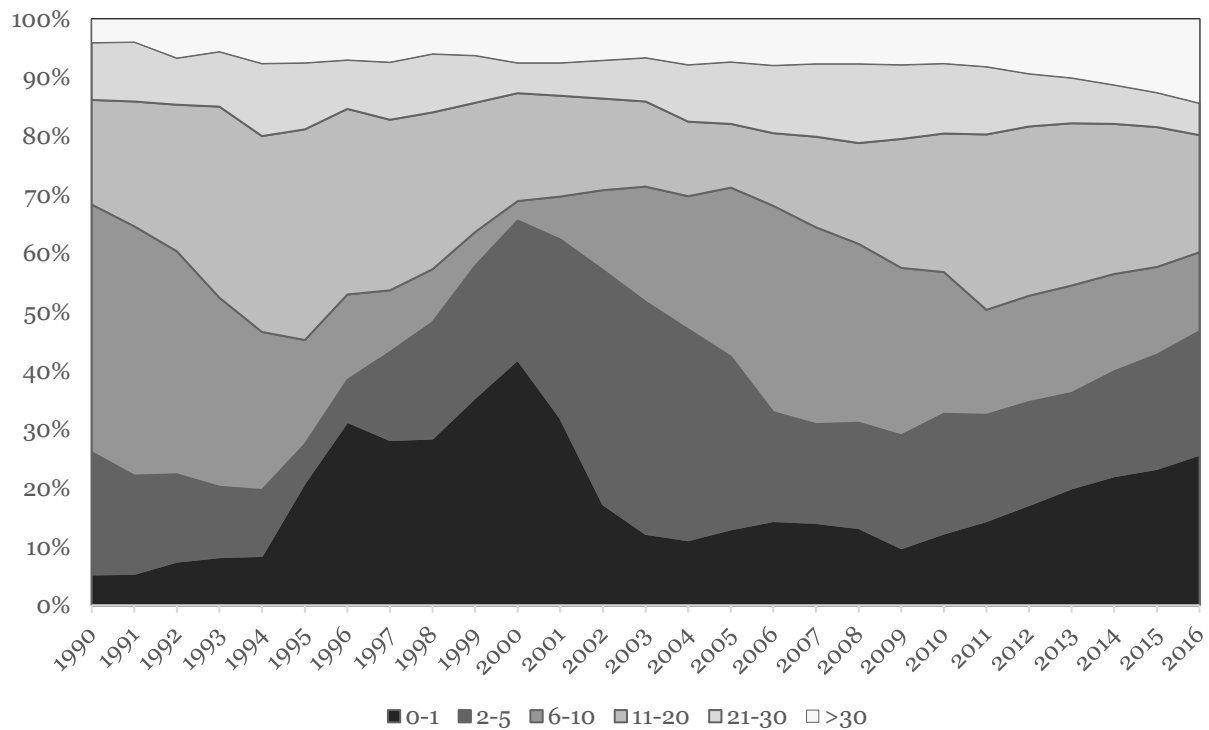


Fig. 8: Active VC firms by experience

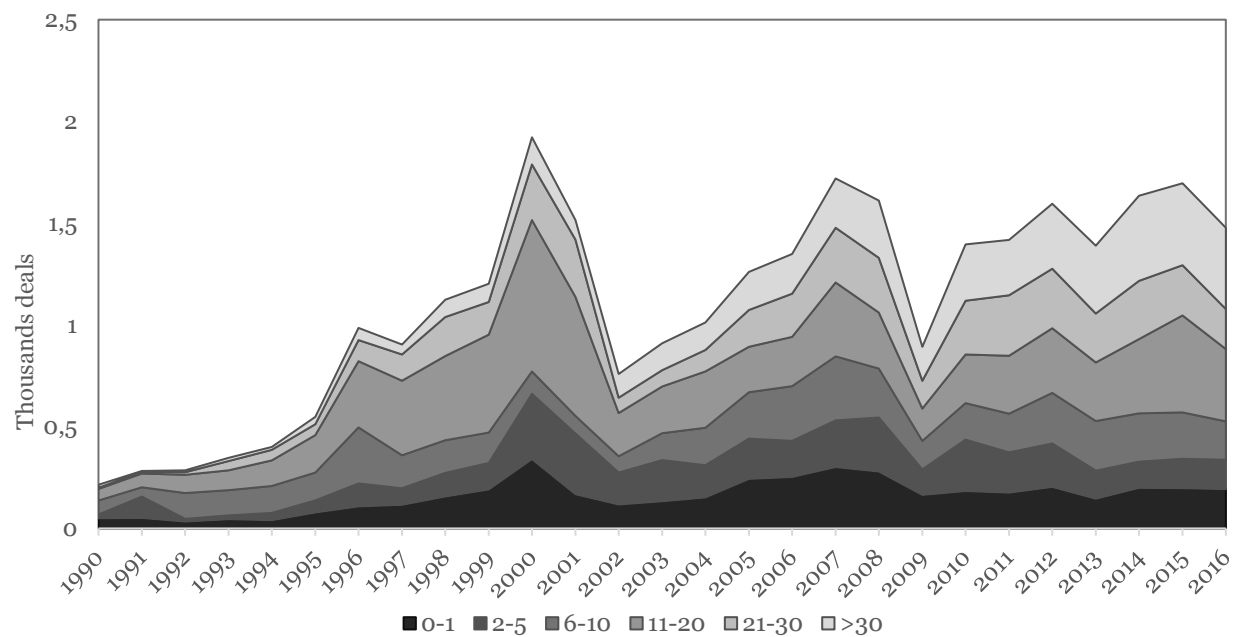


Fig. 9: Number of BO deals, by experience

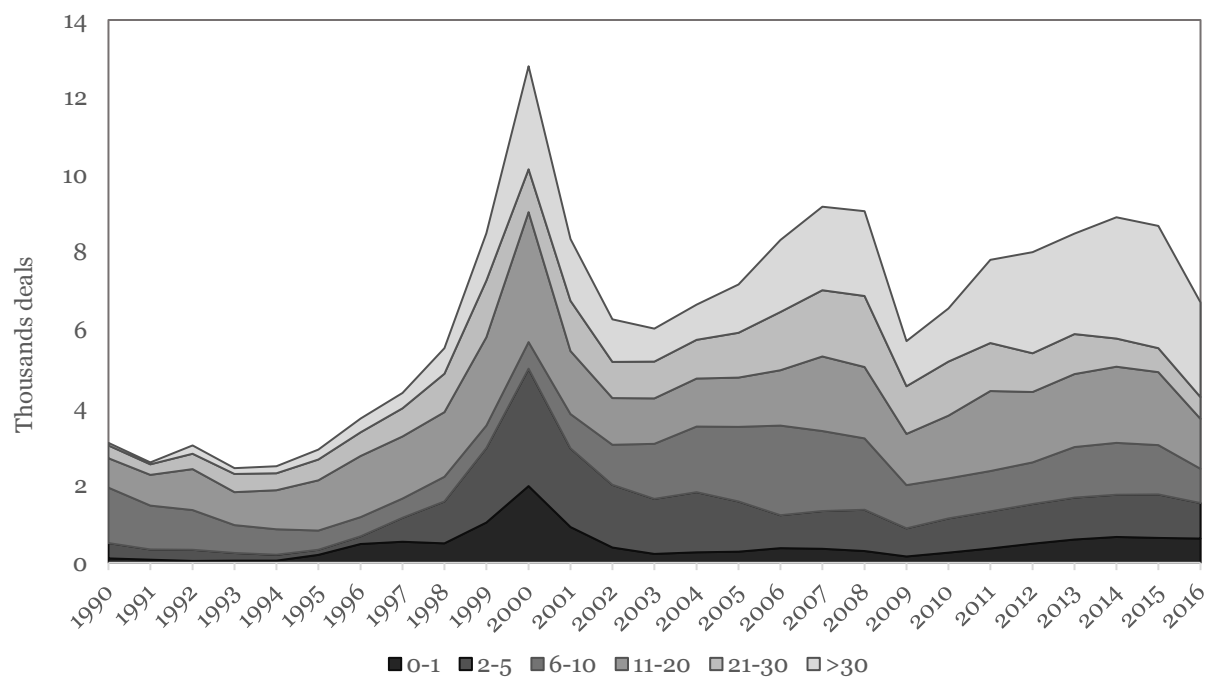


Fig. 10: Number of VC deals, by experience

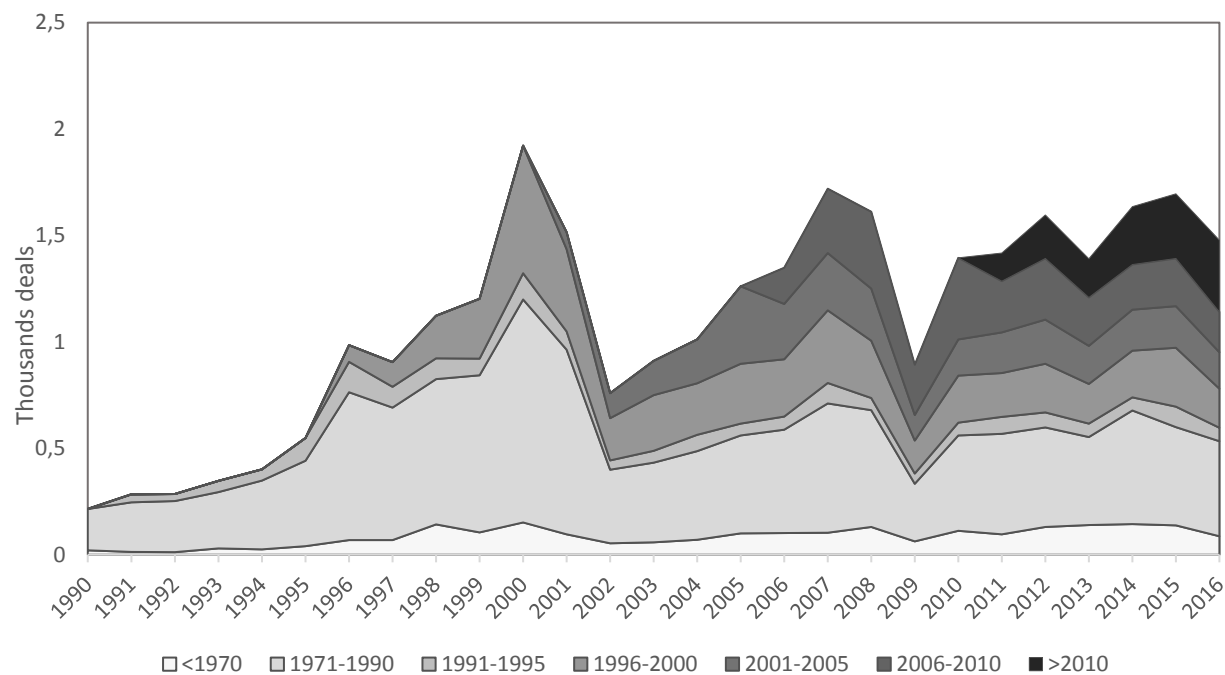


Fig. 11: Number of BO deals, by year founded

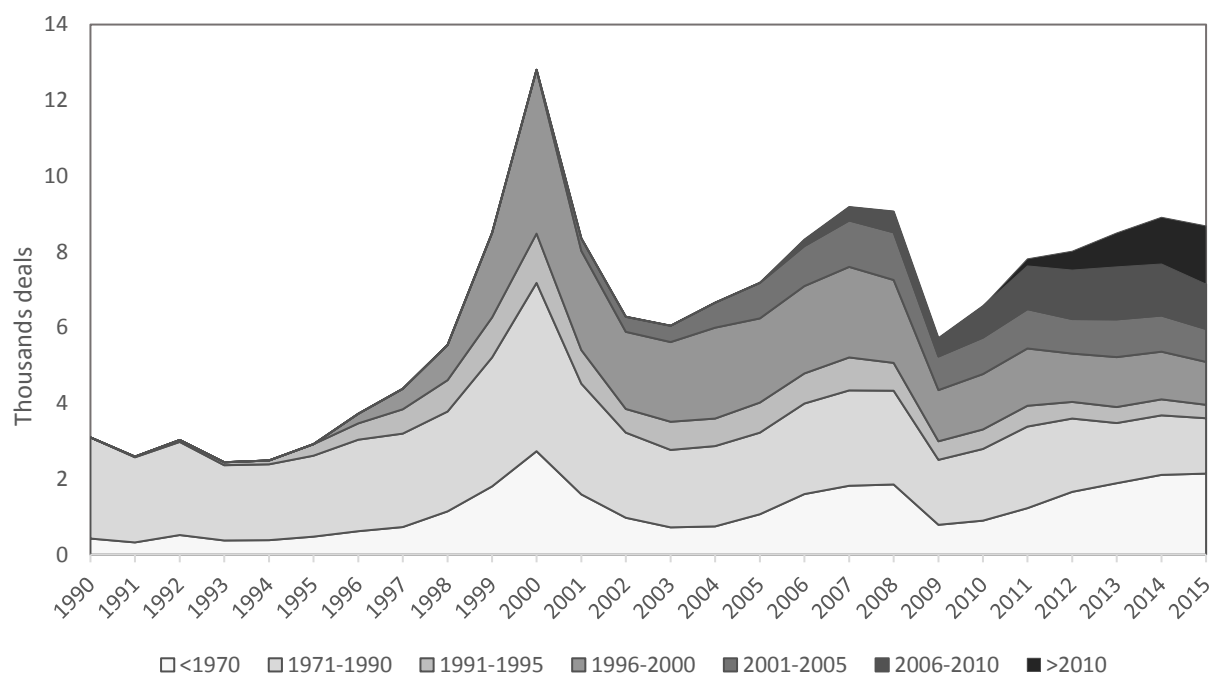


Fig. 12: Number of VC deals, by year founded